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The Determinants of Trade and Trade Direction of Arab Maghreb Union

Norehan Abdullah[1], Hussin Abdullah and
Hadi Mohamad Othman Abuhriba

The Arab Maghreb Union (AMU) comprising Algeria, Libya, Mauritania, Morocco, and Tunisia have established a framework to enhance regional cooperation on trade facilitation. Today, the AMU countries have increased their trade integration into the world economy. Despite the effort of trade openness in the AMU, the economic growth, intra-trade and inter-trade are still lagging behind other developing countries in the Middle East, Asia, and Latin America. The paper examines the determinants of intra-regional trade in the AMU countries. Using a data set of 1989-2009; the standard gravity model is used to measure the pattern and trend of bilateral trade. The results from gravity model indicate that there are strong positive and negative relationship between trade and GDP, population, distance, foreign currency reserves (FOC) and real exchange rate (RER) among AMU countries. AMU has helped to improve trade flows in its member trading. Evidently this study shows that the gravity model is still a useful instrument in analyzing the implications of international economic integration. In a way, this study established that regional economic integration is plausible and beneficial.

1. Introduction

The Arab Maghreb Union comprising Algeria, Libya, Mauritania, Morocco, and Tunisia have established a framework to enhance regional cooperation on issues of common interest, focusing initially on trade facilitation. Over the last decade, the Arab Maghreb Union countries

[1] Corresponding Author: School of Economics, Finance and Banking, College of Business,Universiti Utara Malaysia, 06010 Sintok, Kedah, MALAYSIA

have increased their trade integration into the world economy, including in the context of the Association Agreements between the European Union and Arab Maghreb countries. However, there is a debate that, whether the Arab Maghreb countries achieve the goals of this regional cooperation or not. In addition, there were an opposite views that, the Arab Maghreb countries were affected by this regional integration.

According to Brenton et al. (2006) the Maghreb countries have experienced lackluster growth rates during the last decade. Tunisia was the best performer with growth at 4.8 per cent, but even this was only average for developing countries; the other two countries grew substantially less at 3.2 per cent. While Maghreb exports of goods and services have grown at global averages in the last decade, they have not fully realized the growth potential associated with their location advantages of close proximity to the European Union (EU). Their exports have grown at less than half the rate of Turkey, Poland and Hungary in the last decade. However, according to the statistics of the Arab monetary fund and Arabian press release in 2000 indicated that member states of the Arab Maghreb Union suffered from economic dependency in the form commerce, food, technology and finance (Brenton et al., 2006).

Maghreb countries' trade with the Arab world and with the rest of the world is relatively small. Despite the establishment of the Arab Maghreb Union over two decades ago, the bulk of the Maghreb's trade is with Europe. The level of intra-Maghreb trade is lower than that of many of the world's trading blocs. In 2007, intra-Maghreb trade represented less than 2 per cent of the sub region's combined gross domestic product (GDP) and less than 3 per cent of the sub region's total trade. Some of the reasons for this low performance include high barriers to trade, logistical bottlenecks, lack of production base diversification, and political considerations (World Bank, 2001).

Table 1: Trade in the Arab Maghreb Union (% of GDP)

	1990-1999		2000-2008	
	Exports	**Imports**	**Exports**	**Imports**
Algeria	26	24	42	23
Libya	29	25	57	28
Mauritania	37	48	40	68
Morocco	26	31	32	37
Tunisia	43	47	49	52

Source: World Bank, GDF and WDI data, April 2010

By referring to Table 1, overall exports accounted for between 57 per cent to 32 per cent of GDP and import for between 67 per cent to 28 per cent in the Arab Maghreb Union during the period 2000–2008. This represents a slightly increase from trade levels in the 1990s, with Libya showing the greatest increase. Mauritania and Tunisia are the most open economies in the sub region, with average trade volumes exceeding GDP during 2000–2008. Trade among the countries of the Maghreb was less than 3 per cent of the regions's total trade in 2008. The low levels of trade within the Maghreb persit despite the existence of overlapping institutional frameworks for regional integration, such as the Arab Maghreb Union. World Bank (2006) estimated the loss due to weak trade integration as equal to two to three per cent of the annual Gross Domestic Product of The Maghreb. Thus, this paper examines determinants of intra-regional trade in the Arab Maghreb Union (AMU) countries.

2. Literature Review

Only a few empirical studies have examined whether regional economic integrations had trade creation effects or trade diversion effects. At cross-country level, Endoh (1999) found that the European Economic Community (EEC) had a trade creation effect, the Latin American free Trade Association (LAFTA) to have had a trade diversion effect, and the Council of Mutual Economic Assistance (CMEA) to have had a relatively stronger trade creation effect than the trade diversion effect. Aitken (1973) as cited in Musila (2004) found that the EEC to have no significant trade creation effects. Pelzman (1977) also as quoted by Musila (2004) finds the CMEA to have a trade creation effect. At individual country level, Endoh (1999) found the EEC and LAFTA to

have had no statistically significant effect on Japanese trade but found the CMEA to have had greatly reduced trade with Japan (i.e. trade diversion). Pelzman (1977) found the CMEA to have had a trade diversion effect in the case of Czechoslovakia and East Germany (Musila, 2004).

In examining the effect of regional integration on bilateral trade, Ghosh and Yamarik (2004) and Siliverstovs and Schumacher (2006) found that the North American Free Trade Agreement (NAFTA) had led to reduction in trade among its members. Preferential trade agreements (PTAs) involving Asian countries have also received a lot of attention in the literature. Those studies have mainly focused on the trade impact of the Association of South East Asian Nation Free Trade Agreement (AFTA), the South Asian Association for Regional Cooperation Preferential Trade Agreement (SAPTA) and the Asia-Pacific Economic Cooperation (APEC). Lee and Park (2002) have argued that ASEAN+3 (China, Japan and Korea) is emerging as a promising regional integration more than other PTAs in the East Asia Region. Rahman (2005), Lee and Park (2005), and Pusterla (2007) have all concluded that AFTA has enhanced trade among members. Similar results have been found for SAPTA.

Musila (2004) uses the gravity model to examine the impact of the Common Market for Eastern and Southern Africa (COMESA) on the flow of Kenya's exports. The empirical results of this study suggest that COMESA has the effect of trade creation. No evidence for trade diversion was found. The results also show that nominal GDP of importing countries, distance, adjacency, and common official language have a statistically significant impact on the flow of Kenya's exports. Micco et al. (2003), Hassan (2001), and Walsh (2006) have used the gravity model to examine the effect of EEC/EU and EFTA on bilateral trade. They concluded that the PTAs have fostered trade among members and between members and non-members. However, evidence of trade diversion for the EEC/EU agreement has been found by Westerlund and Wilhelmsson (2006) and Kien and Hashimoto (2005). Study by Breuss and Egger (1999) has also showed that the formation of NAFTA has led to increase in intra-PTA trade.

Martinez-Zarzoso, Inwald and Nowak-Lehman (2003) applies the gravity trade model to assess Mercosur-European Union trade, and trade

potential following the agreements reached recently between both trade blocks. The study found out that the fixed effect model should be preferred to the random effects gravity model. A number of variables, namely, infrastructure, income differences and exchange rates added to the standard gravity equation, are found to be important determinants of bilateral trade flows. Furthermore, Martinez-Zarzoso and Nowak-Lemann (2004) study also helps us to understand the effects of geographic and economic distance. According to Hirsch and Hashai (2000) geographical distance refers to miles or kilometers between capitals of trading countries. Since local products are cheaper than products transported over long distances, it is expected that geographical distance hinder trade. The second type, economic distance refers to absolute differences in the per capita income of the trading countries. These differences are expected to play a crucial role in explaining trade between the Arab Maghreb Union and other major trading blocs.

3. Methodology

Several methods have been used to analyze the intra-regional trade effects of regional economic integration. A frequently used approach, however, is the gravity equation (see Endoh, 1999). According to Yamazawa (1970) cited in Darku (2009), the trade intensity model concentrates on the structure of departures of actual trade flows from trade flows estimated in gravity models. He proved that in a simplified gravity model where bilateral trade is solely determined by the GDPs of country i and j, the index (export or import intensity index) is always equal to unity. An index greater than unity reflects the importance of various factors such as distance, favorable trade agreements, and strong complementarities of comparative advantages in determining trade flows. Hence, the dynamics in these intensities must be consistent with the predictions of the gravity model that captures these factors.

An export intensity index measures the extent to which the proportion of a country ***i***'s export to another country ***j*** differs from the proportion of exports from the rest of the world to country *j*. The index is given as:

$$\mathrm{EX}_{ij} = \left[\frac{\mathrm{X}_{ij}}{\mathrm{X}_{i}}\right] / \left[\frac{\mathrm{X}_{wi} - \mathrm{X}_{ij}}{\mathrm{X}_{w} - \mathrm{X}_{i}}\right] \quad (1)$$

where EX_{ij} is the exports intensity index of country ***i*** with trading partner ***j***, $X_{ij}$is the exports of country ***i*** to trading partner ***j***, X_i is the total exports of country ***i***, $X_{wj}$is the total exports to country ***j***, and X_w is the total world exports. The index measures the extent to which country j is over or under-represented as country i's export market. The index will take a value of unity if the proportion of country ***i***'s exports to country j is the same as the proportion of the rest of the world's exports to country ***j***. If the value exceeds unity, country ***j*** is said to be over-represented as country ***i***'s exports market. A value less than unity imply relative under-representation.

Similar to the analysis of exports, an import intensity index measures the extent of AMU member country's import dependence on its trading partners. This index is given as:

$$\mathrm{IM}_{ij} = \left[\frac{\mathrm{M}_{ij}}{\mathrm{M}_i}\right] / \left[\frac{\mathrm{M}_{wi} - \mathrm{M}_{ij}}{\mathrm{M}_w - \mathrm{M}_i}\right] \quad (2)$$

Where IM_{ij} is the imports intensity index of country I with trading partner j, M_{ij} is the imports of country *i*to trading partner *j*, M*i* is the total imports of country i, M_{wj} is the total world imports from country *j*, and M*w* is the total world imports. The index is equal to one if an AMU member country's import from a particular country as a proportion of its total imports is the same as the proportion of the rest of the world's imports from that country. If an AMU member country is over-dependent on a particular country for its import, then the ratio will be greater than one. On the other hand, if the ratio is less than one, then an AMU member is under-dependent on that country.

To augment the standard gravity equation with country specific dummies instead of the traditional approach, this study includes regional trading block dummies. The variables included in the standard gravity equation are income of both the importing and exporting countries, and distance. Income of the importing country represents the purchasing power or its absorption capacity, while the income for the exporting country represents the country's production and supply capacity. Distance is used as a proxy for transportation cost.

Equation (3) is extended from Equation (1) and Equation (2). In order to examine the gravity model of AMU (first objective) and between AMU, the empirical model is as follows:

$$lnY_{ijt} = \beta_0 + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnPOP_{it} + \beta_4 lnPOP_{jt} + \beta_5 lnDINS_{ij} + \beta_6 lnFCR_{ij} + \beta_7 lnRER_{ij} + \beta_8 lnOPEN_{ij} + \beta_9 AGMT_{ij} + \beta_{10} LAN_{ij} + u_{ijt} \quad (3)$$

where lnY_{ijt} is the trade variable between country *i* (AMU) and country *j* at time *t*; $lnGDP_{it}$ is a measure of income of country *i*at time *t*;$lnGDP_{jt}$ is a measure of income of country *j* at time *t*; $lnPOP_{it}$ and $lnPOP_{jt}$ are local and target populations, respectively at time *t*; $lnDINS_{ij}$ is the distance between countries ***i*** and *j;* $lnFCR_{ij}$ is the target country's foreign currency reserves at time *t*; $lnRER_{ij}$ is the real exchange rate between the two countries at the time *t*. $lnOPEN_{ij}$is the most basic measure of trade intensity is the so-called ''trade openness'' that is the ratio of exports plus imports to GDP. $LAN_{ij}$is a dummy variable for trading partners sharing a common language. Ability to communicate in a common language is predicted to reduce the costs of trade. We use measure for English as a common language.$AGMT_{ij}$is a dummy variable which evaluate the effects of preferential trading agreements. *ßi* (i = 1,2,..,7) are parameters of the equation, and u_{ijt} is a white noise disturbance term. All variables are in logs so the estimated coefficients are interpreted as elasticities.

The data set consists of a panel of observations for five Arab Maghreb Union (AMU) countries, namely Algeria, Libya, Mauritania, Morocco and Tunisia for the period 1989-2009. For the empirical application, we follow the broad specification and data sets of Egger and Pfaffermayr (2003).

4. Analysis

The estimation results for Equation 3 are presented in Table 2 to Table 6 including the five Arab Maghreb Union (AMU) countries namely Algeria, Libya, Mauritania, Morocco and Tunisia. These tables present the intra-trade among the AMU countries which is each country will

take place as a anchor country, while the others as a partner trading. Each table shows the results of the pooled model are in the second column, while those of fixed effects and random effects models are in the third and fourth columns. The main problem of the pooled model is that it does not allow heterogeneity of countries. It does not estimate country specific effects and assumes that all countries are homogenous. It is a restricted model (Eita, 2008).

Fixed effects model introduces heterogeneity by estimating country specific effects. It is an unrestricted model as it allows the intercept and other parameters to vary across trading partners. The F-test statistic was performed to test whether countries are able to pool and the results indicate that the null hypothesis of equality of individual effects is rejected. This means that a model with individual effects must be selected.

Like the fixed effects, the random effects model also acknowledges heterogeneity in the cross-section. However, it differs from the fixed effects model in the sense that the effects are generated by a specific distribution. Although it assumes that there is heterogeneity in the cross-section, it does not model each effect explicitly. This prevents the loss of degrees of freedom which happens in fixed effects model. The LM test was performed and the null hypothesis of equality of the individual effects is rejected in favour of random effect specification.

The Hausman statistic is used to test the null hypothesis that the regressors and individual effects are not correlated in order to distinguish between fixed effects model and random effects model. Failure to reject the null hypothesis implies that the random effects model will be preferred. If the null hypothesis is rejected, the fixed effects model will be appropriate. The Hausman test statistic shows that the null hypothesis is rejected and this indicates that country specific effects are correlated with regressors. This suggests that the fixed effects model is appropriate, and the random effects estimates are not consistent. Since the fixed effects model is the appropriate one, interpretation of the results will focus on the fixed effects model (Eita, 2008).

Table 2 shows the intra-trade between Algeria and the others AMU countries namely Libya, Mauritania, Morocco, and Tunisia. The

Hausman specification test statistic shows that the null hypothesis failed to reject and indicated that there was no systematic difference between fixed and random models, whereby confirmed that the random effects estimator was efficient in our empirical framework for intra-trade between Algeria and among others AMU countries.

The results show that an increase in the foreign GDP ($lnGDP_{it}$) causes an increase in Algeria's trade. The coefficient for this variable is positive by 1.049 in random effects model and statistically significant at 1 per cent level as expected and in line with the previous literature on trade (see, for example, Cheng and Wall, 2002, and Serlenga and Shin, 2004). It suggests that the demand-side "pull" effects of foreign output dominate the supply-side effects of domestic output. On the overall this indicates that an increase in foreign GDP causes Algeria trade to increase. On the other hand, domestic GDP is not statistically significant, that means we found the domestic GDP not causes Algeria trade to increase.

The population coefficients of foreign country ($lnPOP_{it}$) and domestic population ($lnPOP_{jt}$) are positive sign coefficient by 1.511 and 34.245 in random effects model, and strongly significant at 1 per cent level. These positive sign indicates that the country size is directly related to trade. These results are consistent with Martines-zarzoso (2003) who was studied on Gravity Model: An Application to Trade between Regional Blocs found that from the year 1991 onwards, the sign is positive which point towards the growing importance of the role played by scale economies and market-size effects in international trade models.

Table 2: Algeria – Dependent variable: $\boldsymbol{lnY_{ijt}}$ (Trade)

Variables	Pooled Model	Fixed Effects Model	Random Effects Model
$Constant$	-882.277***(-4.89)	-222.782**(-2.07)	-581.277***(-4.21)
$lnGDP_{it}$	2.049*** (3.58)	0.514***(2.94)	1.049***(4.80)
$lnGDP_{jt}$	-0.557(0.36)	-0.009(-0.11)	-0.054 (-0.36)
$lnPOP_{it}$	2.561***(3.86)	69.341**(2.19)	1.551**(2.86)
$lnPOP_{jt}$	44.845***(4.52)	76.799** (2.30)	34.245***(4.02)
$lnDINS_{ij}$	-2.955***(-7.67)		-1.715***(-7.44)
$lnFCR_{ij}$	0.661***(3.91)	0.085(0.69)	0.601**(2.93)
$lnRER_{ij}$	0.986 (0.55)	0.393(0.88)	0.186(0.25)
$lnOPENNESS_{ij}$	0.233*** (7.33)	0.026***(4.71)	0.0438*** (11.03)
$AGMT_{ij}$	-2.453***(7.54)	-0.633 (-1.40)	-2.083***(-8.76)
LAN_{ij}	0.124*(1.90)	0.165 (0.37)	0.124(0.25)
F Test		10.46***[0.000]	
LM Test			1.47[0.226]
Hausman Test		5.34[0.253]	
Time Fixed Effect		1.04[0.236]	
R-squared	0.852	0.732	0.932
Number of Observation	84	84	84

Notes: *** indicates significant at 1%, ** indicates significant at 5%, and * indicates significant at 10%; t-statistics are in parentheses ( ) and p-value are in [ ].

$lnPOP_{it} lnPOP_{jt}$

The distance variable ($lnDINS_{ij}$) is intended as a proxy for transportation cost. The distance variable in the random effects model and pooled model has the right sign in the sense that increased trade is negatively correlated with distance. The coefficient is -1.715 and statistically significant at 1 per cent level. It indicates that this variable may hide the fact that the transaction costs of trading in Algeria in respect of distance are far higher than the others AMU countries.

The real exchange rate($lnRER_{ij}$) has positive coefficient but an insignificant coefficient, implying that it does not have an impact on trades.

The foreign currency reserves ($lnFCR_{ij}$) is typically positive coefficient; 0.601 in random effects model and statistically significant at 1 per cent. This result is consistent with previous evidence (Harris and Matyas, 2001, Egger and Pfaffermayr, 2003, and Serlenga and Shin, 2004).

The study takes a particular interest in how both exporters and importer respond to trade openness. As expected, trade and Openness ($lnOPENNESS_{ij}$) are correlated significantly and positively with each other. The coefficient is 0.0438 in random effects model and statistically significant at 1 per cent level. Given the strong and positive relationship between trade intensity ratios and growth, the existence of a significant correlation between trade and Openness indicates that Openness is fairly effective for increasing trade.

The interpretation of the coefficients on the integration dummy variables is also relevant for our analysis. The regression results in Table 4.1 are consistent with the predictions of theoretical studies, rather than the conventional view on the issue. The random effects model column shows report that a significant and negative relationship between trade and agreement($AGMT_{ij}$) among Algeria and the others AMU countries. The coefficient of the agreement($AGMT_{ij}$) are -2.083 in random effects model. Since the model is log-linear, the impact of AGMT on bilateral trade can be computed in percentage terms as 100 x [exp(β_{AGMT}) − 1.00] or 100 x [0.12455 – 1.00] = -87.54%. This indicates that with the AGMT agreement, the percentage reduction of trade between Algeria and other four AMU countries is 87.54%. On the other hand, Libya, Mauritania and Tunisia demonstrate trade expansion by signing the PAFTA.

Table 2 also shows that the fixed effects model doesn't have any significant effect between trade and agreement. The estimated coefficient of lagged English language (LAN_{ij}), is not significant in random effects model.

The Goodness of fit reflected by the R-square, as well as the total number of observations are given in the final rows. The overall goodness of fit of four estimation of the gravity model can be concluded that the specified models explain the variety in trade flows to a sufficient extends. Time fixed effects are needed if the independent variables for all are equal to 0, if they are, then no time fixed effects are needed. In

Table 2, we fail to reject the null that all years coefficients are jointly equal to zero which is 3.17. Therefore time fixed effects are not needed in this model.

Table 3 illustrates the intra-trade between Libya and the others AMU countries namely Algeria, Mauritania, Morocco, and Tunisia. The Hausman specification test statistic shows that the null hypothesis fail to reject and indicate that there was no systematic difference between fixed and random models, thereby confirmed that the random effects estimator was efficient in our empirical framework for intra-trade between Libya and among others AMU countries.

Table 3: Libya – Dependent variable: Trade

Variables	**Pooled Model**	**Fixed Effects Model**	**Random Effects Model**
$Constant$	-32.753 (-1.46)	94.9611 (0.72)	-35.953 (-1.06)
$lnGDP_{it}$	0.823** (2.64)	-0.203(-0.87)	0.8553*** (2.96)
$lnGDP_{jt}$	0.2911* (1.86)	0.115 (0.67)	0.3903* (1.64)
$lnPOP_{it}$	1.389*** (5.34)	8.010 (0.92)	1.659*** (4.49)
$lnPOP_{jt}$	4.441*** (2.96)	1.700 (0.98)	5.341** (2.41)
$lnDINS_{ij}$	-1.132*** (-6.25)		-1.892*** (-7.38)
$lnFCR_{ij}$	0.437 *** (5.00)	0.3487* (1.70)	0.338*** (5.25)
$lnRER_{ij}$	2.100*** (3.61)	1.509** (2.24)	2.430*** (3.31)
$lnOPENNESS_{ij}$	9.226*** (20.06)	9.585*** (37.67)	9.616*** (39.49)
$AGMT_{ij}$	0.233*** (5.32)	0.370** (2.72)	0.313** (2.58)
LAN_{ij}	-0.139 (-1.12)	-0.168 (-0.80)	-0.249 (-1.46)
F Test		1.82 [0.1512]	
LM Test			2.10 [0.1474]
Hausman Test		5.46 [0.7924]	
Time Fixed Effect		1.43 [0.2433]	
R-squared	0.9938	0.8737	0.9634
Number of Observation	84	84	84

Notes: *** indicates significant at 1%, ** indicates significant at 5%, and * indicates significant at 10%; t-statistics are in parentheses ( ) and p-value are in [ ].

The results show that an increase in the foreign GDP ($lnGDP_{it}$) and domestic GDP ($lnGDP_{jt}$) causes an increase in Libya's trade. The coefficient for both variables are positive by 0.8553 and 0.3903 in random effects model and statistically significant at 1 per cent and 10 per cent level, as expected and in line with the previous literature on trade. Overall, this indicates that an increase in foreign GDP and domestic GDP causes Libya trade to increase. The results also show that foreign GDP and domestic GDP are an insignificant in the fixed effect. The results are in line with those found in other gravity model studies suggesting that the results are consistent. These results also show that foreign GDP in Libya have the same impact in Algeria to the trades through the intra-trade between Algeria and others AMU countries as well as Libya and others AMU countries.

The population coefficients of foreign country ($lnPOP_{it}$) and domestic population ($lnPOP_{jt}$) are positive sign coefficient by 1.659 and 5.341 in random effects model and strongly significant at 1 per cent level. Population as gravitational variables is expected to have a positive sign. This reflects that countries with large GDP have more goods to trade and greater demand for good to import and export. These results also show that population of foreign country and domestic population in Libya have the same impact in Algeria to the trades through the intra-trade between Algeria as well as Libya and others AMU countries.

The distance variable ($lnDINS_{ij}$) in the random effects model has the right sign in the sense that increased trade is negatively correlated with distance. The coefficient is -1.892 and statistically significant at 1 per cent level. It is indicate that this variable may hide the fact that the transaction costs of trading in Libya in respect of distance are far higher than other AMU countries. This result consistent with Alam et al. (2009) stated that geographical distance has significant impact on imports of Bangladesh which means transport costs and other transaction costs, such as, the probability of surviving intact of perishable goods etc. still have significant impacts on its import. The result of the distance in Libya also had the same impact in Algeria in term of a resistance factor and has a negative impact on volume of intra-trade.

Libya's real exchange rate ($lnRER_{ij}$) has positive coefficient by 2.430 and statistically significant at 1 per cent level, implying that it have an

impact on trades. The foreign currency reserves ($lnFCR_{ij}$) are typically positive coefficient by 0.338 in and statistically significant at 1 per cent level. This result is consistent with previous evidence. The results show that the real exchange rate and the foreign currency reserves are akin to a price variable in the trade demand schedule.

As expected, trade and Openness ($lnOPEN_{ij}$) are correlated significantly and positively with each other. The coefficient of the openness is 9.616 and statistically significant at 1 per cent level. Given the strong and positive relationship between trade intensity ratios and growth, the existence of a significant correlation between trade and Openness indicates that Openness is fairly effective for increasing trade.

The interpretation of the coefficients on the integration dummy variables is also relevant for our analysis. The regression results in Table 3 are consistent with the predictions of theoretical studies, rather than the conventional view on the issue. Reports on the random effects model column show a significant and positive relationship between trade and agreement ($AGMT_{ij}$) among Libya and the others AMU countries. The coefficient is 0.313 and statistically significant at 1 per cent level. Since the model is log-linear, the impact of AGMT on bilateral trade can be computed in percentage terms as 100 x [exp(β_{AGMT}) − 1.00] or 100 x [1.36752 – 1.00] = 36.75%. This indicates that with the AGMT agreement, the percentage expansion of trade between Algeria and other four AMU countries is 36.75%. On the other hand, Libya, Mauritania and Tunisia demonstrate trade reduction by signing the PAFTA. The estimated coefficient of lagged English language (LAN_{ij}) is not significant. The Goodness of fit reflected by the R-square, as well as the total number of observations is given in the final rows. The overall goodness of fit of four estimation of the gravity model can be concluded that the specified models explain the variety in trade flows to a sufficient extends. Time fixed effects are needed if the independent variables for all are equal to 0, if they are then no time fixed effects are needed. In Table 3 we fail to reject the null that all years coefficients are jointly equal to zero which is 1.43. Therefore time fixed effects are not needed in this model.

Table 4 shows the intra-trade between Mauritania and the others AMU countries namely Algeria, Libya, Morocco, and Tunisia. The Hausman

test statistic shows that the null hypothesis is rejected and this indicates that the country specific effects are correlated with regressors. This suggests that the random effects model is appropriate, and the fixed effects estimates are not consistent. That means the random effects model is the appropriate one for trade of exports between countries.

Table 4: Mauritania – Dependent variable: Trade

Variables	**Pooled Model**	**Fixed Effects Model**	**Random Effects Model**
$Constant$	-690.563** (-2.12)	-551.172* (-2.01)	-690.563** (-2.36)
$lnGDP_{it}$	3.538* (1.76)	3.554** (6.90)	3.432*** (7.42)
$lnGDP_{jt}$	9.971*** (6.58)	9.962*** (9.68)	9.715*** (11.10)
$lnPOP_{it}$	1.036** (2.35)	2.479* (1.93)	1.067** (2.63)
$lnPOP_{jt}$	37.607* (1.93)	37.587* (1.93)	38.034** (2.08)
$lnDINS_{ij}$	-61.125** (-2.22)		-59.551*** (-3.21)
$lnFCR_{ij}$	1.199** (2.16)	1.162** (2.45)	1.210** (2.69)
$lnRER_{ij}$	1.425 (1.27)	1.567 (0.99)	1.644 (1.18)
$lnOPENNESS_{ij}$	11.169*** (28.73)	11.172*** (66.30)	11.143*** (71.49)
$AGMT_{ij}$	2.846*** (3.48)	2.806* (1.84)	3.465*** (5.16)
LAN_{ij}	0.794 (0.62)	0.392 (0.19)	0.794 (0.66)
F Test		0.05 [0.9861]	
LM Test			2.10 [0.1477]
Hausman Test		0.14 [0.9325]	
Time Fixed Effect		0.56 [0.6462]	
R-squared	0.9229	0.9815	0.9939
Number of Observation	84	84	84

Notes: *** indicates significant at 1%, ** indicates significant at 5%, and * indicates significant at 10%; t-statistics are in parentheses ( ) and p-value are in [ ].

The results show that an increase in the foreign GDP ($lnGDP_{it}$) and domestic GDP ($lnGDP_{jt}$) causes an increase in Mauritania's trade. The coefficient for both variables are positive by 3.432 and 9.715 and statistically significant at 1 per cent level, as expected and in line with the previous literature on trade and also the results in Algeria and Libya. Overall this indicates that an increase in foreign GDP causes Mauritania trade to increase.

The domestic population ($lnPOP_{jt}$) is positive sign coefficient by 38.034 and strongly significant at 5 per cent level. Population as gravitational variables is expected to have a positive sign. This reflects that countries with large GDP have more goods to trade and greater demand for good to import and export. On the other hand, the population coefficients of foreign country ($lnPOP_{it}$) have positive coefficient but not significant at any level (1.067). This means no impact on trades. In relation to the foreign and domestic population variables, we should point out that their role in the Gravity setting is generally considered to be ambiguous (Oguledo and MacPhee, 1994).

The distance variable ($lnDINS_{ij}$) in the random effects model has the right sign in the sense that increased trade is negatively correlated with distance. The coefficients are -59.551 and statistically significant at 1 per cent level. It indicates that this variable may hide the fact that the transaction costs of trading in Mauritania in respect of distance are far higher than the others AMU countries.

Mauritania's real exchange rate ($lnRER_{ij}$) have positive coefficient (1.644) but statistically an insignificant, implying that it have no impact on trades. The foreign currency reserves ($lnFCR_{ij}$) is typically positive coefficient by 1.210 and statistically significant at 5 per cent level. This result is consistent with previous evidence (Harris and Matyas, 2001, Egger and Pfaffermayr, 2003, and Serlenga and Shin, 2004). We can conclude that the reason could well be that these simply represent the accumulation of trade flows combined with past exchange rate and the foreign currency reserves policies, rendering their effect on contemporaneous trade flows somewhat ambiguous. Trade and Openness ($lnOPENNESS_{ij}$) are correlated significantly and positively with each other. The coefficients are 11.143 and statistically significant at 1 per cent level. Given the strong and positive relationship between trade intensity ratios and growth, the existence of a significant correlation between trade and Openness indicates that Openness is fairly effective for increasing trade.

Table 4 also show that the random effects model column report show a negative relationship between trade and agreement ($AGMT_{ij}$) among Mauritania and other AMU countries. The coefficient is 3.465 and statistically significant at 1 per cent level. Since the model is log-linear,

the impact of AGMT on bilateral trade can be computed in percentage terms as 100 x [exp(β_{AGMT}) − 1.00] or 100 x [31.974 – 1.00] = 3,097.64%. This indicates that with the AGMT agreement, the percentage expansion of trade between Algeria and other four AMU countries is 3,097.64%. On the other hand, Libya, Mauritania and Tunisia demonstrate trade reduction by signing the PAFTA. The estimated coefficient of lagged English language (LAN_{ij}) is not significant.

The Goodness of fit reflected by the R-square, as well as the total number of observations is given in the final rows. The overall goodness of fit of four estimation of the gravity model concluded the specified models explain the variety in trade flows to a sufficient extends. Time fixed effects are needed if the independent variables for all are equal to 0, if they are then no time fixed effects are needed. In Table 4.3, we fail to reject the null that all years coefficients are jointly equal to zero which is 0.56. Therefore time fixed effects are not needed in this model.

Table 5 shows the intra-trade between Morocco and the others AMU countries namely Algeria, Libya, Mauritania, and Tunisia. The Hausman specification test statistic shows that the null hypothesis fail to reject and indicated that there was no systematic difference between fixed and random models, thereby confirmed that the random effects estimator was efficient in our empirical framework for intra-trade between Morocco and among others AMU countries.

Table 5: Morocco – Dependent variable: Trade

Variables	Pooled Model	Fixed Effects Model	Random Effects Model
$Constant$	-188.875 (1.56)	-154.840 (-1.23)	-168.875 (-1.26)
$lnGDP_{it}$	0.334** (2.21)	0.221 (1.39)	0.309** (2.01)
$lnGDP_{jt}$	2.152*** (3.80)	3.354*** (3.87)	3.041*** (3.41)
$lnPOP_{it}$	0.786* (1.78)	-1.292 (-0.71)	0.988 (1.63)
$lnPOP_{jt}$	4.112 (0.89)	7.781 (1.01)	5.492 (0.70)
$lnDINS_{ij}$	-1.885** (-2.06)		-2.985* (-1.96)
$lnFCR_{ij}$	0.482** (2.67)	0.420** (2.47)	0.402** (2.31)
$lnRER_{ij}$	2.837*** (4.93)	3.078*** (5.42)	2.837*** (4.93)
$lnOPENNESS_{ij}$	11.169*** (28.73)	11.172*** (66.30)	6.162*** (22.58)
$AGMT_{ij}$	-2.846*** (-3.48)	-2.806* (-1.84)	-0.055 (-0.80)
LAN_{ij}	-0.794 (-0.62)	-0.392 (-0.19)	2.10 (0.1477)
F Test		0.05 [0.9861]	
LM Test			2.10 [0.1477]
Hausman Test		0.23 [0.9735]	
Time Fixed Effect		0.59 [0.6352]	
R-squared	0.9229	0.9845	0.9613
Number of Observation	84	84	84

Notes: *** indicates significant at 1%, ** indicates significant at 5%, and * indicates significant at 10%; t-statistics are in parentheses ( ) and p-value are in [ ].

The results show that an increase in the foreign GDP ($lnGDP_{it}$) and domestic GDP ($lnGDP_{jt}$) causes an increase in Morocco's trade. The coefficient for both variables are positive by 0.309 and 3.041 and statistically significant at 1 per cent and 5 per cent level, as expected and in line with the previous literature on trade. Overall this indicates that an increase in foreign GDP causes Morocco trade to increase. The results are in line with those found in other gravity model studies suggesting that the results are consistent.

The population coefficients of foreign country ($lnPOP_{it}$) and domestic population ($lnPOP_{jt}$) are positive sign coefficient by 0.988 and 5.492

but strongly an insignificant at any level. This reflects that there is no impact on trade. The distance variable ($lnDINS_{ij}$) in the random effects model has the right sign in the sense that increased trade is negatively correlated with distance. The coefficients are -2.985 and statistically significant at 10 per cent level. It indicates that this variable may hide the fact that the transaction costs of trading in Morocco in respect of distance are far higher than the others AMU countries.

Morocco's real exchange rate ($lnRER_{ij}$) have positive coefficient by 2.837 and statistically significant at 1 per cent level, implying that it have an impact on trades. The foreign currency reserves ($lnFCR_{ij}$) is typically positive coefficient (0.402), and statistically significant at 5 per cent level. This result is consistent with previous evidence and the intra-trade between Libya and other AMU countries. The results show that the real exchange rate and the foreign currency reserves are akin to the price variable in the trade demand schedule.

Trade and Openness ($lnOPENNESS_{ij}$) are correlated significantly and positively with each other. The coefficients are 6.162 and statistically significant at 1 per cent level. Given the strong and positive relationship between trade intensity ratios and growth, the existence of a significant correlation between trade and Openness indicates that Openness is fairly effective for increasing trade.However, agreement ($AGMT_{ij}$) and English language (LAN_{ij})are not significant.

The Goodness of fit reflected by the R-square, as well as the total number of observations is given in the final rows. The overall goodness of fit of four estimation of the gravity model concluded the specified models explain the variety in trade flows to a sufficient extends. Time fixed effects are needed if the independent variables for all are equal to 0, if they are, then no time fixed effects are needed. In Table 5, we fail to reject the null that all years coefficients are jointly equal to zero which is 0.59. Therefore time fixed effects are not needed in this model.

Table 6 shows the intra-trade between Tunisia and the others AMU countries namely Algeria, Libya, Mauritania, and Morocco. The Hausman specification test statistic shows that the null hypothesis fail to reject and indicate that there are no systematic difference between fixed and random models, thereby confirmed that the fixed effects estimator

was efficient in our empirical framework for intra-trade between Tunisia and among others AMU countries.

The results show an increase in the foreign GDP ($lnGDP_{it}$) and the domestic GDP ($lnGDP_{jt}$) causes an increase in Tunisia's trade. The coefficients for these variables are positive by 0.808 and 1.056 and statistically significant at 1 per cent level, respectively, as expected and in line with the previous literature on trade. Overall this indicates that an increase in foreign GDP causes Tunisia trade to increase.

The population coefficients of foreign country ($lnPOP_{it}$) and domestic population ($lnPOP_{jt}$) are positive and have a positive sign coefficient by 2.843 and 5.076 and strongly significant at 1 per cent level, respectively. Population as gravitational variables is expected to have a positive sign. This reflects that countries with large GDP have more goods to trade and greater demand for good to import and export.

Tunisia's real exchange rate ($lnRER_{ij}$) have negative coefficient by -0.028 in but statistically not significant, implying that it have not an impact on trades. The foreign currency reserves ($lnFCR_{ij}$) are typically positive coefficient (1.383) and statistically significant at 1 per cent level. This result is consistent with previous evidence and the intra-trade between Tunisia and the others of AMU countries. The results show that the foreign currency reserves are akin to a price variable in the trade demand schedule.

Table 6: Tunisia – Dependent variable: Trade

Variables	Pooled Model	Fixed Effects Model	Random Effects Model
$Constant$	87.082*** (3.10)	-10.883 (-0.38)	87.621*** (4.50)
$lnGDP_{it}$	0.707*** (11.55)	0.808*** (12.57)	0.700*** (9.41)
$lnGDP_{jt}$	0.414*** (4.79)	1.056*** (4.43)	0.365*** (8.28)
$lnPOP_{it}$	7.551*** (32.42)	2.843** (2.77)	7.545*** (45.49)
$lnPOP_{jt}$	6.796*** (3.30)	5.076*** (4.31)	6.756*** (5.19)
$lnDINS_{ij}$	-0.482** (-2.32)		-0.475*** (-3.35)
$lnFCR_{ij}$	0.197*** (3.89)	1.383** (2.47)	0.197*** (6.15)
$lnRER_{ij}$	0.420** (1.79)	-0.028 (-0.11)	0.303 (1.16)
$lnOPENNESS_{ij}$	7.874*** (102.97)	7.880*** (116.38)	7.866*** (96.99)
$AGMT_{ij}$	1.307** (2.05)	0.031 (0.11)	1.320*** (5.16)
LAN_{ij}	0.380* (1.89)	-0.002 (-0.10)	0.380 (1.02)
F Test		11.75*** [0.0000]	
LM Test			1.99 [0.1585]
Hausman Test		35.32***[0.0001]	
Time Fixed Effect		15.58*** [0.0000]	
R-squared	0.9736	0.6565	0.9956
Number of Observation	84	84	84

Notes: *** indicates significant at 1%, ** indicates significant at 5%, and * indicates significant at 10%; t-statistics are in parentheses ( ) and p-value are in [ ].

In Table 6, trade and Openness ($lnOPEN_{ij}$) are correlated significantly and positively with each other. The coefficients are 7.880 and statistically significant at 1 per cent level. Given the strong and positive relationship between trade intensity ratios and growth, the existence of a significant correlation between trade and Openness indicates that Openness is fairly effective for increasing trade. The estimated coefficient of agreement ($AGMT_{ij}$) and English language (LAN_{ij}) are not significant in fixed effects model.

The Goodness of fit reflected by the R-square, as well as the total number of observations is given in the final rows. The overall goodness

of fit of four estimation of the gravity model concluded the specified models explain the variety in trade flows to a sufficient extends. Time fixed effects are needed if the independent variables for all are equal to 0, if they are, then no time fixed effects are needed. In Table 6, we reject the null that all years coefficients are jointly equal to zero which is 15.58. Therefore time fixed effects is needed in this model.

5. Conclusion

This paper attempts to identify the important of intra-trade among AMU countries namely Algeria, Libya, Mauritania, Morocco, and Tunisia. The results from the traditional approach of the gravity model, indicate that there are significant relationships between trade and GDP, population, distance, foreign currency reserves (FOC) and real exchange rate (RER) among the AMU countries. These results answered the first objective which is to examine the impact of regional integration on trade among the Maghreb countries. Overall we can conclude that the AMU has had mix relationships of intra-regional trade in the member countries. This study also shows that AMU's non-traditional trading partners are relatively more open to AMU's member states trade. On the hand, the dummy variables for trading agreement and English language have mix results. As shown by the study, the existence of a significant correlation between trade flows and openness shows that openness are fairly effective for increasing trade.

Several policy implications emerged from the analysis. First, identifying that trade direction, this is intra-trade and inter-trade. The intra-trade among AMU is below the expected level, this study clearly identifies that GDP, population, distance, Foreign currency reserve (FOC), and Real Exchange Rate (RER) measures to promote trade relationships and which look like remove barriers to trade is justified. Importantly, there is evidence that the deviation from the expected level of trade is increasing among AMU especially among Mauritania, Morocco, and Tunisia, further highlighting the need for appropriate policies in population and Real Exchange Rate (RER).

The real exchange rate is best thought of as a facilitating condition as keeping it at competitive levels and can be critical for jump-starting growth. From our study, we found that the real exchange rate gave mixed results of significant level. Algeria, Mauritania, and Tunisia have

a positive and negative impact, but not significant into trade among the other AMU countries, while only Libya and Morocco have positive and significant impact into the trade. From a policy perspective, it is important to consider where resources are most effectively used to promote trade. Furthermore, it is also important to consider the appropriate policy tools as these may well differ between countries. As the global exchange rate system is in a state of flux, it is important for AMU countries to work towards some kind of convergence with respect to exchange rate policies in the immediate term. There has to be a clear understanding among the foreign exchange authorities of the kind of interventions that will have to be made in the near term. This will facilitate increased intra-regional trade transactions. We found that the language is not significant to the Arab Maghreb Union trade more to countries where the official language is English, which suggests that sharing the same language promotes volumes of trade.

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