

**UNIVERSITAT
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THE IMPACT ON TRADE OF NORTH AFRICAN MIGRATION TO EUROPE

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Abstract: In this project, we analyze the impact of the recent exodus of Africans to the European Union (EU) countries on trade flows. In concrete, we focus on North African countries and their main EU partners receiving African migrant for the period 2009-2019. The empirical method used to identify the influence of migrants from North Africa to EU on European-African bilateral trade rests on gravity econometric models. The results confirm that migration increases trade relations, specially export flows from EU to North African countries.

Keywords: Bilateral migration; Bilateral trade; European Union; North America

JEL codes: F14, F22, O24

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1. Introduction

The economies of Africa and Europe have been economically related since colonial times. The metropolis used to sell manufactured products with high added value while African countries provided raw materials. European colonist countries not only invaded the African territory, but they also changed the internal functioning of their economies starting with trade, taxes, and the national currency of each country. The colonializers took advantage of the abundance of existing resources in the continent for their own benefit in their land. However, from the First World War (IWW), when the independence movements emerged, most African countries achieved a peaceful transition, except Algeria, Egypt, Libya. After decolonization, Pérez (2016) affirms that, on the one hand, the African continent achieved a strong instability since it depended on the colonizing powers, but it also had to face multiple conflicts and civil wars. On the other hand, he states that independence was not completely since European countries still use trade and investment as a way to colonize Africa. Indeed, the former colonizer became the main trading partner for these colonized countries. Currently, a massive amount of money comes from the extraction of energy resources, such as oil or gas from companies like British Petroleum (BP), and Royal Dutch Shell.

In this paper we try to analyze to what extent the trade relationship, at the intensive margin, between the European Union and the North African region has been affected by recent migratory movements. Specifically, we focus on the countries of the Mediterranean area of Africa: Algeria, Tunisia, Egypt, Libya, and Morocco. Each of these countries has been colonized by some European country, as was almost the entire African continent at the end of the 19th century. So, we will analyze if this may be the reason for opening borders to immigrants. The case of Algeria, which was invaded for more than a century (1830-1962) by the French power, being this the colony that has remained in French hands the longest. Tunisia was also colonized by the French colonial empire in the year 1881 when it previously created an Anglo-Franco-Italian commission. This gave way to the three European powers entering the country and in 1956 it achieved independence. In the year 1882, Egypt was occupied by British forces during the Anglo-Egyptian War. After the Suez Crisis in 1954, the last remaining British forces in the country were withdrawn. Italy took advantage of the proximity to Libyan territory and invaded it in 1912, seeking for itself a colonial empire in Libya until 1969. Finally, Morocco was renamed Spanish Morocco thanks to the Franco-Spanish

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agreements signed in 1912. Later, it achieved independence, and in the same year (1956) France and Spain left the area.

In short, we can say that Africa and the European Union (EU) are two continents separated by the Mediterranean Sea, which unites them by geographical and historical proximity, apart from economic interests. African countries are energy providers and abundant in raw materials. The European area needs coal, energy, hydrocarbons and other types of products or services from the African continent.

Numerous studies have analyzed the trade relations between the countries of North Africa and the European Union, such as the analysis by Marín Egoscózábal (2005) in which the different agreements that have been created between the EU and Sub-Saharan Africa are argued. Asci, Koç and Erdem (2014) explain how North Africa and the Middle East (MENA), and the EU have benefited from becoming partners through trade liberalization. Institutional quality is found to favor trade, while MENA countries rely heavily on imports. Although Padilla (2014) states that the European Union is the one that depends on energy imports from Africa and that is why a Common Energy Policy must be consolidated. According to the latest Eurostat data, the European Union is Africa's main trading partner. The main exporting countries for Africa during 2018 of the European Union was France with sales of approximately 26 billion euros. Followed by Germany, Spain, and Italy with figures between 18,000-23,000 euros in sales. They also were the main importers, although in this case Spain took first place, with purchases of approximately 27,000 million euros.

We also find studies that analyze migratory flows from North Africa to Europe. A growing increase is observed for socioeconomic reasons, wars, or poverty (Rojas, 2021). López Sala (2012) studies the link between migratory flows between Morocco and the European Union. She assures that a framework of political agreements has been created between these two areas to fight against illegal immigration. Furthermore, Ospina (2014) analyzes the threat that migratory movements can pose and, to encourage regular migration, suggests that a more open visa policy should be carried out without so many limitations.

It should be noted that most African migration is internal. According to the International Organization for Migration (IOM) and the African Union (AU), 53% of migratory movements occur internally among African countries. Concerning external migration, the continent that receives the most migrants from Africa is Europe with 26% of the total and the remaining 20%

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is divided between Asia, North America, and Oceania. This means that, the European continent encompasses more than half of total African emigrants moving out of Africa.

This massive entry of African migrants to Europe has provoked a recent controversial political and social debate. This migration has been sometimes presented as a threat to these welfare state-based economies and as a source of job displacement by cheaper labour. However, these arguments would ignore the positive effects of migration on the receiving economies and specially on trade. As pointed out by Rapoport (2018), migration and trade can be considered as complements, with strong and robust evidence of the trade-creating effects of migration.

Despite that many works have analysed the links between trade and migration (see, for instance, Felbermayr, Gabriel and Toubal (2012); Law, Genc and Bryan, 2013; Karagöz, 2016), to the best of our knowledge, this literature has avoided the explicit examination of the impact of migration from North African countries to European countries on the bilateral trade between both areas. This project fills this gap in this area of research.

The rest of the paper is organized as follows. The next section presents the data and key stylized facts. Section 3 describes the underlying theoretical framework and the empirical strategy. Section 4 presents the estimation results, and the final section concludes.

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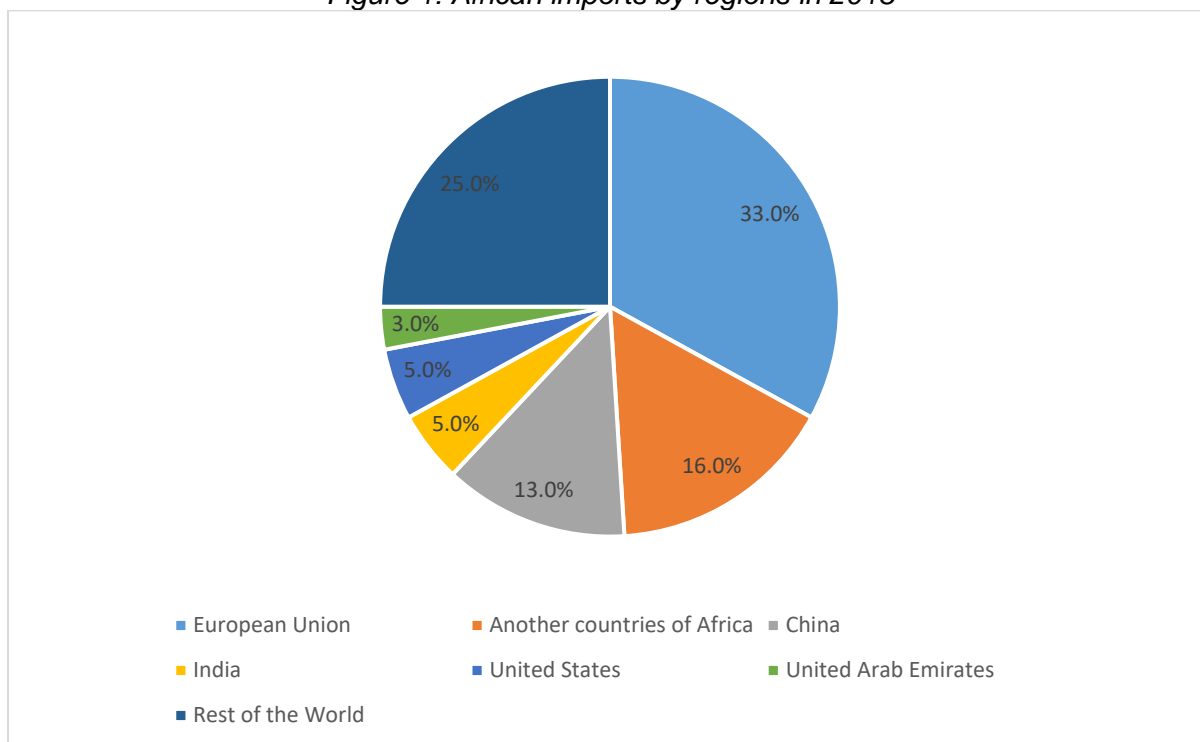
2. Stylized facts

This project uses data from the five countries of the European Union (Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom.), and from the five Mediterranean African countries (Algeria, Morocco, Libya, Tunisia and Egypt).

Figures 1 and 2 show the share of exports and imports from and to Africa to and from the different geographical regions in 2018. In these figures, we can clearly see that Africa's main partner is the European Union, for which it imported the 33% and exported 36.4% of the total. Mediterranean African countries supply most of the imports to Europe, 36.4% according to UNCTAD. According to Dieye (2021), Africa's exports to the European Union increased by 30% between 2008 and 2018. These exports amounted to a figure of 73,000 million euros, composed mainly of natural resources such as oil and its derivatives in addition to gas, in a period of 10 years (2008-2018). It should be noted that this increase was accompanied by a reduction in prices due to the absence of tariffs after the Euro-Mediterranean Agreements. These agreements vary for each of the five African countries considered in this project, although they share common characteristics such as free trade. However, it should be noted that international organizations such as the World Trade Organization (WTO) or the General Agreement on Tariffs and Trade (GATT) aim to eliminate or reduce the barriers that prevent free trade in order to facilitate and achieve a beneficial trade. Thanks to agreements like this, additional costs such as quotas or tariffs are saved and foreign investment is encouraged (Millet, 2001).

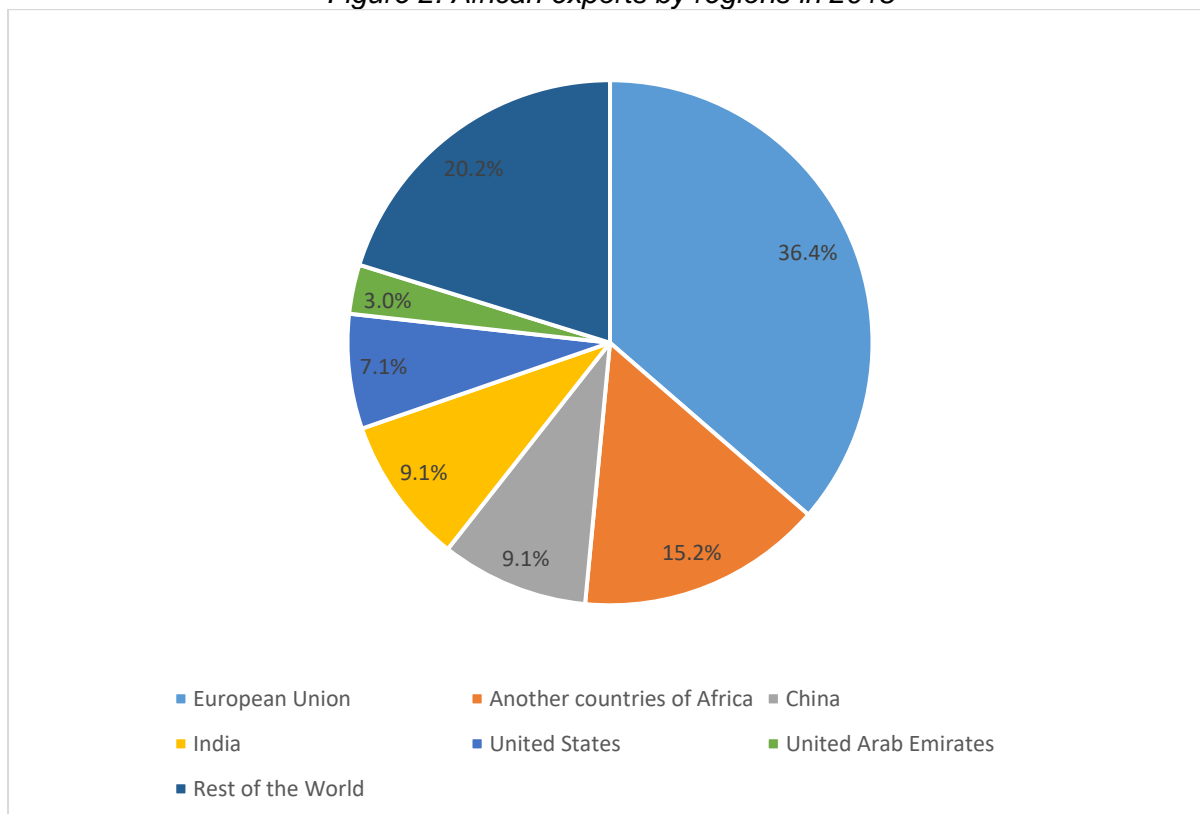
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Figure 1: African imports by regions in 2018



Source: Author elaboration using data from UNCTAD

Figure 2: African exports by regions in 2018

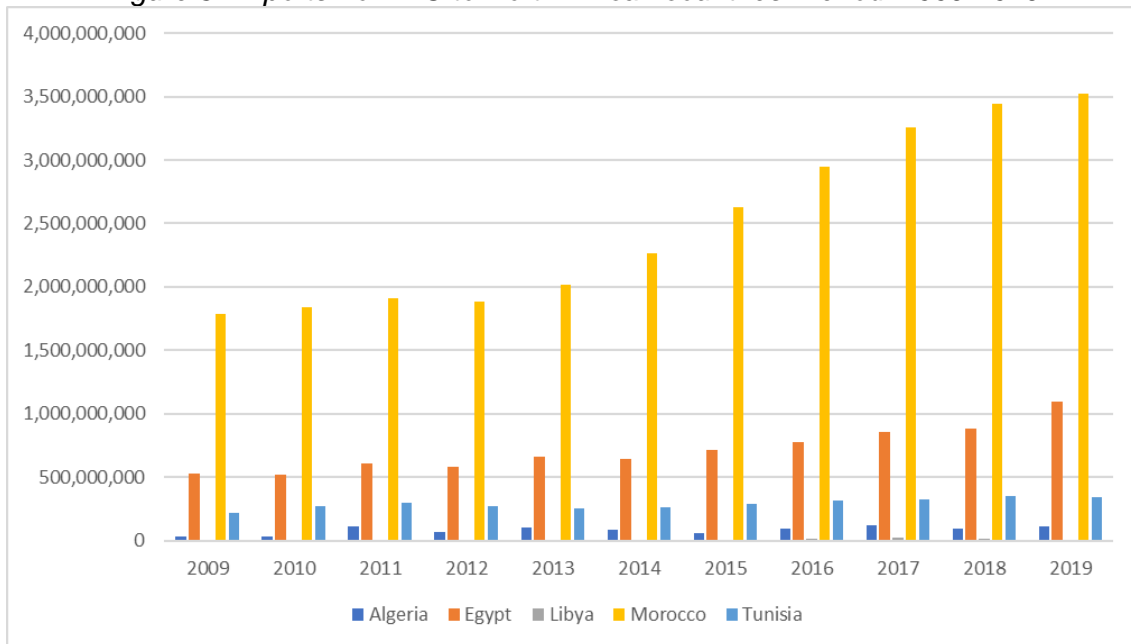


Source: Author elaboration using data from UNCTAD

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Next, in Figure 3 and 4, we show the trade relationship between European Union and the African countries under study.

Figure 3: Imports from EU to North African countries. Period: 2009-2019



Source: Author elaboration using Eurostat data

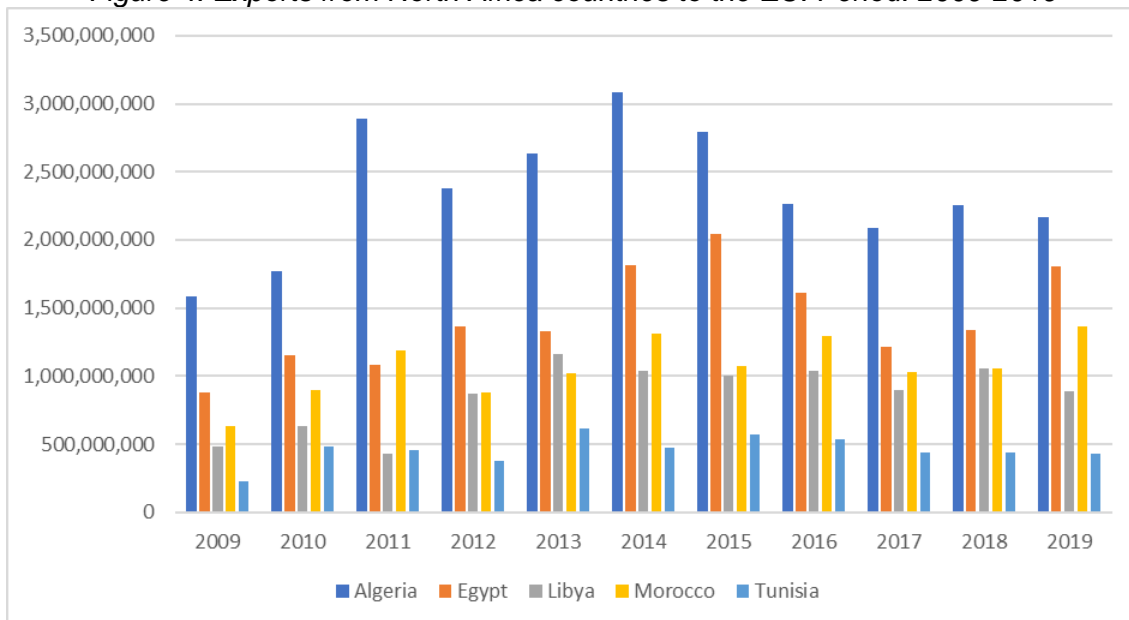
As we can see in Figure 3, the largest North African importer in Europe is Morocco, which has been growing over time, almost multiplying by two the number of its imports during the sample period. Contel (2020) highlights that Spain is Morocco's largest trade partner providing 15.6% of the total imports, followed by France with 12.2%, Italy 5.4%, and Germany 4.9%. Egypt also maintains an upward trend. However, according to the Secretary of State for Trade (2022), the government has decided to place restrictions on imports since 2016, reducing them to approximately 40%. The European Union decided to take these facts to the World Trade Organization given the damages caused. Tunisia has kept its imports from the EU constant, while Algeria and Libya barely import from the area studied.

Regarding Figure 4, we see that the largest exporter is Algeria. Fuente Cobo (2022) states that it is the eleventh among world oil exporters and seventh of natural gas and affirms that in 2017 70% of hydrocarbon exports are destined to Europe. The sustained growth is explained by the ease of transportation between the zones. For example, the export of gas to Spain is carried out through the gas pipeline that unites them. What this entails is a clear comparative advantage thanks to the reduction of transport costs. The same happens with Libya. This country is one of the largest exporters of gas thanks to the gas pipeline that unites Libya with

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Italy, making Algeria and Libya the largest energy powers in North Africa. As shown, Egypt's exports have been affected in 2011, one of the possible causes could be the political situation in the country and on the African continent, given the claims that have erupted. According to the statistical analysis of data from the International Monetary Fund (2011) those countries, such as Libya, Egypt, Tunisia, etc. in which the strongest and most tragic protests took place, experienced a worse decrease in their economy. Concerning to the Moroccan exports, they have had a very variable evolution. According to Contel (2020), the European Union imports only 0.3% of the total among which are agricultural, textile, and automotive products..., but the exports of Morocco to these countries are much higher: Spain (24.1%), France (21.6%), and Italy (4.7%). Finally, Tunisia is the one that exports the least to the EU because it is a very small country. As a supplier, World Integrated Trade Solution (2019) states that in 2019 Tunisia exported consumer goods and intermediate goods mainly to France (29.13%), Italy (16.16%), Germany (12.85%), and Spain (3.77%).

Figure 4: Exports from North Africa countries to the EU. Period: 2009-2019



Source: Author elaboration using Eurostat data

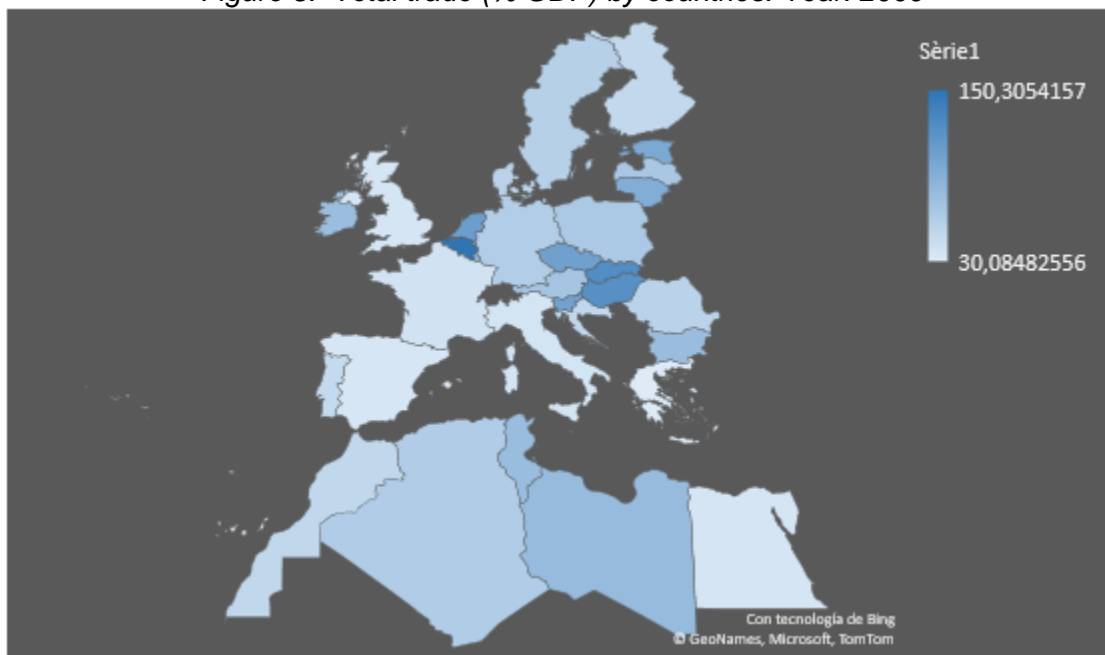
Pajares and Guarasa (2011) highlight the advantage that for these two trading partners suppose their geographical proximity. For them, given the competitive advantages and proximity, it would be profitable for both partners to liberalize trade and promote exports and imports. In addition, North Africa has achieved an average year-on-year growth equal to 4% since 2000 thanks to its opening to trade, according to Martín and Galduf (1994) theory, who explains the intensification of factors and goods trade flows because of the trade agreements.

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Eventually, these effects translate into economic growth in the region too, since it improves competitiveness, productivity and innovation. Over time, trade began to have more importance and became part of GDP. For better understanding, we will analyze trade development as a percentage of gdp in 2009 and 2019.

As can be seen in Figures 5 and 6, there is an evident change in the relevance of trade in both areas analyzed since 2009. At first glance, we can see that there is a significant variation in trade relations in the countries of the north of Africa, with considerable trade growth as a percentage of GDP. As an exception, we can mention the case of Algeria, which has experienced a negligible decline, probably due to the restrictions imposed by the Algerian government since 2016. These measures went against the free trade agreement mentioned above. Furthermore, Algeria does not belong to the World Trade Organization according to the Ministry of Industry, Trade and Tourism (2022). As for the European Union, many countries have experienced an increase in the weight of their trade with respect to GDP, among them the following stand out: the Slovak Republic, Slovenia, Belgium, the Czech Republic, Hungary and the Netherlands, being the main exporting countries. products that are vehicles and machinery. We also find countries that maintain a practically stable trade share or with a small increase with respect to GDP, as is the case of Spain, France, Italy and the United Kingdom.

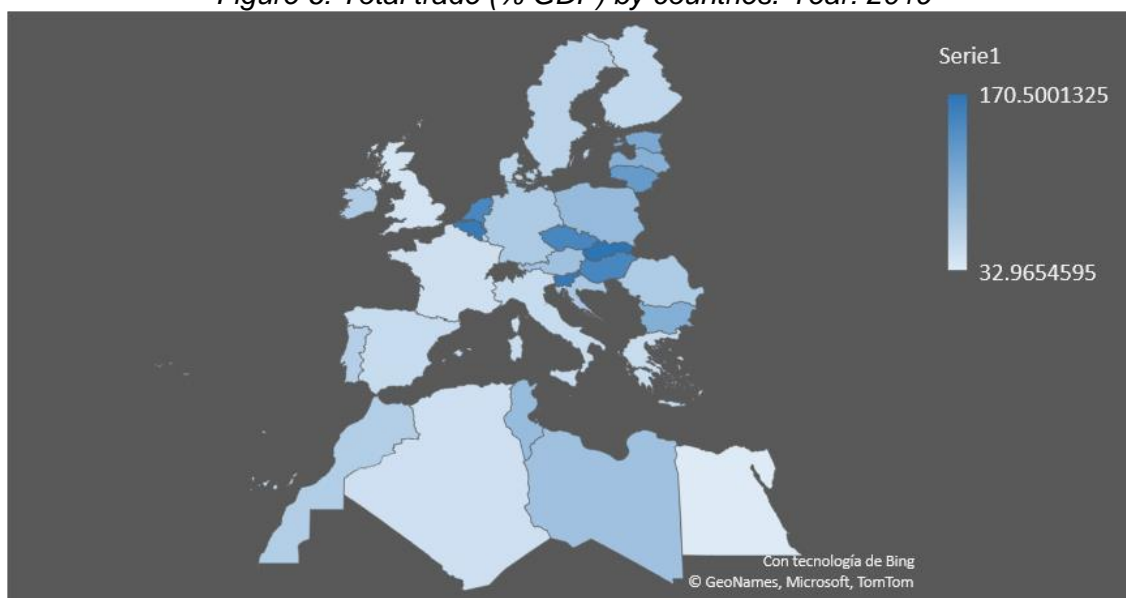
Figure 5: Total trade (% GDP) by countries. Year: 2009



Source: Author elaboration using World Bank data

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Figure 6: Total trade (% GDP) by countries. Year: 2019

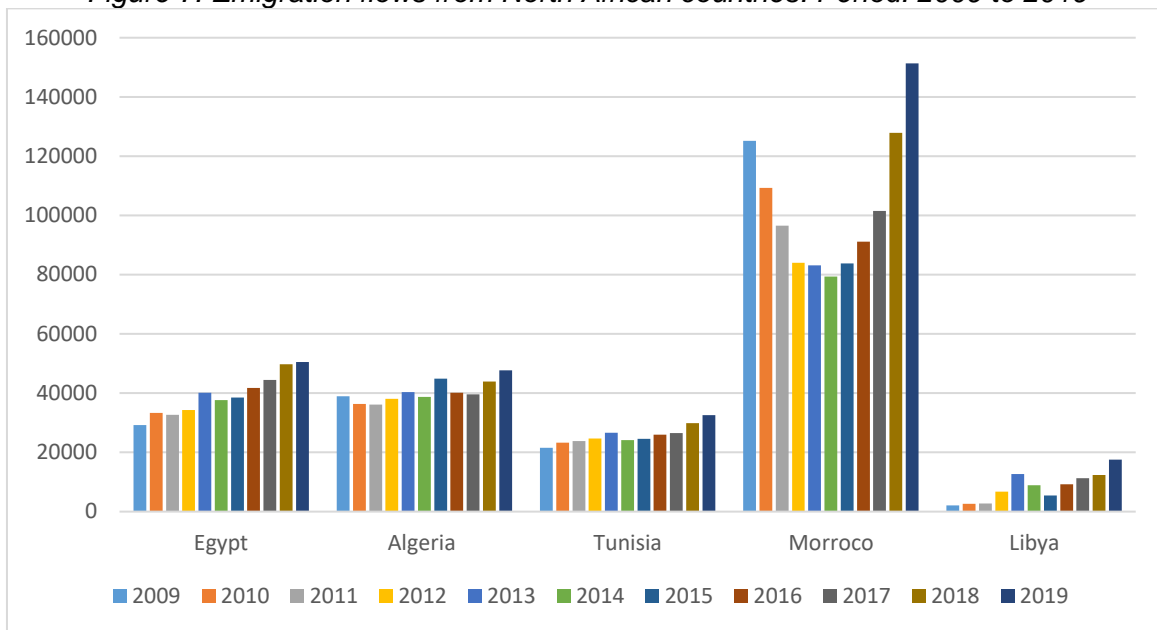


Source: Author elaboration using World Bank data

Turning now to the international movements of people, in Figure 7 we show the variation of the migratory flows of the five Mediterranean African countries during the years 2009-2019. It is observed that the country with the greatest exodus is Morocco, with a great difference with the rest. The variations it shows are U-shaped, presenting a sharp decline until 2014 and a pronounced and growing rise from 2015, reaching a total of 150,000 emigrants. According to the OECD (Organization for Economic Cooperation and Development), the main destination of Moroccan emigrants is Spain, with an approximate annual average of 35,500, followed by Italy and France (see Table 1). This is probably due to its geographical proximity, as Bokbot and Faleh (2010) explain in their analysis.

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Figure 7: Emigration flows from North African countries. Period: 2009 to 2019



Source: Author elaboration using data from the Organization for Economic Co-operation and Development (OECD)

Egypt and Algeria show similar figures in terms of emigration. However, Egypt presents a growing trend. During these years, the number of emigrants from this country increases more and more. In the case of Algeria, this trend is more stable. The countries to which Egypt emigrates the most are Italy, with an average of 8,300, and Germany, with an average of 4,600, as can be seen in Table 1. Moreover, the countries to which they emigrate the most Algerians are France with an average of 22,300 and Spain with approximately 5,000.

Next, Tunisia takes the fourth position with a progressive growth. The main recipient countries of Tunisian immigrants are France, Germany, and Italy. Finally, the lowest figures of emigration is shown by Libya where the number of emigrants does not even reach 10,000 people. It is seen that there is a rebound in 2011 caused by the armed conflict and the fall of the Gaddafi government (Aragall, 2015). In addition, a rebound can also be seen from 2015, showing stable growth until 2019. From all this information, we can conclude that despite the different migratory trends in the five Mediterranean African countries under analysis, they have in common that emigrants mainly go to the European Union.

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Table 1. Average migration in thousands of North African countries to the EU. Period: 2009-2019

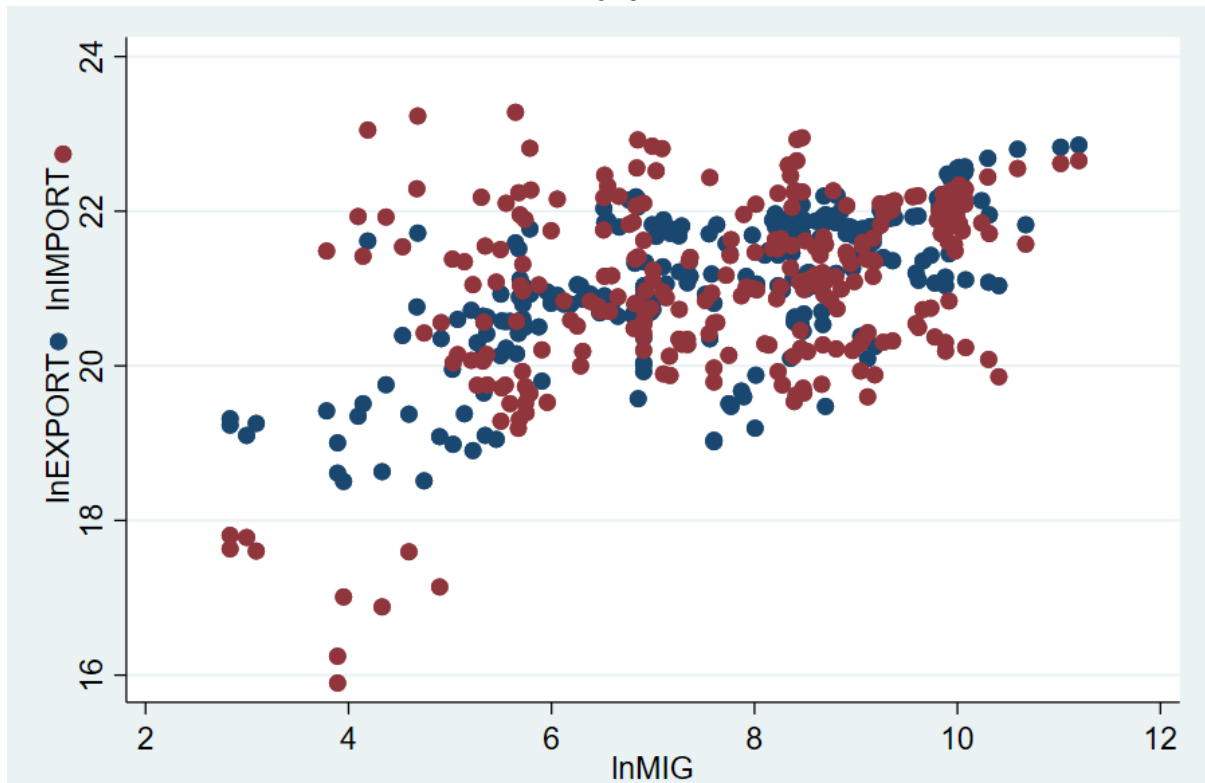
	<i>Algeria</i>	<i>Morocco</i>	<i>Tunisia</i>	<i>Libya</i>	<i>Egypt</i>
<i>France</i>	22313	19811	11616	170	1227
<i>Spain</i>	4854	35588	171	141	372
<i>Germany</i>	3394	7279	4112	2376	4639
<i>United Kingdom</i>	1000	1000	2000	3667	1200
<i>Italy</i>	903	20576	4614	281	8372
<i>Belgium</i>	844	6086	708	54	307
<i>Poland</i>	205	196	359	107	473
<i>Sweden</i>	121	510	228	110	588
<i>Netherlands</i>	70	1595	159	43	624

Source: Author elaboration using data from the Organization for Economic Co-operation and Development (OECD)

Next, Figure 8 shows the relationship between emigration movements and trade flows between the countries of Mediterranean Africa and the EU during the years 2009 to 2019. Trade is shown on the ordinate axis and flows on the coordinate axis. migratory. As can be seen, both imports and exports are positively correlated with migration. That is, the increase in migration produces an increase in trade. This correlation between both variables is becoming stronger. However, atypical data are also found, that is, data that do not follow the positive slope of the axis that joins both variables. This may be due to the fact that there are countries where migration has not had a regular and constant number over time.

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Figure 8: Migration outflows and bilateral trade between North Africa and EU. Period: 2009-2019



Source: Author elaboration using data from the Organization for Economic Co-operation and Development (OECD) and Eurostat data

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3. Literature review

Given its economic and social impact, Migration has always been an important topic that has been studied in greater depth in the literature (Simmons, 1991). Especially, most works have analyzed the effects that migration produces on the economy development of both the origin and destination countries (Grebeniyk, Aleshkovski and Maksimova, 2021). Questions such as whether migratory movements harm or improve the level of trade in the countries of origin and especially in the countries of destination have been analyzed in more detail in the literature, leaving a series of contradictory results. A summary of selected papers on this issue is presented in Table 2 at the end of this section.

For example, Gen et al. (2011) compiled 48 studies and showed that immigration complements and promotes trade between countries of origin and destination, although the effect is greater on exports than on imports, apart from the fact that the impact is less when it comes to homogeneous goods. Ghani et al. (2019) examine this relationship for 248 countries between 1990 and 2010 and find complementarity between them and that larger migration flows are associated with larger trade flows. Sgrignoli et al. (2015) identify a series of products for which migration increases trade and in general they find that it significantly boosts trade. Another case of analysis is the one by Gómez García (2014). This author relates migration between Latin America and the European Union, showing that migrants bring their preferences for the goods of their country, promoting so the exports of national goods to the host economies.

Concerning the European countries, we find some works that analyse the links between trade and migration for the specific case of Spain. Blanes Cristóbal (2003), for instance, affirms that there is a positive impact of immigration on exports, increasing trade and reducing transaction costs. Also, Peri and Requena Silvente (2010) that carried out an investigation using data on exports and immigrants in Spanish provinces between 1995 and 2008, found that immigrants significantly increase exports, particularly in differentiated goods in the most developed countries and in all kinds of goods in the less developed. They even state that the return of immigrants to their country of origin can reduce Spain's trade volume with other countries. Similarly, in the case of Leitão and Faustino (2008) show a positive relationship between immigration and Portuguese exports, imports and bilateral trade, via a reduction in trade costs.

Roux and Peridy (2012) that analyze the effect of the MENA (Middle East and North Africa) on France show that a 1% increase in immigrants from the Middle East and North Africa

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represents an increase of 0.15% of French exports and 0.20% of French imports to and from these countries. Similarly, Millogo and Trojette (2020), also focusing on France and considering 10 countries of the 18 existing MENA countries, although he does not specify which ones they are, from 1995 to 2015. He indicates that immigrants strengthen exports of differentiated goods and that they have no impact on imports. In the case of Italy, Bellino and Celi (2019) find that both emigration and immigration positively affect intra-industry trade, although the amount varies according to the type of trade, the destination of the migrants and the partner countries.

Positive results are also found between trade and immigration in Sweden from 155 countries (Garamaza, 2011). For the UK, an analysis by Girma and Yu (2002) shows two ambiguous effects. On the one hand, they find a strong and positive relationship between immigrants from non-Commonwealth countries and UK exports and, on the other hand, they do not find any type of relationship that improves the trade of the United Kingdom can be improved by immigrants from the Commonwealth.

Other empirical studies, such as the one by Head and Ries (1998), finds a positive and significant relationship between immigration and international trade in Canada during the years 1980-1992, with a higher impact in imports than in exports. In addition, an article by Lewer (2011) ensures that immigration should be promoted since it enhances international trade, positively affecting both the country of origin and the host country. It focuses on sixteen OECD countries to estimate the quantifiable relationship between the flow of trade and the movement of people between the years 1991-2000. In many cases, it is stated that the opening of countries to migratory flows may reduced transaction costs, and this is seen as one of the causes that benefits trade (Genç, 2014).

So far, most studies have found evidence to declare that there is a positive and significant relationship between trade and migration, while others have found that there is no relationship between these two international flows, or even a substitution one. For example, Ekakkararungroj Ong and Devadason (2021) that analyzes these connections for the ASEAN¹ with a time interval between 1990-2019 states that there is not enough evidence to affirm that there is an intra-regional trade impact caused by ASEAN immigrants.

¹ ASEAN: Association of Southeast Asian Nations created in 1967 by five Southeast Asian countries and currently made up of 10 is an intergovernmental organization with the aim of improving the economy.

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Bruder (2004) studied the relationship of trade and migration between Germany and its main countries of origin of foreign labor such as Spain, Portugal, Greece, Italy and Turkey. The results show that there is a substitution relationship and a non-significant impact between trade and labor from abroad or labor migration. In the case of Blanes-Cristóbal (2003), the result on imports is not so clear since it does not show a significant impact on them and Parsons (2012) affirms that, in the long term, migration has an insignificant impact or even can become negative in trading. In addition, Panagariya (1992) carry out a study differentiating the migration of skilled labor from non-skilled migration. It concludes that skilled labor migration exhibits a complementarity relationship with trade while the non-skilled migration is accompanied with a possible substitution effect.

In short, we can say that many studies have suggested that the relationship between trade and migration is complementary, others that it is substitutive or that it does not have a direct relationship. In addition, some works have found positive effects for exports while for imports there is no clear effect or that they depend on the type of immigrant affected in one way or another. Therefore, given the ambiguity of the results shown by the previous literature, we understand that it is necessary to delve into this matter. Specifically, with this project we contribute to this field of research by analyzing the specific case of migration from Mediterranean African countries to EU countries, and its connection with bilateral trade flows. To our knowledge, there is no evidence analyzing the relationship between trade and migration for the European Union and the African Mediterranean countries.

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Table 2. Overview of a selection of studies on the relationship between migration and trade

Author/s	Year of Publication	Focus	Geographic area	Years	Main results
Simmons (1991)	1991	Literature review	/	/	There is a need to develop a consistent classification of types of migration and their origins using terminology standardized.
Panagariya (1992)	1992	Effects of migration with skilled labor and trade qualified.	/	/	The migration of skilled labour and capital exhibits complementarity with trade, while the labor migration may exhibit complementarity or possibility of substitution.
Head and Ries (1998)	1998	Impact of the immigrants in exports Canadians.	Canada	1980-1992	A 10% increase in immigrants causes a 1% increase in exports Canadians to the country of origin and an increase 3% on Canadian exports to the country of origin of the immigrant.
Girma and Yu (2002)	2002	Connections between immigration and trade	United Kingdom	/	Immigration from non-Commonwealth countries enhances trade, while Commonwealth immigration appears to be reducing imports.
Blanes Cristóbal (2003)	2003	The impact of immigration in Spanish bilateral trade.	Spain	1991-1998	Immigration contributes positively to exports. The impact on imports is not so clear.
Bruder (2004)	2004	Trade movements and immigrants	Germany Spain Portugal	1970-1998	There is no significant impact of labor migration on the trade.

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			Greece Italy Turkey		
Leitão and Faustino (2008)	2008	Relationship between immigration and trade Portuguese bilateral.	Portugal	1995-2003	Immigration stock has a positive effect on Portuguese imports and intra-industry trade.
Peri and Requena Silvente (2010)	2010	Investigate the immigration link-trade in the provinces Spanish.	Spain	1995-2008	Immigrants significantly increase exports.
Garmaza (2011)	2011	Investigate the impact of immigrants in exports and imports from Sweden.	Sweden	1980-2010	A 10% increase in the stock of immigrants facilitate a 1% increase in exports and an increase 0.5% on imports.
Lewer (2011)	2011	Investigate the links between movement of people and flow of international trade.	16 OECD countries	1991-2000	Immigration flows have a positive impact in the flow of bilateral trade.
Gene et al. (2011)	2011	Collection and analysis of studies of effects of migration over trade.	/	/	Immigration complements rather than replaces flows trade between host and home countries.
Parsons (2012)	2012	Reexamination of the trade-migration.	World	1960-2000	Migrants can both create how to divert trade.
Perdy and Roux (2012)	2012	Find the cause of the lows trade revenue Mediterranean.	European Union Norte de Africa Middle East	/	Despite significant business gains expected from the Euro-Mediterranean Agreements, the benefits are small.
Genç (2014)	2014	Causal link positive relationship between immigration and trade.	/	1994-2010	A 10% increase in immigrants causes an increase of world trade of \$29 billion.

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Gomez (2014)	2014	Study of the impact of migration on trade (causes and consequences)	Latin America European Union	/	Migratory relations between Latin America and the European Union strengthen trade relations
Sgrignoli et al (2015)	2015	/	/	1960-2000	Migration significantly drives trade between countries and depends on the type of product this relationship is more or less strong.
Ghani et al (2020)	2020	Find out if trade drives migration	World	1990-2010	Trade significantly drives migration
Bellino and Celi (2019)	2019	Analysis in the relationship between human migration and trade.	/	/	Migration significantly drives trade.
Millogo and Trojette (2019)	2019	Exploration of the migration nexus trade taking the case Italy.	Italia	/	Immigration and emigration are related positively and significantly with trade intra-industry.
Ekakkararungroj Ong and Devadason (2021)	2021	Identify the connections between the migration within ASEAN and the two-way trade.	ASEAN	1990-2019	No evidence of an intra-regional trade impact of ASEAN immigrants.
Grebeniyk, Aleshkovski and Maksimova (2021)	2021	Analysis of the positive effects and negative in human capital due to labor migration.	/	/	Both the countries of origin and those of destination must carry out effective and fair management of labor migration to make the most of its benefits internationally.

Source: Author elaboration

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4. Empirical analysis

4.1. Model specification and data

The main objective of this project is to investigate, rest on empirical grounds, the relationships between the bilateral trade and migration between the European Union and the North African countries. To do that, we apply a gravity equation approach, as used by Krugman (1980) in his seminal work, which was motivated in part by the empirical regularity of the gravity formula.

In our model, the dependent variable includes bilateral trade between six EU economies (France, Spain, Germany, United Kingdom, Italy, and Belgium) and five North African countries (Algeria, Tunisia, Egypt, Libya, and Morocco) expressed in logarithms. We are interested in both exports ($\ln EXPORT$) and imports ($\ln IMPORT$). Concretely, we estimate two regressions (one for exports and one for imports), where in both cases our main explanatory variable is the migration flows ($\ln MIG$) that measures the annual number in thousands of migrants from North Africa to a selected European countries, and it is expressed in log terms. These countries have been chosen, since they are the ones that receive the most immigrants as shown in Table. We expect that our main explanatory variable to have a positive sign since, as most previous empirical works conclude that migration encourages trade flows. However, we do not rule out the possibility that the results are not significant or even that migration negatively affects trade flows, as shown in other papers.

In our model, we also add some controls found in traditional gravity models, as:

1. Per capita gross domestic product of the European Union ($\ln GDP_{Ceu}$): expressed in logarithms, it is defined as gross domestic product divided by mid-year population expressed in current US dollars from the World Bank database. It is a common variable used in the regressions corresponding to the gravity equations, as is the case of Vicente (2003). For both dependent variables ($\ln EXPORT$) and ($\ln IMPORT$) we expect the effect of this independent variable to be positive given that empirical evidence has recently emerged, for example in the work of Hummels and Klenow (2005) where it is explained that the greater the economic expansion, greater trade relationship a country will have. But we

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do not rule out the possibility that this variable has a negative sign when it comes to the dependent variable ($\ln EXPORT$) since according to Engels' law, in our case the European zone could have a detrimental effect on the demand for imports.

2. Gross domestic product per capita of the European Union ($\ln GDPCaf$): Like the variable ($\ln GDPCeu$), it is defined as gross domestic product divided by mid-year population expressed in current US dollars from the World Bank database and is expressed in logarithms.

For both dependent variables ($\ln EXPORT$) and ($\ln IMPORT$) we expect the effect of this independent variable to be positive given that empirical evidence has recently emerged, for example in the work of Hummels and Klenow (2005) where it is explained that the greater the economic expansion, greater trade relationship a country will have.

3. Distance ($\ln DIST$): expressed in logarithms, it shows the distance in kilometers between the capitals of each European country and the capitals of each North African country according to the database of the Center for Prospective Studies and International Information (CEPII). Trade and migration are expected to be negatively affected by geographical distance, as the greater the distance, the higher the costs of trade and migration. Distance is one of the defining variables of the gravity model (McCallum 1995). It can also be said that distance can be a way of capturing information costs, as argued by Freund and Weinhold (2000), Portes, Rey and Oh (2001).

The model comprised a total of 330 observations since we have a total of 30 bilateral connections and a time interval of 11 years (as our panel data set is balanced). Accordingly, we estimate two models using panel data econometric methods. Most of the data is extracted from the World Bank database, although we have also used those from the OECD and Eurostat as we have previously specified the source of each of the variables

$$\ln EXPORTS_{ijt} = \beta_0 + \beta_1 \ln MIG_{ijt} + \beta_2 \ln GDPCeu_{jt} + \beta_3 \ln GDPCaf_{jt} + \beta_4 \ln DIST_{ij} + \alpha_{ij} + u_{it}$$

$$\ln IMPORTS_{ijt} = \beta_0 + \beta_1 \ln MIG_{it} + \beta_2 \ln GDPCeu_{it} + \beta_3 \ln GDPCaf_{it} + \beta_4 \ln DIST_{it} + \alpha_i + u_{it}$$

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$i = 1, 2, 3, 4, 5$ North African countries

$j = 1, 2, 3, 4, 5, 6$ EU countries

$t = 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019.$

u_{ijt} = the error term.

Table 3: Description and source of variables

FULL NAME OF THE VARIABLE	ABBREVIATION	SOURCE
Dependent variables		
<i>Bilateral exports corresponding to North African countries to European countries in millions of euros.</i>	<i>lnEXPORT</i>	<u>EUROSTAT</u>
<i>Bilateral imports corresponding to North African countries from European countries in millions of euros.</i>	<i>lnIMPORT</i>	<u>EUROSTAT</u>
Independent variables		
<i>Migratory flows that leave the North African countries towards the countries of the European zone in miles of people</i>	<i>lnMIG</i>	<u>OECD</u>
<i>Distance between both studied areas measured in kilometers</i>	<i>lnDIST</i>	<u>CEPII</u>
<i>Gross Domestic Product of the European Union country measured in US dollars per year</i>	<i>lnGDPCeu</i>	<u>THE WORLD BANK</u>
<i>Gross Domestic Product of the North African measured in US dollars per year</i>	<i>lnGDPCaf</i>	<u>THE WORLD BANK</u>

Source: Author elaboration

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4.2. Descriptive analysis

Table 4: Main descriptive statistics

Variable	Obs	Mean	CV	Std.Dev.	Min	Max
<i>lnEXPORT</i>	330	20.89	0.05	1.03	18.29	22.85
<i>lnIMPORT</i>	330	20.86	0.06	1.18	15.89	23.28
<i>lnMIG</i>	270	7.63	0.24	1.80	2.83	10.19
<i>lnGDPCeu</i>	330	10.49	0.02	0.19	10.10	10.77
<i>lnGDPCaf</i>	330	8.27	0.03	0.26	7.81	9.09
<i>lnDIST</i>	330	7.51	0.05	0.41	6.56	8.16

Source: Author elaboration

The table above (Table 4) shows the main descriptive statistics of the variables included in our econometric model. We see that exports experience an increase of 20.89%, while imports did so by 20.86%. Likewise, migratory flows between North Africa and the European Union increased by 7.63% annually. It can be seen how there is a clear difference between the gross domestic product per capita of the European Union and the gross domestic product per capita of the North African partners of 2.22%, with the EU GDP being higher with a growth of 10.49% per year and the GDP with an annual increase of 8.27%. On average, the distance between countries differs by 7.51%. We can also see the coefficient of variation (CV), which is calculated by dividing the standard deviation by the mean. For all the variables, it shows a figure less than 1, which means that the countries in the sample present similar or relatively homogeneous values. It is a low dispersion, that is to say that they show a relatively small heterogeneity.

To see how bilateral trade relates with the rest of variables, we next present the correlation matrix among all the covariates included in our model. As can be seen in Table 5 below, the correlation coefficient shows a strong positive relationship between migration flows and export, with a value of 0.69. In the case of imports, this correlations coefficient is also positive but a bit smaller, reaching the value of 0.4. It is also important to note the negative relationship between migratory flows and the GDP per capita of the African zone, with a correlation coefficient of 0.59, showing that the lower the GDP per capita in North Africa, the higher the number of African emigrants going to the European Union. Moreover, as expected, we find a negative the relationship between trade flows

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and distance, indicating that the longer the distance is the higher the costs to trade or to migrate.

Table 5: Correlation matrix

	<i>lnEXPORT</i>	<i>lnMIG</i>	<i>lnGDPCeu</i>	<i>lnGDPCaf</i>	<i>lnDIST</i>
<i>lnEXPORT</i>	1				
<i>lnMIG</i>	0.69	1			
<i>lnGDPCeu</i>	-0.21	0.03	1		
<i>lnGDPCaf</i>	-0.38	-0.59	0.02	1	
<i>lnDIST</i>	-0.35	-0.18	0.55	-0.10	1
<i>lnIMPORT</i>	1				
<i>lnMIG</i>	0.41	1			
<i>lnGDPCeu</i>	-0.33	0.03	1		
<i>lnGDPCaf</i>	0.09	-0.59	0.02	1	
<i>lnDIST</i>	-0.53	-0.18	0.55	-0.10	1

Source: Author elaboration.

4.3. Estimation results

In this section, since we have panel data, we will use different models to obtain our estimates:

First, estimates using Ordinary Least Squares are classic in analyzes of this type since they serve as a reference, although they do not take into account unobserved effects in the model. Second, the Fixed Effects estimations will allow us to avoid the biases that constant variables can cause, as in our case the variable (*lnDIST*), so it is consistent since it assumes that there is an unobservable effect α_{it} and it is classified as the best unbiased linear estimator. Third, Random Effects, in addition to being consistent, is also efficient since the unobservable effect should not be correlated with the explanatory variables $Cov(X_{it}, \alpha_i)$, but we have to take into account that it assumes it does not exist $Cov(\frac{X_{it,j}}{\alpha_i})$. Finally, we will use the Poisson Pseudo Maximum Likelihood method since it is the most compatible with trading models as we will see below: it is ideal for heteroskedasticity and also for model specification errors.

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To compare the methods used and select the ones that give the best results, we will do some tests.

The Hausman test is a comparison between random effects and fixed effects econometric estimates. This test will allow us to indicate through the Chi^2 if there are significant differences between our estimates of fixed effects and random effects. The test is also frequently used to find out if the estimators are consistent and to find out if the variables are relevant or not. Next, we present the null and alternative hypotheses with their respective implications:

$H_0: FE = RE$ Similar results, both are consistent, but only RE is efficient

$H_0: FE \neq RE$ FE is the only one consistent between the two

The null hypothesis H_0 , both the random effects estimator and the fixed effects estimator are consistent, although the random effects estimator is more efficient. In this case, the null hypothesis is rejected in favor of the alternative, so the fixed effects estimator will be consistent, while the random effects will not.

Table 6: Hausman test: Fixed effects vs Random effects

<i>Dependent variable: lnEXPORT</i>	<i>Fixed effects</i>	<i>Random effects</i>	<i>Difference</i>	<i>s.e.</i>
<i>lnMIG</i>	0.201***	0.265***	0.063	0.023
<i>lnGDPCeu</i>	-1.075**	-1.439***	0.354	0.225
<i>lnGDPCaf</i>	1.273***	1.237***	0.036	0.018
$Chi^2=19.02$	$PROB>Chi^2=0.000$			

Source: Author elaboration.

If we look at Table 6 and observe the Chi^2 , or the p-value corresponding to said parameter, we can reject the null hypothesis in 95% of the cases, assuming that in 5% of the cases we could make a type I error. Therefore, we have statistical evidence that the fixed effects estimation is more suitable for our model, being consistent but on the contrary, it is not efficient.

Secondly, we assess whether there is unobservable and time-invariant individual behavior. If this is the case, the combined OLS is biased and, on the contrary, Fixed Effects consider dummy variables, which is why it is more appropriate:

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$H_0 : \alpha_1 = \alpha_2 = \dots$ Ordinary Least Squares it is preferable

$H_1 : H_0 \text{ it is false}$ Fixed Effects is better

Table 7: Fixed effects test results

F test that all $u_i = 0$: $F(28, 238) = 67.60^{***}$		PROB>F=0.000
$*p < 0,1$	$**p < 0,05$	$***p < 0,01$

Source: Author elaboration.

The results in Table 7 state that we can reject the null hypothesis at a significance level of 1%, so fixed effects estimates are preferred over OLS.

We present the estimate coefficients of the gravity equation for bilateral exports using two different estimation methods: Poisson Pseudo Maximum Likelihood (PPML), Fixed Effects (FE). We include the PPML estimator which is not linear to avoid zero trade flows. Like other empirical analyzes such as: Shepherd & Wilson (2009) or Silverstovs & Schumacher (2008) where it is considered that in the presence of heteroscedasticity, as is common in trade data, this estimator would be robust.

In both estimates, the migration variable is highly significant in explaining exports, so we can say that the relationship between both variables is complementary: the more migration, the more exports, *ceteris paribus*. Specifically, in the case of the FE model, the increase in exports due to an increase in migration is much higher than in the case of the PPML estimates.

As we can see, the coefficients obtained by PPML are lower than those of FE since the latter are probably biased by the presence of heteroscedasticity in a logarithmic model. For many authors (Gourieroux et al. (1984), Santos Silva & Tenreyro (2006), among others) PPML estimates are more robust for this type of equation.

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Table 8: Estimation results for bilateral exports (in logs). Period: 2009-2019

	PPML		Fixed effects		OLS	
Dependent variable: <i>lnEXPORT</i>	<i>coef</i>	<i>Std. Err.</i>	<i>coef</i>	<i>Std. Err.</i>	<i>coef</i>	<i>Std. Err.</i>
<i>const</i>	3.431***	0.148	20.305***	4.467	29.303***	2.699
<i>lnMIG</i>	0.017***	0.002	0.201***	0.045	0.354***	0.029
<i>lnGDPCeu</i>	-	0.041***	0.011	-1.075**	0.448	-0.868***
<i>lnGDPCaf</i>	0.002	0.011	1.273***	0.108	0.035	0.188
<i>lnDIST</i>	-	0.013***	0.005	OMITTED		-0.279**
<i>Time effects</i>			YES			
<i>Country-pair effects</i>			YES		NO	
<i>n=270</i>	<i>log-likelihood=-663.50</i>		<i>F(3,238)=46.76 PROB>F=0.000</i>		<i>F(5,49)=79.87 Prob>F=0.000</i>	
	* <i>p</i> <0.1 ** <i>p</i> <0.05 *** <i>p</i> <0.01					

Source: Author elaboration.

Specifically, according to the OLS estimate, for every additional 10% increase in migratory flows in the EU, exports from European countries increase by 3.54%, keeping the rest of the variable's constant (both GDP per capita and distance). The effect of the rest of the covariates is in line with the models of the theory of gravity. As expected, the GDP per capita of the selected European countries negatively influences trade. In all the models, this variable presents a negative and significant coefficient, indicating that a high GDP per capita is associated with low bilateral exports from the EU country to the North African partner. Regarding the effect of the GDP per capita of the North African countries on exports, the associated coefficient is positive in all the models, but only significant in the estimates using FE. Finally, the distance variable presents the expected negative sign that reflects the higher cost of exporting to distant countries. The effect of distance on exports is significantly negative using PPML and OLS with exports decreasing by 0.013% and 0.279%, respectively, for each additional percentage point of distance.

Regarding the variable of imports, (*lnIMPORT*), in the following table we will decide which estimation method is more appropriate and faithful to reality. As in the previous case, we present the null and alternative hypotheses and their respective implications:

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$H_0: FE = RE$ Similar results, both are consistent, but only RE is efficient

$H_0: FE \neq RE$ FE is the only one consistent between the two

Table 9: Hausman test: Fixed effects vs Random effects

<i>Dependent variable: lnIMPORT</i>	<i>Fixed effects</i>	<i>Random effects</i>	<i>Difference</i>	<i>s.e.</i>
<i>lnMIG</i>	0.037	0.142***	-0.105	0.035
<i>lnGDPCeu</i>	0.017	-0.56	0.573	0.34
<i>lnGDPCaf</i>	1.711***	1.724***	-0.013	0.028
<i>Chi²=10.18</i>	<i>PROB>Chi²=0.0171</i>			

Source: Author elaboration.

Again, to decide between fixed or random effects, we run the Hausman test (see Table 9). According to the Chi^2 test and the corresponding p-value, we reject the null hypothesis H_0 with a 95% of confidence. Therefore, we have statistical evidence that the fixed effects estimation fits better for our model as it is the one that provides consistent estimations.

We evaluate if there is an individual behavior that is not observable and invariable over time. If this is the case, the pooled OLS is biased and, conversely, the fixed effects consider dummy variables, so it is more appropriate:

$H_0: \alpha_1 = \alpha_2 = \dots$ Ordinary Least Squares it is preferable

$H_1: H_0$ it is false Fixed Effects is better

Table 10: Fixed effects test results

<i>F test that all $u_i = 0$: $F(28, 238) = 61.11^{***}$</i>		<i>PROB>F=0.000</i>
<i>*$p < 0.1$</i>	<i>**$p < 0.05$</i>	<i>***$p < 0.01$</i>

Source: Author elaboration.

The results in Table 10 state that we can reject the null hypothesis at a significance level of 1%, so fixed effects estimates are preferred over OLS.

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Table 11: Estimation results for bilateral imports (in log). Period: 2009-2019

	PPML		Fixed effects		OLS	
Dependent variable: <i>lnIMPORT</i>	coef	Std. Err.	coef	Std. Err.	coef	Std. Err.
<i>const</i>	3.079***	0.160	6.406	6.218	21.973***	3.504
<i>lnMIG</i>	0.020***	0.002	0.037	0.063	0.424***	0.038
<i>lnGDPCeu</i>	0.070***	0.019	0.017	0.624	-1.469***	0.351
<i>lnGDPCaf</i>	0.094***	0.013	1.711***	0.150	1.968***	0.245
<i>lnDIST</i>	0.032***	0.007	OMITTED		-0.680***	0.154
Time effects			YES			
Country-pair effects			YES		NO	
<i>n=270</i>	log-likelihood=-664.716		F(3,238)=46.44	PROB>F=0.000	F(4,265)=71.10	Prob>F=0.000
* <i>p</i> <0.1 ** <i>p</i> <0.05 *** <i>p</i> <0.01						

Source: Author elaboration.

Regarding the imports variable, the results of the estimation by fixed effects show that for each additional 1% of migration, exports increase by 0.037%, keeping the rest of the variables constant (both GDP per capita and distance). This effect is positive and greater in imports than in exports, but it is not significant. The effect obtained from the GDP per capita of the selected European area through PPML is contrary to the resulting sign through Fixed Effects, but in the latter case it is not significant. As for the relationship between North African GDP per capita and imports, it is significant and positive for all estimates, which is what we expected.

Lastly, the distance variable maintains a negative relationship since the greater the distance, the lower the trade relations. As in the case of exports, the result lives up to expectations. The effect of distance on imports is significantly negative, not including estimates with fixed effects. This is because the variable is omitted since the distance is a factor that it does not vary on time and therefore its effect is captured by the country-pair effects.

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5. Conclusion

In this project, we have investigated the effect of migration from the African Mediterranean area to the countries of the European Union on trade. In particular, we seek to verify the hypothesis of a potential enhancing effect of the presence of immigrants on bilateral trade between destination and origin countries. To do that, and following previous literature, we have estimated a gravity model what has allowed us to identify the specific effect of the African exodus to Europe on bilateral exports and imports between both areas with past connections due to the colonization. The results indicate a positive influence of the immigration from North African countries to bilateral trade in Europe. According to our estimates, this effect is more robust in the case of exports than imports, as the migration appear significant only in the OLS regression, but not in the FE regression. Thus, the presence of African immigrants in the EU countries seems to favor the sale of European products to the countries of origin, but it is least clear that this also stimulates the purchase of products from them.

Therefore, North African migration should be contemplated more like something positive than negative for destination European economies. In this line, politicians' makers should seek to foster greater connections between the two geographical areas. Like the European Neighborhood Policy (ENP) that covers the five African countries studied in this work: Algeria, Egypt, Libya, Morocco, and Tunisia. This policy is intended to create bilateral agreements and strengthen ties between the two areas. At the end of 2019, the European Commission and Foreign Affairs and Security Policy have suggested a new strategy with Africa. This new idea aims to intensify the relationship between the EU and Africa in order to benefit and improve migration, mobility, growth, peace and employment. Therefore, Europe will meet with African partners to agree on a new strategy jointly at the European Union-African Union Summit in October 2020.

This work can be extended in several ways. First, we may think in the presence of a reverse causality problem between the dependent variable (exports and imports) and the per capita GDPs of both areas, since these variables could be explained their self by trade. In this sense, an improvement that can be applied is the introduction of appropriate instrumental variables to check if the results obtained hold. An additional extension refers to the geographical dimension since this work could be also extended to other African and European countries. Also, an econometric model could be created that encompasses more links that explain the relationship between both areas analyzed such

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as foreign investment, finance linkages. In this sense, we could empirically analyzed if these factors are linked or reinforce the connections between trade and migration in the model. This project is a further step towards understanding how a migration network can enhance or influence economic factors such as trade over time and can convey new insights into the importance of the migration-trade relationship.

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