ESTIMATION OF THE INTEGRATION OF TUNISIA AND EGYPT IN THE EURO-MEDITERRANEAN AND SOUTH-EAST AFRICAN REGIONS USING THE GRAVITY EQUATION

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SHIFTING PARADIGMS:
Opportunities for a Deeper EU-Mediterranean Integration in a Changing World
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CONTENTS

ABSTRACT

Tunisia and Egypt signed various trade agreements with several partners around the world and hold open economies. Association Agreements (AAs) concluded by both countries respectively in years 1995 and 2001 with the European Union (EU) within the framework of the Barcelona Process implemented bilateral Free Trade Areas (FTAs) covering industrial products and followed previous tariff advantages that have been shared for decades. Commercial ties between both countries and the EU remain strong. In harmony, Tunisia and Egypt tried to strengthen their trade links with Eastern and Southern African countries by integrating respectively in 2018 and 1998 the COMESA (Common Market for Eastern and Southern Africa), a Customs Union bringing together 21 African member countries. Within the Euro-Mediterranean region, both countries also signed various other integrations such as the bilateral FTAs with Türkiye respectively in 2004 and 2005.

This work tries to assess the trade integration of Tunisia and Egypt by considering all mentioned trade agreements, i.e. the Association Agreements concluded with the EU, the COMESA and FTAs with Türkiye. By the use of the Gravity Model estimation on Panel Data, the purpose is to evaluate whether determining factors included in the Gravity Equation raise or decline exports and imports of both countries with their selected partners. This also enables us to evaluate the attractiveness of target markets (EU, COMESA countries and Türkiye) for Tunisian and Egyptian exports and vice versa. The aim of this work is to go beyond previous empirical works carried out on this topic on various samples covering several countries around the world.

Findings confirm the positive impacts of countries' economic sizes on bilateral trade, the negative effects of geographic distance, etc. Results permit also to compare between the influences of all considered trade agreements on Tunisian and Egyptian exports and imports. Finally, with reference to the estimation results, the idea is to foresee whether Tunisia and Egypt could assume intermediation roles facilitating triangular trade relations between the EU, the Southern Mediterranean and Southeastern Africa regions.

RÉSUMÉ

La Tunisie et l'Egypte, ayant signé divers accords régionaux de commerce avec plusieurs pays partenaires, détiennent des économies ouvertes sur le reste du monde. Dans le cadre du Processus de Barcelone, les deux pays ont signé respectivement en 1995 et 2001 des Accords d'Association (AA) avec l'Union européenne (UE) pour l'instauration de Zones de libre-échange (ZLE) applicables aux produits industriels. Ces AA remplacent les précédents avantages tarifaires mutuellement partagés depuis des décennies, d'où les liens commerciaux forts que les deux pays entretiennent avec l'UE jusqu'à présent.

Dans la même attitude, la Tunisie et l'Egypte ont entrepris des efforts pour renforcer les liens commerciaux avec les pays des régions du Sud et de l'Est de l'Afrique par le biais de l'intégration au Marché commun de l'Afrique orientale et australe (COMESA) respectivement en 2018 et 1998 ; le COMESA étant une union douanière réunissant 21 États africains membres. Au sein de la région euro-méditerranéenne, les deux pays ont également adhéré à divers accords d'intégration telles que notamment les Zones de libre-échange bilatérales avec la Turquie conclues respectivement en 2004 et 2005.

Ce travail tente d'apprécier les intégrations commerciales de la Tunisie et l'Egypte en considérant les accords régionaux de commerce cités, à savoir les Accords d'Association signés avec l'UE, le COMESA et les ZLE établies avec la Turquie. En ayant recours au Modèle de Gravité, des estimations sur des données de panel sont menées dans l'objectif d'évaluer si les variables exogènes inclues dans l'équation gravitationnelle accroissent ou réduisent les exportations et les importations des deux pays avec leurs partenaires sélectionnés. Ceci permet également d'apprécier l'attractivité des marchés cibles (UE, pays du COMESA et Turquie) pour les exportations tunisiennes et égyptiennes, et inversement. L'objectif dans ce travail est d'aller au-delà des travaux empiriques antérieurs menés dans ce thème sur des échantillons couvrants divers pays d'autres régions du monde.

Les résultats d'estimation confirment les contributions positives du poids économique des pays au commerce bilatéral, les effets négatifs de la distance géographique, les influences des accords régionaux de commerce considérés sur les exportations et importations tunisiennes et égyptiennes, etc. Enfin, eu égard aux résultats d'estimation, l'idée serait également de prévoir si la Tunisie et l'Egypte pourraient assumer les rôles d'intermédiaires facilitant les liens commerciaux triangulaires entre l'UE, les régions du Sud de la Méditerranée et de l'Afrique du Sud-Est.

ملخص

قياس التكامل التجاري بين تونس ومصر في المنطقة الأورو متوسطية ومنطقة جنوب شرق أفريقيا باستخدام معادلة الجاذبية

وقّعت تونس ومصر اتفاقيات تجارية مختلفة مع العديد من الشركاء في جميع أنحاء العالم ولديهما اقتصادات مفتوحة. وقد التي أبرمها كلا البلدين على التوالي في عامي 1995 ((Association Agreements (AAs)) نفذت اتفاقيات الشراكة و2001 مع الاتحاد الأوروبي في إطار عملية برشلونة مناطق تجارة حرة ثنائية تغطي المنتجات الصناعية وتتبع المزايا الجمركية السابقة التي تم إبرامها منذ عقود. ولا تزال العلاقات التجارية بين البلدين والاتحاد الأوروبي قوية. وفي سياق متصل، حاولت تونس ومصر تعزيز روابطهما التجارية مع دول شرق وجنوب أفريقيا من خلال الاندماج في عامي 1998 على التوالي في السوق المشتركة لشرق وجنوب أفريقيا (الكوميسا)، وهو اتحاد جمركي يضم 21 دولة 2018 أفريقية عضو في الاتحاد. وفي داخل المنطقة الأورومتوسطية، وقّع البلدان أيضًا على العديد من الاتفاقيات الأخرى مثل اتفاقيات التجارة الحرة الثنائية مع تركيا في عامي 2004 و2005 على التوالي.

تحاول هذه الدراسة تقييم التكامل التجاري لتونس ومصر من خلال النظر في جميع الاتفاقيات التجارية المذكورة، أي اتفاقيات الشراكة المبرمة مع الاتحاد الأوروبي والكوميسا واتفاقيات التجارة الحرة مع تركيا. وباستخدام تقدير نموذج الجاذبية (Gravity Model) على البيانات التتبعية، فإن الغرض من ذلك هو تقييم ما إذا كانت العوامل المحددة المدرجة في معادلة الجاذبية تزيد أو تقلل من صادرات وواردات كلا البلدين مع شركائهما المختارين. كما يمكّننا ذلك أيضًا من تقييم جاذبية الأسواق المستهدفة (الاتحاد الأوروبي وبلدان الكوميسا وتركيا) للصادرات التونسية والمصرية والعكس صحيح. والهدف من هذه الدراسة هو التوسّع في الدراسات التطبيقية السابقة التي أجريت حول هذا الموضوع على عينات مختلفة تغطي العديد من البلدان حول العالم.

وتؤكد النتائج الآثار الإيجابية للأحجام الاقتصادية للبلدان على التجارة الثنائية، والآثار السلبية للبعد الجغرافي، وما إلى ذلك. وتسمح النتائج أيضاً بالمقارنة بين تأثيرات جميع الاتفاقيات التجارية التي تم تناولها على الصادرات والواردات التونسية والمصرية. وأخيرًا، بالرجوع إلى نتائج نموذج الجاذبية، فإن الهدف هو معرفة ما إذا كان بإمكان تونس ومصر القيام بأدوار الوساطة التي تسهل العلاقات التجارية الثلاثية بين الاتحاد الأوروبي ومنطقة جنوب البحر الأبيض المتوسط وجنوب شرق أفريقيا.

INTRODUCTION

The involvement of South Mediterranean countries in free trade is not a recent affair. Commercialization with neighbor countries of the European Union (EU) goes back decades and was initially governed by various bilateral protocols providing trade benefits. The collective relaunch of the Euro Mediterranean (Euro-Med) trade integration took place in 1995 with the adoption of the Barcelona Process. The purpose was to implement an inclusive Free Trade Area (FTA) between the EU and several Southern and Eastern Mediterranean countries.

Achievements were below expectations although links between mentioned partners remained strong. Bilateral Association Agreements (AAs) have taken over, setting up FTAs that cover industrial products. In line with this trend, AAs were signed between the EU and Tunisia in 1995, Morocco in 1996, Egypt in 2001, Algeria in 2002, etc. Despite the lack of the multilateral scope that would have enabled comprehensive free trade between all partners, progress has been made in terms of strengthening bilateral trade.

Alongside this recent trend, South Mediterranean countries have continued and expanded their integration efforts. They have joined further integrations with various other partners. In this field, Tunisia, Egypt, Morocco and Jordan are the founding members of the Agadir Agreement that was signed in 2004 and entered into force in 2007. Based on the Barcelona Process, the Agadir Agreement enables the cumulation of rules of origin between member states and Euro-Mediterranean countries. In terms of achievements, intra-Agadir trade varies between only 1% and 3% of the total trade of the four member countries from the Agreement's inception to the present day. According to the Euromed Trade Helpdesk which is a trade intelligence tool implemented by the International Trade Center (ITC) and funded by the EU, the unrealized intra-regional trade potential within the Mediterranean region is currently 3290 million USD for Egypt, 911.5 million USD for Morocco, 548.9 million USD for Jordan and 782.5 million USD for Tunisia.

On the same wavelength, the Pan-Arab Free Trade Area (PAFTA) covers manufactured and agricultural goods trade between Arab state members. The agreement was signed in 1997 by sixteen Arab countries and entered into force in 1998; its implementation period ended in 2005. All North African Arab states i.e. Morocco, Algeria, Tunisia, Libya and Egypt are original signatories of the PAFTA. Considered initially a significant footstep for the economic integration between Arab countries in the MENA (Middle East and North Africa) region, the PAFTA generated the removal of the majority of customs duties between member countries by 2005. Nevertheless, the PAFTA "*is one of the shallowest free trade agreements ever signed*" as pointed out by El-Sahli Z. (2023). The author explored in his work the ex-post partial and general effects of the Free Trade Area on 14 original signatory countries and found that the PAFTA, despite having led to some increase in bilateral trade according to partial equilibrium results, had insignificant effects regarding the general equilibrium results. The intra-Arab trade of goods remains

well below 10% of the region's total trade even though customs duties were removed. Many gaps would be at the origin of this lack of integration: non-tariff barriers remain widespread in MENA countries and their average tariff equivalents keep on being high; furthermore, transport remains overpriced and the PAFTA agreement does not include rules on competition laws, standard harmonization and dispute settlements.

In parallel to this process, three North African countries i.e. Tunisia, Egypt and Morocco signed FTAs covering industrial and agricultural goods with Türkiye respectively in 2004, 2005 and 2004. Following the entries into force one or two years later (depending on the country), the implementation periods ended when custom duties were reciprocally removed respectively in 2014, 2020 and 2015. Unlike the above-mentioned intra-Arab Agreements, the three FTAs with Türkiye have led to significant increases in bilateral trade particularly in terms of imports of Tunisia, Egypt and Morocco. Each of these FTAs has assumed a role in trade diversion, as Türkiye has become a major supplier of capital goods to all three countries. Recent data show that the shares of Türkiye in the three countries' total imports were respectively about 5.5%, 4%, and 5% in 2021. Regarding exports, only Egypt has a strong commercial presence in the Turkish market, which is the main destination for Egyptian exports with an export share of around 6.5% of its total exports in 2021. All three countries have had trade deficits with Türkiye over the past decade. In 2021, these deficits were respectively around 959,301 thousand USD, 483,901 thousand USD and 2,581,820 thousand USD for Tunisia, Egypt and Morocco.

On the African side, trade integration is firstly considered by the accession of three Southern Mediterranean countries (Egypt, Libya and Tunisia) to the COMESA (the Common Market for Eastern and Southern Africa). Such integration was created in 1994 replacing a former Preferential Trade Area that had existed since 1981, and currently brings together twenty-one African countries with a population of over 583 million. Since its creation, the COMESA integration has governed the free exchange of goods (manufactured and agricultural products) between member countries by carrying out a Free Trade Area (FTA) whose implementation period ended in October 2000. Since then, COMESA has continued its efforts to move towards a Customs Union, which remains incomplete to date. The accession of Egypt to the COMESA dates back to June 1998 (date of signature), and entered into force in 1999, while the accession of Tunisia dates back to July 2018 and entered into force in 2020. Libya joined the COMESA in 2005.

African integrations and the involvement of the South Mediterranean countries in such efforts are continuing and expanding, particularly in recent years. In this field, the African Continental Free Trade Area (AfCFTA) was created in 2018 and brings together almost all the African countries, i.e. 54 signatory states covering a population of 1.3 billion. This makes it the world's largest FTA in number of member states, in population and geographic size. The agreement implementing the AfCFTA entered into force in July 2019 and started officially in January 2021. The first phase of the AfCFTA specifies that members are committed to removing trade barriers on goods (manufactured and agricultural products) and services over a period ranging from 5 to 13 years, depending on the country's level of development and the nature of the product. The second phase of the agreement will deal with trade-related issues such as competition policies, intellectual property rights, investments, etc.

Given the progress of the above-mentioned integrations, this work attempts to consider the concomitant free trade involvement of southern Mediterranean countries in both the Euro-Mediterranean (Euro-Med) and the African areas. Two South Mediterranean countries are thus considered, namely Tunisia and Egypt, in their trade integrations with the European Union (EU), the COMESA and Türkiye. Precisely, by considering all EU, COMESA and Türkiye markets as emphasis partners for Tunisian and Egyptian trades, the purpose is to estimate the effects of key determinants on Tunisian and Egyptian trades with their selected partner countries through the estimation of a Gravity model. In this context, in addition to assessing the attractiveness of all destination markets for exports, the estimates and tests permit to evaluate the increasing or decreasing effects on trade of the determining factors included in the Gravity Equation.

This paper tries to go beyond previous works by first applying the Gravity model estimation to trade between the South Mediterranean and the EU on the one hand, and the South Mediterranean and Eastern and Southern African countries on the other. Two exporting and importing countries were selected in this field, namely Tunisia and Egypt considering their trade integrations within the Barcelona Process and the COMESA. The idea, through estimation results, is to compare the influences of these trade agreements on Tunisian and Egyptian exports and imports, as well as to think about progressing triangular trade and economic cooperation between the EU, the South Mediterranean and Eastern and Southern Africa.

For purposes of comparison and taking into account the importance of FTAs with Türkiye within the Euro-Mediterranean area, the sample of partner countries for Tunisia and Egypt is subsequently extended to include Türkiye. This makes it possible to include such FTAs in the gravity equation and thus test their effects on Tunisian and Egyptian trades.

Previous works in this framework include various estimations held on gravity equations regarding samples that cover distinct regions and countries around the world. Among these works, Gbetnkom (2013) tested the determinants of trade inside the Economic Community of Central African States (ECCAS) while referring to the impact of economic reforms held during the period 1980-1990. Results confirm that traditional exogenous variables as included in the gravity equation are the main factors that act on the region's internal trade; results approve also that the integration Agreement increases trade between partners after the economic reforms' period. Likewise, Geda and Seid (2014) examined "*the potential for intra-Africa trade and the prospects for advancing regional economic integration through such trade*" using the gravity model. Findings call for policies that go beyond liberalization through setting up regional and domestic infrastructure, harmonizing macroeconomic policies, enhancing trade-enabling institutions, etc. In addition, Carrère and Masood (2015) explored "*how French as a common language influences trade compared to other dimensions of proximity (geography, history, etc.)*". They found that "*sharing a common language not only fosters bilateral trade but also allows for more resilient trade during crises*". Besides, Millogo and Oulmane (2012) estimated the intra-Maghreb countries' potential trade using the gravity equation. Findings confirm that the level of existing trade is well below the potential that could be achieved.

In order to deal with the reported issues, this work is structured as follows: Section 2 outlines the literature review of the Gravity model: its basis, equations, challenges and estimating methods. Section 3 discusses the empirical approach by presenting the equations to be estimated, the described variables and the data. Section 4 presents the estimation results, their relevance, their explanations and their implications given the context discussed. Finally, Section 5 is for concluding.

THE LITERATURE REVIEW OF THE GRAVITY MODEL

Basically, the Gravity model relies on Newton's law of universal gravitation, which links bilateral trade between countries to "attraction forces". In this field, the works of Tinbergen J. (1962) were the pioneers in explaining that countries trade more with each other in proportion to their economic sizes and their geographical closeness, following the "general" multiplicative calculation as shown in Equation 1:

$$X_{ij} = G \, S_i \, M_j \, \varphi_{ij} \qquad\qquad (1)$$

where:

X_{ij} are exports from country i to partner country j;

S_i and M_j are respectively the exporter and the importer-specific factors that capture their willingness to trade abroad as approximated by their output and demand and measured by their GDPs (GDP_i and GDP_j);

G are factors that do not depend on i neither on j;

φ_{ij} denotes the ease of country i to export to its partner country j, which is the inverse of bilateral trade costs.

The Tinbergen equation has the merit of being the pioneer of gravity works in international trade. However, several criticisms have been levelled at it. These criticisms are mostly based on the following points: the lack of theoretical foundations and the absence of ties between each trading partner separately (the exporter and the importer) with the rest of the world. To remedy these shortcomings, Anderson and Van Wincoop (2003) introduce a new formulation of the gravity calculation. Such a new formulation called the "structural" gravity equation relies on the Armington hypothesis (1969) relating to the demand function with constant elasticity of substitution and imperfect substitutability between local and imported goods. Equation 2 presents the structural gravity calculation:

$$X_{ij} = (Y_i \, Y_j / \, Y) \times (t_{ij} / \, \Omega_i \, \Omega_j)^{1-\sigma} \qquad\qquad (2)$$

Where:

X_{ij} are exports from country i to partner country j;

$(Y_i \, Y_j / \, Y)$ symbolizes the relative economic size of trading partners, considering that Y, Y_i and Y_j designate respectively Worldwide GDP, GDP of country i and GDP of country j.

$(t_{ij}/\,\Omega_i\,\Omega_j)^{1-\sigma}$ denotes the relative trade costs between partner countries i and j, as tij defines bilateral trade costs between countries i and j, Ω_i and Ω_j are two newly introduced variables called "Multilateral Resistance Terms" (MRT), and σ embodies the elasticity of substitution (with $\sigma >1$).

In more detail, bilateral trade costs (t_{ij}) include various geographical, cultural and economic relations between both partner countries such as distance, land-locking, linguistic links, colonial ties, membership of regional trade agreements, etc. according to the following Equation 3:

$$t_{ij} = d_{ij}{}^{\delta_1} \times \exp (\delta_2\, cont_{ij} + \delta_3\, lang_{ij} + \delta_4\, ccol_{ij} + \delta_5\, landlockij + \delta_6\, RTA_{ij}) \qquad (3)$$

given that exp designates exponential, dij is the bilateral distance between countries i and j, $cont_{ij}$, $lang_{ij}$, $ccol_{ij}$, $landlock_{ij}$ and RTA_{ij} are dummy variables indicating respectively whether both countries i and j have common borders, share a common language, have common colony links, are landlocked, and are both members of a mutual Regional Trade Agreement.

In addition to all the mentioned variables, the gravity equation could take into consideration more country's specific variables other than GDPs that would affect trade. These include the infrastructure qualities, the population size, regulations, institutions, etc.

"Multilateral Resistance Terms" (MRT) as embodied in variables Ω_i and Ω_j refer respectively to the resistances imposed on the exporter and the importer with third countries. In other words, the more countries i and j face trade barriers with the rest of the world, the more they are likely to commercialize with each other and vice versa. Consequently, MRT comprise trade barriers of countries i and j with all their trading partners, except for j and i.

Estimation of the structural gravity equation is commonly achieved by transforming the equation into a linear form, using the logarithm. This deduces the following Equation 4 with the error term ε_{ij} :

$$Log\,(X_{ij}) = -\, Log\,(Y) + Log\,(Y_i) + Log\,(Y_j) + (1-\sigma)\, Log\,(t_{ij}) - (1-\sigma)\, Log\,(\Omega_i) - (1-\sigma)\, Log\,(\Omega_j) + \varepsilon_{ij} \qquad (4)$$

In this context, it is important to note that MRT are hard-to-observe and may not vary hugely when the sample period is not very long. To seize them while estimating, it is common to use the following options:

- Referring to the works of Head and Mayer (2013) in which a variable named "Remoteness" is used as a proxy for MRT. "Remoteness" computes the weighted average of the distance separating the country (i or j) from all its N trading partners (except for j or i).

  $Remoteness_i = \sum (GDP_n/GDP_w) \times distance_{ni}$ where $n = [1….N]$ and w: world

- Referring to the works of Feenstra (2004), Baldwin and Taglioni (2006) by using exporter and importer fixed effects through Dummy variables when panel data is considered. This practice as the most widely used in gravity estimations, leads to contain all constant country specific factors in the mentioned exporter and importer dummies.

In view of these explanations, the following Equation 5 would be a more advanced formulation of the Log linear gravity model:

$$\text{Log}(X_{ij}) = \alpha_0 + \beta_1 \text{Log}(GDP_i) + \beta_2 \text{Log}(GDPj) + \beta_3 \text{Log}(dist_{ij}) + \beta_4 \text{Log}(Population_i) + \beta_5 \text{Log}(Population_j) + \beta_6 \text{Log}(Remoteness_i) + \beta_7 \text{Log}(Remoteness_j) + \beta_8 cont_{ij}$$

$$+ \beta_9 lang_{ij} + \beta_{10} ccol_{ij} + \beta_{11} landlock_{ij} + \beta_{12} RTA_{ij} + \varepsilon_{ij} \qquad (5)$$

If panel data is considered and fixed effects are introduced, the resulting Equation 6 is as follows:

$$\text{Log}(X_{ijt}) = \alpha i + \lambda j + \beta_1 \text{Log}(GDP_{it}) + \beta_2 \text{Log}(GDP_{jt}) + \beta_3 \text{Log}(Population_{it})$$

$$+ \beta_4 \text{Log}(Population_{jt}) + \beta_5 RTA_{ijt} + \varepsilon_{ijt} \qquad (6)$$

Regarding estimation methods, this obviously depends on both the equation and the data structure. While OLS estimation is applied to log-linear equations when data is cross-sectional or temporary, fixed effects estimation is regularly functional when panel data is used.

In this context of data structure, it is important to bear in mind two important regular specifics:

- the likely presence of heteroscedasticity in trade data, which while existing would lead to biased estimates of the effects of trade costs and trade policies in log-linear equations;

- the existence of zero trade flows (zero or missing values); this would generate dropping such observations from the estimation sample when the trade value is transformed into a logarithm. Zero values occur often when data are disaggregated.

To overcome such two constraints, a substitute methodology consists of estimating directly the multiplicative form of the Gravity equation using the Poisson Pseudo Maximum Likelihood (PPML) estimator, as specified in the works of Santos Silva and Tenreyro (2006). The multiplicative gravity equation considered in this framework and gotten by using the exponential is Equation 7 below:

$$X_{ijt} = \exp[\alpha_i + \lambda_j + \beta_1 \text{Log}(GDP_{it}) + \beta_2 \text{Log}(GDP_{jt}) + \beta_3 \text{Log}(Population_{it}) + \beta_4 \text{Log}(Population_{jt}) + \beta_5 RTA_{ijt}] \times \varepsilon_{ijt}$$

where exp: exponential $\qquad (7)$

THE EMPIRICAL APPROACH

As mentioned above, this work tries to think through the concomitant free trade involvement of southern Mediterranean countries with both the Euro-Mediterranean and the African areas, by considering two South Mediterranean countries that are Tunisia and Egypt in their trade integrations with the European Union (EU), the COMESA and Türkiye.

Specifically, through the estimation of a Gravity model, the objective is to assess the effects of key determinants included in the selected equations, on Tunisian and Egyptian trades with the EU, the COMESA and Türkiye commercial partners.

Before presenting the estimating equations, it is useful to give a brief overview of Tunisian and Egyptian contemporary trade. Regarding Tunisia, trade balances of goods (excluding services) show structural deficits that accounted 4,583,218 and 5,379,223 thousand USD respectively in years 2020 and 2021 (Source: Trademap). Theses deficits, which represent around 15% of GDP, are mainly due to the energy shortages and trade deficits in raw materials, semi-finished products, capital goods and foodstuffs. Tunisia's export sectors are mainly focused on mechanical and electrical industries, phosphates, textiles and clothing, energy, agriculture and the agro-food industry. Regarding imports, Tunisia buys principally from abroad energy products, capital equipment for the manufacturing industry, raw materials, semi-finished products and food products. The European Union is the most important trading partner of Tunisia, both in terms of exports (almost 75% of total Tunisian exports) and imports (almost 50% of total Tunisian imports). Whereas France, Italy and Germany remain the leading partners in Tunisian trade, China and Türkiye are emerging as major suppliers of Tunisia, with respective shares of around 10.5% and 5.4% of its total imports in 2021 (Source: Trademap).

Concerning Egypt, trade deficits of goods (excluding services) are structural and reached levels of 33,464,409 and 33,079,525 thousand USD respectively in years 2020 and 2021 (Source: Trademap), representing shares of between 10% and 15% of GDP. Egypt is the world's largest importer of wheat, and its incompressible imports are furthermore made up of inputs for manufacturing and industrial production. Egyptian exports commonly consist of hydrocarbons, textile goods, household appliances, mineral fertilizers and phosphates. Whereas the EU is Egypt's largest trading partner (almost 30% of its trade), Egypt commercializes also with various partners around the world. In this field, China, Saudi Arabia and the United States are respectively the largest suppliers of Egypt with respective shares of around 13.6%, 8.5% and 7% of its total imports in 2021. In terms of export markets, Türkiye, Italy and Spain are Egypt's main destinations with respective shares of around 6.5%, 6.3% and 4.2% of its total exports in 2021 (Source: Trademap).

METHODOLOGY AND MODEL

The methodology used in this work is a Gravity model estimation on panel data. Following the equation model stated above, Tunisian and Egyptian exports directed firstly to the EU and COMESA countries (dependent variable) are linked to various usual exogenous variables that are either country-specific features or bilateral links. Such exogenous variables that may include or not time dimension, comprise GDPs, distance, shared languages, colonial ties, MRTs and bilateral FTAs.

Then, for purposes of comparison and considering the importance of FTAs with Türkiye within the Euro-Mediterranean region, the sample of partner countries is extended to Türkiye and the gravity equation comprises additionally the FTAs with Türkiye in its exogenous variables.

The started Gravity equations (Equation 8 and Equation 9) are inspired by the Structural formula as introduced by Anderson and Van Wincoop (2003). They initially take the following log-linear form:

$$LExports_{ijt} = \varphi_0 + \beta_1\, LGDP_{it} + \beta_2\, LGDP\_Partner_{jt} + \beta_3\, LDist_{ij} + \beta_4\, Lang_{ij} + \beta_5\, Colony_{ij} + \beta_6\, COMESA_{ijt} + \beta_7\, EUM\_AA_{ijt} + \beta_8\, MRT_{it} + \beta_9\, MRT_{jt} + \varepsilon_{ijt} \quad (8)$$

$$LExports_{ijt} = \varphi_0 + \beta_1\, LGDP_{it} + \beta_2\, LGDP\_Partner_{jt} + \beta_3\, LDist_{ij} + \beta_4\, Lang_{ij} + \beta_5\, Colony_{ij} + \beta_6\, COMESA_{ijt} + \beta_7\, EUM\_AA_{ijt} + \beta_8\, FTA\_Türkiye_{ijt} + \beta_9\, MRT_{it} + \beta_{10}\, MRT_{jt} + \varepsilon_{ijt} \quad (9)$$

The dependent variable is $LExports_{ijt}$: Natural Logarithm of exports from country (i) to partner country (j) in year t.

The prefix "L" denotes the natural logarithm of a quantitative variable. The index (i) refers to Tunisia or Egypt. The index (j) refers to a partner country member of the EU or the COMESA, as well as to Türkiye. (t) is a time index.

The exogenous variables are as follows:

- $LGDP_{it}$: Natural Log of GDP of country (i) in year t. GDP is in current US dollars (USD).

- $LGDP\_Partner_{jt}$: Natural Log of GDP of partner country (j) in year t. GDP is in current USD.

- $LDist_{ij}$: Natural Log of the distance between countries (i) and (j). The distance separating the biggest cities of countries (i) and (j), is weighted by the share of the city in the overall country's population and is measured in km.

- $Lang_{ij}$: Dummy variable for a common language.

- $Colony_{ij}$: Dummy variable for colonial links.

- COMESA$_{ijt}$: Dummy variable equals to 1 if both countries (i) and (j) are members of the COMESA, and 0 otherwise.

- EUM_AA$_{ijt}$: Dummy variable equals to 1 if both countries (i) and (j) are members of a bilateral EU-Mediterranean Association Agreement, and 0 otherwise.

- FTA_Türkiye$_{ijt}$: Dummy variable equals to 1 if both countries (i) and (j) are members of the Free Trade Area with Türkiye, and 0 otherwise.

- MRT$_{it}$: Multilateral Resistance Terms of country (i) in year t.

- MRT$_{jt}$: Multilateral Resistance Terms of partner country (j) in year t.

- φ_0 is a constant

- ε_{ijt} is an error term.

In order to take into account both sides of trades of Tunisia and Egypt with their partner countries, estimations also apply to imports as linked to previous exogenous variables. This would permit to make allowance for trade balances of the two countries, as well as to compare the elasticities of each of the exogenous variables. The gravity equations referring to imports (Equation 10 and Equation 11) become the following:

$$LImports_{ijt} = \varphi'_0 + ß'_1 LGDP_{it} + ß'_2 LGDP\_Partner_{jt} + ß'_3 LDist_{ij} + ß'_4 Lang_{ij} + ß'_5 Colony_{ij} + ß'_6 COMESA_{ijt} + ß'_7 EUM\_AA_{ijt} + ß'_8 MRT_{it} + ß'_9 MRT_{jt} + \varepsilon'_{ijt} \tag{10}$$

$$LImports_{ijt} = \varphi'_0 + ß'_1 LGDP_{it} + ß'_2 LGDP\_Partner_{jt} + ß'_3 LDist_{ij} + ß'_4 Lang_{ij} + ß'_5 Colony_{ij} + ß'_6 COMESA_{ijt} + ß'_7 EUM\_AA_{ijt} + ß'_8 FTA\_Turkiyeijt + ß'_9 MRT_{it} + ß'_{10} MRT_{jt} + \varepsilon'_{ijt} \tag{11}$$

The dependent variable is LImports$_{ijt}$: Natural Logarithm of imports of country (i) from partner country (j) in year t. φ'_0 is a constant and ε'_{ijt} is an error term.

As mentioned above, "Multilateral Resistance Terms" are hardly observable, and it is common to seize them using importer and exporter fixed effects through Dummy variables (αi and λj for exports' equation; α'i and λ'j for imports' equation) in line with the works of Feenstra (2004), Baldwin and Taglioni (2006). Such fixed effects Dummy variables would encompass all constant country-specific factors and would generate collinearities with other constant-valued variables. Therefore, the Gravity equations to be estimated separately for Tunisia and Egypt become the following Equations 12 and 13 regarding exports, and Equations 14 and 15 regarding imports:

$$LExports_{ijt} = \alpha_i + \lambda_j + ß_1 LGDP_{it} + ß_2 LGDP\_Partne_{rjt} + ß_3 COMESA_{ijt} + ß_4 EUM\_AA_{ijt} + \varepsilon_{ijt} \tag{12}$$

$$LExports_{ijt} = \alpha_i + \lambda_j + \beta_1\, LGDP_{it} + \beta_2\, LGDP\_Partner_{jt} + \beta_3\, COMESA_{ijt}$$
$$+ \beta_4\, EUM\_AA_{ijt} + \beta_5\, FTA\_Türkiye_{ijt} + \varepsilon_{ijt} \tag{13}$$

$$LExports_{ijt} = \alpha'_i + \lambda'_j + \beta'_1\, LGDP_{it} + \beta'_2\, LGDP\_Partne_{rjt} + \beta'_3\, COMESA_{ijt}$$
$$+ \beta'_4\, EUM\_AA_{ijt} + \varepsilon_{ijt} \tag{14}$$

$$LExports_{ijt} = \alpha'_i + \lambda'_j + \beta'_1\, LGDP_{it} + \beta'_2\, LGDP\_Partne_{rjt} + \beta'_3\, COMESA_{ijt}$$
$$+ \beta'_4\, EUM\_AA_{ijt} + \beta'_5\, FTA\_Türkiye_{ijt} + \varepsilon_{ijt} \tag{15}$$

αi and $\alpha'i$ are (i) fixed effects λj and $\lambda'j$ are partner country fixed effects.

In accordance with the aforementioned, trade data is characterized by the presence of some zero trade flows, particularly in commerce with COMESA countries. To overcome such constraint, as well as the probable existence of heteroscedasticity in trade data, the alternative approach that is in line with the works of Santos Silva and Tenreyro (2006) consists of estimating directly the multiplicative form of the Gravity equations using the Poisson Pseudo Maximum Likelihood (PPML) estimator. The multiplicative gravity equations obtained in this setting are the following Equations 16 and 17 as regards exports, and Equations 18 and 19 as regards imports:

$$Exports_{ijt} = \exp\,(\alpha_i + \lambda_j + \beta_1\, LGDP_{it} + \beta_2\, LGDP\_Partner_{jt} + \beta_3\, COMESA_{ijt} +$$
$$\beta_4\, EUM\_AA_{ijt}) \times \varepsilon_{ijt} \tag{16}$$

$$Exports_{ijt} = \exp\,(\alpha_i + \lambda_j + \beta_1\, LGDP_{it} + \beta_2\, LGDP\_Partner_{jt} + \beta_3\, COMESA_{ijt} +$$
$$\beta_4\, EUM\_AA_{ijt} + \beta_5\, FTA\_Turkiye_{ijt}) \times \varepsilon_{ijt} \tag{17}$$

$$Imports_{ijt} = \exp\,(\alpha'_i + \lambda'_j + \beta'_1\, LGDP_{it} + \beta'_2\, LGDP\_Partner_{jt} + \beta'_3\, COMESA_{ijt} +$$
$$\beta'_4\, EUM\_AA_{ijt}) \times \varepsilon_{ijt} \tag{18}$$

$$Imports_{ijt} = \exp\,(\alpha'_i + \lambda'_j + \beta'_1\, LGDP_{it} + \beta'_2\, LGDP\_Partner_{jt} + \beta'_3\, COMESA_{ijt} +$$
$$\beta'_4\, EUM\_AA_{ijt} + \beta'_5\, FTA\_Turkiye_{ijt}) \times \varepsilon_{ijt} \tag{19}$$

where (exp) denotes exponential, and the dependent variables become:

- $Exports_{ijt}$: exports from country (i) to partner country (j) in year t, in current USD

- $Imports_{ijt}$: imports of country (i) from partner country (j) in year t, in current USD.

DATA

Data is annual and covers the period from year 2001 to 2021. Two exporter or importer (i) countries are considered: Tunisia and Egypt. Forty-one partner countries (j) are selected in the sample: 22 EU countries, 18 COMESA countries and Türkiye, representing together more than 95% of the partner countries' populations. The 22 EU countries are Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Poland, Portugal, Spain, United Kingdom (Brexit taken into account), Romania, Slovakia and Sweden. The selected COMESA countries are Burundi, Comoros, Djibouti, Egypt (when the exporter is Tunisia), Eritrea, Ethiopia, Kenya, Libya, Madagascar, Mauritius, Malawi, Rwanda, Sudan, Swaziland, Seychelles, Tunisia (when the exporter is Egypt), Uganda, Zambia and Zimbabwe.

The Gravity equations are to be estimated separately for Tunisia and Egypt. Therefore, two samples of 861 observations each are considered in this work (840 observations each are considered here when the estimation does not include Turkiye). Data come from various databases as follows:

- Figures relating to distances and Dummies "EUM_AA", "Lang", and "Colony" come from the Gravity Dataset of CEPII (Centre d'Etudes Prospectives et d'Informations Internationales).

- Statistics of exports and imports are taken from the Trade-Map Database of the International Trade Center (ITC) calculations based on UN COMTRADE statistics.

- GDP values come from the WDI (World Bank Development Indicators Dataset).

- The Dummy variables "COMESA" and "FTA_Türkiye" are based on the information provided on the COMESA and WTO websites.

For both Tunisia and Egypt, trade values with the European Union and Türkiye are much higher than trade values with COMESA countries. It is also important to point out in this context the existence of a few missing values in the GDP of some COMESA countries (10 observations in total).

ESTIMATION RESULTS AND IMPLICATIONS

ESTIMATION RESULTS

All estimates are carried out in this context on panel data using STATA software. First, the focus is on equations 16, 17, 18 and 19, which enables us to estimate their multiplicative form using the PPML technique. As mentioned above, these equations include exporter and importer fixed effects to incorporate the "Multilateral Resistance Terms" that are difficult to observe and measure. Fixed effects encompass also the country-unchanged features such as distance, and lead to the removal of variables with which the collinearity risk is high such as language and colony Dummies. PPML estimates allow to deal with the likely heteroscedasticity, as well as to take into account the zero-trade observations.

Moving from equation 16 to equation 17 allows to include Tunisian and Egyptian exports to Türkiye and to estimate the effects of the related FTAs. Analogously, moving from equation 18 to equation 19 permits to comprise both countries' imports from Türkiye, as well as to estimate the effects of the related FTAs on imports.

Next, in line with the works of Trefler (2004) and Baier and Bergstrand (2007), all four gravity equations are re-estimated using 3-year intervals. The underlying idea is that the adjustment of trade flows in response to trade policy changes could not be instantaneous, which leads sometimes to criticize estimations applied to data pooled over consecutive years. In the case of this work, the challenge is the weighty decrease in the number of observations (one-third, i.e. just 287 observations). Nevertheless, this did not prevent carrying out the estimation with data for the years 2003, 2006, 2009, 2012, 2015, 2018 and 2021. Estimated elasticities are consequently compared.

Then, with the aim of assessing the effects on Tunisian and Egyptian trades of all bilateral distance, common language and colonial links, already incorporated in fixed effects or omitted for collinearity while achieving the PPML technique, estimations are implemented using the Random Effects (RE) technique on equations 8, 9, 10 and 11 in their log-linear form. Because of the difficulties in seizing MRTs, these latter are not considered in the equations for RE. Re- estimations using 3-year intervals are also carried out in this context.

Estimates are implemented separately for Tunisia and Egypt. Tables 1, 2, 3 and 4 show roughly all results for Tunisian and Egyptian trades. Values in brackets refer to standard deviations of estimators: *** denotes 1% significance for the estimator, ** denotes 5% significance for the estimator and * denotes 10% significance for the estimator.

For the two exporting or importing countries (Tunisia and Egypt), the number of observations is higher with PPML estimations than with RE estimations. This is obviously explained by the inclusion of the zero-value exports or imports in the PPML technique.

Table 1: Estimation results for exporter Tunisia

	Estimation method							
	PPML Partners: EU and COMESA Dependent variable: Exports		**PPML** Partners: EU, COMESA and Türkiye Dependent variable: Exports		**RE** Partners: EU and COMESA Dependent variable: LExports		**RE** Partners: EU, COMESA and Türkiye Dependent variable: LExports	
Exogenous variable	Consecutive years: 2001-2021	3-years intervals	Consecutive years: 2001-2021	3-years intervals	Consecutive years: 2001-2021	3-years intervals	Consecutive years: 2001-2021	3-years intervals
LGDP	0.635 *** (0.001)	0.648*** (0.000)	0.644 *** (0.000)	0.659 *** (0.000)	0.859 *** (0.000)	1.549 *** (0.000)	0.847 *** (0.000)	1.517 *** (0.000)
LGDP_Partner	0.629 *** (0.001)	0.583*** (0.000)	0.617 *** (0.001)	0.568 *** (0.000)	1.017 *** (0.000)	0.914*** (0.000)	1.019 *** (0.000)	0.919 *** (0.000)
EUM_AA	0.938 *** (0.000)	0.950*** (0.000)	0.940 *** (0.000)	0.952 *** (0.000)	1.122 *** (0.000)	1.076 *** (0.001)	1.115 *** (0.000)	1.052 *** (0.001)
COMESA	-0.239 ** (0.049)	-0.077 (0.521)	-0.239 ** (0.045)	-0.079 (0.503)	0.321 (0.123)	0.269 (0.375)	0.322 (0.118)	0.271 (0.367)
FTA_Turkiye	-	-	-0.046 (0.644)	-0.126 (0.250)	-	-	-0.501 (0.361)	-0.454 (0.633)
LDist	-	-	-	-	-1.255 *** (0.003)	-1.442 *** (0.002)	-1.273 *** (0.002)	-1.464 *** (0.002)
Lang	-	-	-	-	1.969 *** (0.000)	1.796 *** (0.002)	1.880 *** (0.000)	1.693 (0.002)
Colony	-	-	-	-	1.202 (0.136)	1.002 (0.236)	1.438 ** (0.040)	1.273 * (0.092)
Constant	-	-	-	-	-21.993*** (0.000)	-34.67*** (0.001)	-21.573*** (0.000)	-33.844*** (0.001)
Number of observations	830	276	851	283	765	255	786	262
R² between	-	-	-	-	0.8337	0.8251	0.8359	0.8272
Fixed effects	Yes	Yes	Yes	Yes	No	No	No	No

Estimation of the Integration of Tunisia and Egypt in the Euro-Mediterranean
and South-East African Regions Using the Gravity Equation

Table 2: Estimation results for exporter Egypt

	Estimation method							
	PPML **Partners:** EU and COMESA **Dependent variable:** Exports		**PPML** **Partners:** EU, COMESA and Türkiye **Dependent variable:** Exports		**RE** **Partners:** EU and COMESA **Dependent variable:** LExports		**RE** **Partners:** EU, COMESA and Türkiye **Dependent variable:** LExports	
Exogenous variable	Consecutive years: 2001-2021	3-years intervals	Consecutive years: 2001-2021	3-years intervals	Consecutive years: 2001-2021	3-years intervals	Consecutive years: 2001-2021	3-years intervals
LGDP	0.577 ***	0.609***	0.596 ***	0.627 ***	1.135 ***	1.101***	1.132 ***	1.102 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LGDP_Partner	1.041 ***	0.975***	1.035 ***	0.964 ***	1.087 ***	1.039***	1.091 ***	1.039 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
EUM_AA	0.312 ***	0.337***	0.318 ***	0.343 ***	-0.184	-0.110	-0.184	-0.106
	(0.000)	(0.000)	(0.000)	(0.000)	(0.250)	(0.687)	(0.245)	(0.695)
COMESA	0.368	-0.045	0.355	-0.056	1.972 ***	2.052***	1.973 ***	2.046 ***
	(0.332)	(0.877)	(0.347)	(0.848)	(0.000)	(0.000)	(0.000)	(0.000)
FTA_Turkiye	-	-	0.514 ***	0.597 ***	-	-	-0.058	0.001
			(0.000)	(0.000)			(0.880)	(0.999)
LDist	-	-	-	-	-1.671 ***	-1.687***	-1.665 ***	-1.684 ***
					(0.000)	(0.000)	(0.000)	(0.000)
Lang	-	-	-	-	0.973 **	0.877 **	0.977 **	0.879 **
					(0.026)	(0.046)	(0.026)	(0.046)
Colony	-	-	-	-	omitted	omitted	0.210	0.334
							(0.856)	(0.788)
Constant	-	-	-	-	-27.023 ***	-24.88***	-27.099 ***	-24.879***
					(0.000)	(0.000)	(0.000)	(0.000)
Number of observations	830	276	851	283	811	270	832	277
R² between	-	-	-	-	0.7790	0.7837	0.7912	0.7959
Fixed effects	Yes	Yes	Yes	Yes	No	No	No	No

Estimation of the Integration of Tunisia and Egypt in the Euro-Mediterranean and South-East African Regions Using the Gravity Equation

Table 3: Estimation results for importer Tunisia

Exogenous variable	Estimation method							
	PPML **Partners:** EU and COMESA **Dependent variable:** Imports		**PPML** **Partners:** EU, COMESA and Türkiye **Dependent variable:** Imports		**RE** **Partners:** EU and COMESA **Dependent variable:** LImports		**RE** **Partners:** EU, COMESA and Türkiye **Dependent variable:** LImports	
	Consecutive years: 2001-2021	3-years intervals	Consecutive years: 2001-2021	3-years intervals	Consecutive years: 2001-2021	3-years intervals	Consecutive years: 2001-2021	3-years intervals
LGDP	0.107	0.209	0.085	0.194	-0.009	-0.388	-0.013	-0.398
	(0.713)	(0.428)	(0.761)	(0.442)	(0.968)	(0.319)	(0.951)	(0.299)
LGDP_Partner	0.812 ***	0.556 **	0.853 ***	0.623 **	0.806 ***	0.925***	0.814 ***	0.937 ***
	(0.005)	(0.036)	(0.001)	(0.014)	(0.000)	(0.000)	(0.000)	(0.000)
EUM_AA	0.434 ***	0.439***	0.419 ***	0.417 ***	0.726 ***	0.628 **	0.677 ***	0.559 *
	(0.000)	(0.003)	(0.000)	(0.003)	(0.001)	(0.039)	(0.001)	(0.060)
COMESA	-0.653 *	-0.538	-0.660 *	-0.551	-0.531 **	-0.193	-0.535 **	-0.200
	(0.096)	(0.162)	(0.083)	(0.133)	(0.018)	(0.521)	(0.016)	(0.502)
FTA_Turkiye	-	-	0.455 ***	0.737 ***	-	-	0.852	1.372
			(0.002)	(0.000)			(0.131)	(0.107)
LDist	-	-	-	-	-2.224 ***	-1.826***	-2.266 ***	-1.856 ***
					(0.000)	(0.000)	(0.000)	(0.000)
Lang	-	-	-	-	0.444	0.669	0.268	0.547
					(0.282)	(0.109)	(0.499)	(0.177)
Colony	-	-	-	-	-0.319	-0.516	0.137	-0.203
					(0.607)	(0.401)	(0.803)	(0.717)
Constant	-	-	-	-	13.196***	16.466 *	13.495 ***	16.712 *
					(0.007)	(0.067)	(0.005)	(0.059)
Number of observations	830	276	851	283	782	261	803	268
R² between	-	-	-	-	0.9072	0.8948	0.9070	0.8964
Fixed effects	Yes	Yes	Yes	Yes	No	No	No	No

Estimation of the Integration of Tunisia and Egypt in the Euro-Mediterranean
and South-East African Regions Using the Gravity Equation

Table 4: Estimation results for importer Egypt

	Estimation method							
	PPML Partners: EU and COMESA Dependent variable: Imports		**PPML** Partners: EU, COMESA and Türkiye Dependent variable: Imports		**RE** Partners: EU and COMESA Dependent variable: LImports		**RE** Partners: EU, COMESA and Türkiye Dependent variable: LImports	
Exogenous variable	Consecutive years: 2001-2021	3-years intervals	Consecutive years: 2001-2021	3-years intervals	Consecutive years: 2001-2021	3-years intervals	Consecutive years: 2001-2021	3-years intervals
LGDP	0.970 ***	0.969 ***	0.972 ***	0.926 ***	0.984 ***	0.925***	0.990 ***	0.922 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LGDP_Partner	0.356 **	0.125	0.358 **	0.172	0.564 ***	0.799***	0.557 ***	0.797 ***
	(0.044)	(0.553)	(0.028)	(0.395)	(0.000)	(0.000)	(0.000)	(0.000)
EUM_AA	0.324 **	0.383 ***	0.324 **	0.376 ***	0.216	0.067	0.216	0.072
	(0.019)	(0.000)	(0.019)	(0.000)	(0.247)	(0.832)	(0.243)	(0.818)
COMESA	-0.532 ***	-0.733 **	-0.534 ***	-0.713 **	-1.135 ***	-1.072 **	-1.140 ***	-1.074 **
	(0.000)	(0.020)	(0.000)	(0.024)	(0.000)	(0.039)	(0.000)	(0.038)
FTA_Turkiye	-	-	0.752 ***	1.258 ***	-	-	0.591	0.951
			(0.000)	(0.000)			(0.183)	(0.223)
LDist	-	-	-	-	-1.534 ***	-1.237 **	-1.543 ***	-1.239 **
					(0.004)	(0.029)	(0.003)	(0.029)
Lang	-	-	-	-	0.357	0.603	0.352	0.602
					(0.507)	(0.290)	(0.513)	(0.290)
Colony	-	-	-	-	omitted	omitted	0.191	-0.216
					-9.721 **	-16.5***	(0.893)	(0.891)
Constant	-	-	-	-	(0.040)	(0.004)	-9.655 **	-16.325***
							(0.041)	(0.004)
Number of observations	830	276	851	283	785	261	806	268
R² between	-	-	-	-	0.7855	0.8220	0.7898	0.8282
Fixed effects	Yes	Yes	Yes	Yes	No	No	No	No

Before starting to interpret the estimates, the first highlights that appear from the above figures as revealed in the results tables, are the following:

- The estimates and their significances remain almost unchanged, despite some exceptions when the sample of the partners' countries is enlarged to Türkiye.

- Results obtained from estimations carried out on 3-year intervals data are overall close to results relating to consecutive years data, except few dissimilarities.

In line with the literature, PPML results are the most accurate. Accordingly, the interpretation of the estimated elasticities concerning GDPs and FTA Dummies will be limited here to PPLM estimates. Only estimates with regard to distance, common language and colonial links are gotten from RE estimations. Moreover, taking into account the bigger size of data related to the consecutive-years period, it is fairer to consider for analysis results obtained from such a larger number of observations. Consistent with these selection criteria for interpretation, only figures highlighted in red color are explored below.

Starting with the GDP variables estimation results, we note the appearance of positive and significant PPML estimators for the case of exports and for both Tunisia and Egypt. GDPs are proxies for the exporter country's outputs or the importer country's demands. In this framework, estimated elasticities of GDPs confirm their multiplying effects on exports. The figures show that for every 1% growth in origin GDP, Tunisian exports and Egyptian exports to their partner countries increase by 0.644% and 0.596% respectively. In harmony, every 1% rise in the GDP of the importer partner country generates increases to Tunisian exports and Egyptian exports respectively by 0.617 % and 1.035%.

On the import side, estimated elasticities of GDPs have also multiplying effects on Egyptian imports. For the case of Tunisia, only the estimated elasticity of the GDPs of the partner countries has multiplying effects on its imports; the importer GDP estimated elasticity is not significant. According to the figures, every 1% growth in the importer's GDP generates a 0.972% increase in Egyptian imports. Likewise, for every 1% growth in the partner country's GDP, Tunisian imports and Egyptian imports increase by 0.853% and 0.358% respectively.

Such results confirm that the multiplying effects of GDPs on exports and imports are similar overall. Despite a few shortcomings, findings in this field are mostly in conformity with expectations and with previous empirical works (Avom and Mignamissi, 2017; Carrère and Masood, 2015; De Sousa and Lochard, 2009).

For Dummies relating to the bilateral EU-Med Association Agreements, the COMESA and the Free Trade Areas with Türkiye, results are commonly in line with expectations. At this level and with reference to EUM_AA Dummy, PPML results related to exports show positive and significant estimators for both exporting countries, which means that the Associated Agreements (AA) and the previous protocols conducted with the European Union produce rises in Tunisian and Egyptian exports towards such target market (EU). According to estimated coefficients, Tunisian exports increase by almost 156% [$=100 \text{x}(e^{0.940} - 1)$] when the destination is the EU in comparison with its exports to other markets, while Egypt's exports to the EU grow by 37.4% [$=100 \text{x}(e^{0.318} - 1)$] compared with its exports to other markets.

With regard to imports, PPML results show also positive and significant estimators for both importing countries. The AAs and previous protocols raise Tunisian and Egyptian imports. With respect to estimates, Tunisian imports increase by 52% [$=100 \text{x}(e0.^{419} - 1)$] when the origin is the EU in comparison with other

source markets, while Egypt's imports from the EU grow by 38.3% [=100x($e^{0.324}$ − 1)] compared with its imports from other source markets.

Such results confirm the strong commercial links that Tunisia and Egypt have held with the EU for many decades whether as part of the AAs or the preceding protocols. As mentioned above, almost 75% of Tunisian exports and 50% of Tunisian imports are with the EU. Recent figures show that Tunisia has had a commercial surplus with the EU since 2020 following a period of a decreasing deficit during the preceding two decades; the higher value of the exports' elasticity (compared with imports' elasticity) confirms such trend and underlines the efforts made by Tunisian exporters on the EU market. Concerning Egypt, almost 30% of its trade is done with the EU (more diversified geographically). Over the past two decades, Egypt has had a structural commercial deficit with the EU, although this has narrowed considerably in 2021 and 2022. Export and import elasticities are almost equal, at a level compatible with the geographical diversity of its trade.

Concerning the COMESA Dummy variable, PPML results show negative effects, namely in the case of Tunisia. This could be explained by the low values of trade with COMESA countries. Results related to exports show a negative and significant estimator for Tunisia. According to the estimated coefficient, Tunisian exports decrease by almost 21.3% [=100x($e^{-0.239}$ − 1)] when the destination is the COMESA in comparison with the situation in which exports are targeted to other markets. In the case of Egypt, the estimated coefficient is non-significant.

Regarding imports, PPML results show negative and significant results for both importing countries. With reference to estimates, Tunisian imports and Egyptian imports fall by almost 48.3% [=100x($e^{-0.660}$ − 1)] and 41.4% [=100x($e^{-0.534}$ − 1)] respectively when the origins are COMESA countries in comparison with other source markets.

These results reflect more closely the low levels of mutual trade links that both countries have with COMESA. Tunisia as a recent member within the integration has lower trade values with COMESA countries than Egypt.

As to the effects on trade of the Dummy variable FTA_Türkiye, PPML results are in line with expectations and with the trade trends that both countries have with Türkiye. For exports, the estimated coefficient is positive and significant for Egypt, in harmony with the fact that Türkiye is the leading target market for Egyptian exports in 2021. According to the level of the estimator, Egypt would raise its exports by almost 67.2% [=100x($e^{0.514}$ − 1)] when the destination is Türkiye in comparison with its exports to other markets. In the case of Tunisia, the estimated coefficient is not significant which could be rational as the level of Tunisian exports towards Türkiye is not high.

As to imports, PPML results show positive and significant estimated coefficients for both Tunisia and Egypt, which is in line with the strong offensive of Turkish exports on the Tunisian and Egyptian markets. In this field, figures confirm that Tunisian imports and Egyptian imports rise by 57.6% [=100x($e^{0.455}$ − 1)] and 112.1% [=100x($e^{0.752}$ − 1)] respectively when the origin is Türkiye in comparison with other source markets. Both countries have commercial deficits with Türkiye, which could be confirmed by the relatively higher level of the estimated coefficients related to imports.

With reference to the traditional exogenous variables as included in the log-linear Equations 8, 9, 10 and 11 and estimated in the RE regressions, results firstly meet expectations and previous empirical works as regards the effects of distance on trade. In this respect, estimated elasticities of the variable LDist are strongly negative and significant for Tunisia and Egypt in terms of both exports and imports, confirming that geographical distance has a negative impact on trade. In this context, each additional 1% in the distance separating the partner countries generates reductions in Tunisian exports and Egyptian exports of 1,273% and 1,665% respectively. Similarly, a 1% increase in the distance leads to a 2.266% and 1.534% reduction in imports for the two countries respectively. Such results are in line with the gravity model and previous empirical findings of Borchert and Yotov (2017), Disdier and Head (2008), Yotov (2012), etc.

RE results confirm also that linguistic proximity has favorable effects on Tunisian and Egyptian exports. However, relating to imports, estimated coefficients are non-significant in this setting. Sharing common languages, even as a second language stimulates exports of Tunisia and Egypt. According to the results, exports of Tunisia to a country with which it shares a common language are 555.4% higher $[=100x(e^{1.880} - 1)]$ than its exports to any other destination country that does not enjoy the same linguistic proximity. The same applies to Egypt, where exports to a country with which it shares a joint language is 165.6% higher $[=100x(e^{0.977} - 1)]$ than its exports to any other destination country not benefiting from the same linguistic proximity.

Regarding the effects of colonial ties, most of RE results show insignificant results in this work, except for the case of Tunisian exports that are 321.2% higher $[=100x(e^{1.438} - 1)]$ when the country shares colonial ties with its partner. For the rest of the non-significant estimated coefficients, no interpretation could be stated as to the effects of shared colonial ties.

IMPLICATIONS

Based on the estimation results described above, as well as on data relating to the variables under respect, it is useful to evaluate the progress of Tunisia's and Egypt's involvement in all integrations considered in this work, namely the bilateral AAs with the EU, the COMESA and the FTAs with Türkiye. Findings confirm most of the anticipations and the state of engagement of both countries in trade efforts engaged with member countries of the three integrations. Traditional exogenous variables, namely GDPs and Distance act on trade in conformity with expectations and previous works. Shared language has a positive impact on exports in line with anticipations and prior findings. The estimated effects of the Dummy variable EUM_AA related to Association Agreements with the EU consolidate the strong trade links that Tunisia and Egypt have with the EU. With COMESA countries, Tunisia's trade relations remain largely under-exploited, with low export and import values and negative estimators. As far as Egypt is concerned, the country has not yet succeeded in consolidating the diversification of its regional trade with COMESA countries. Trade with Türkiye is following a very positive trend, confirming the role it plays

in trade diversion. This applies to both exports and imports in the case of Egypt but is limited to imports in the case of Tunisia. Estimates related to the Dummy variable FTA_Türkiye confirm this trend.

In view of the estimation findings and the data relating to the gravity model, two concomitant questions arise at this level:

- How can both countries optimize their integrations into the three FTAs under consideration?

- Which roles could both countries assume for fluidizing triangular trade within the three zones: the European Union, the Southern Mediterranean and the Southeastern Africa?

In this context, regional trade diversification remains desirable for any country with an open economy. Both countries, and Tunisia in particular, should work to ensure a more widespread and balanced commercial presence, in order to avoid the risks associated with dependence on a small number of target markets. Diversification should result in a stronger presence on the markets of the 27 EU countries, as well as on the Turkish market and a focus on all the markets not yet tapped in the COMESA area. To achieve such objectives and to assume effectively the role of bridge within the triangular trade links "EU-South Mediterranean- COMESA African countries", active public and private authorities in Tunisia and Egypt should take several actions. The EU institutions and experts could also intervene at this level when appropriate or required, through investments and/or proficiency. The recommended actions are as follows:

- Fluidizing the logistic chains between countries of the three regions, in order to bring the distances closer by means of various actions such as the removal of bureaucratic constraints in ports and airports, the reinforcement of maritime and air traffic, the investment in fast and modern transport infrastructures, the reduction of the digital gap between countries, etc.

- Strengthening marketing actions within the COMESA countries, in particular by means of more present and more offensive economic representations.

- Supporting cultural links and consolidating the sharing of common languages with partners, particularly through post-graduate academic relations.

- Strengthen business development initiatives in partner regions with which trade is still under-exploited; this applies in particular to Tunisia with all distant EU countries, Türkiye and COMESA countries.

- Strengthening anti-trust measures and standardized competition policies in general, to achieve greater efficiency and harmony between all concerned countries. This would generate a fair business environment that encourages initiatives within the whole region.

CONCLUSION

The proliferation of regional trade agreements in various parts of the world has not systematically led to equivalent growth in mutual trade. In this context, while the European integration has succeeded in generating outstanding trade growth between the EU member countries, the involvement of southern Mediterranean countries in various FTAs has produced mixed results as shown by their trade statistics. The case study of Tunisia and Egypt in this work is edifying in this context. While both countries have open economies and strong trade relations with the EU and recently with Türkiye, their levels of trade with COMESA countries are much lower, particularly for Tunisia.

The gravity model, which is used extensively in international trade works, could check such standings and, above all, could look for explanations through various exogenous variables. As used in this work, this estimated model confirms the level of progress made by Tunisia and Egypt in their integrations with the EU, the COMESA and Türkiye, as well as the determinants that act on their trades such as GDPs, geographical distances and shared languages.

An understanding of the factors influencing trade as set out in the gravity model, enables one to identify the required actions to acclaim and carry on in order to seize opportunities presented by trade agreements signed. This applies in particular to Tunisia and Egypt, which should implement various actions as pointed out above, to increase their trade with COMESA countries and assume an active bridge role in fluidizing triangular trade within the three areas: the European Union, the Southern Mediterranean and the Southeastern Africa. The EU and COMESA institutions should undertake as well key roles in achieving objectives that benefit all the countries involved.

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