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TUNISIA'S TRADE WITH SUB-SAHARAN AFRICA: LARGE ROOM FOR GROWTH?

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SUSTAINABLE DEVELOPMENT GOALS AND EXTERNAL SHOCKS IN THE MENA REGION:

FROM RESILIENCE TO CHANGE IN THE WAKE OF COVID-19

منتدى البحوث الاقتصادية
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Tunisia's trade with Sub-Saharan Africa: large room for growth?

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Abstract. This paper examines Tunisia's trade pattern with Sub-Saharan African (SSA) countries. Specifically, it investigates what are the main factors determining Tunisia's export flows with SSA countries, assesses export potential capacity and determines the proper commercial direction. To this end, an augmented gravity model is used for annual bilateral exports between Tunisia and 40 SSA partners over the 1995-2016 period. The model is estimated using the Pseudo Poisson Maximum Likelihood approach, which enables to deal with zero trade flows and leads to more efficient estimators than the other linear estimation methods. Two main results emerge from the analysis. First, geographical distance and institutional failure in SSA countries are the major obstacle to trade between Tunisia and its SSA partners. Second, the investigation reveals that Tunisia has a highly trade potential with many SSA countries, especially Mozambique, Kenya, São Tomé and Príncipe, Rwanda, Swaziland, Liberia, Niger and Togo. Therefore, SSA countries must be considered as real opportunities for Tunisian foreign trade. Our contribution is to shed light on the importance, for regional integration in SSA countries, and demonstrate the importance of SSA market for Tunisia to stimulate exports and reduce trade deficit.

Keywords: Tunisia; gravity model; export potential; Sub-Saharan African countries.
JEL Classifications : F14, F50, C33.

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1. Introduction

Many policymakers and economists believe that export is one of the key factors of a country's economic development (Kugler, 1991). The export-led growth assumption especially urges policy-makers in developing economies to promote exports to gain more economic growth (Atif *et al.*, 2017). Taking under consideration the importance of exports, many researchers and policy-makers have undertaken studies since the start of globalization to investigate the factors determining and explaining export flows.

In Tunisia, like other emerging economies, exports may help in achieving more economic growth due to hidden potential of exports and especially with fast-growing emerging markets. As does any country searching to encourage exports and improve terms of trade, Tunisia went through a long process of trade reforms under the structural adjustment program in the late 80s. Several measures were undertaken to stimulate exports, such as the implantation of export processing zones, the creation of fiscal incentives for exporting companies and the conclusion of many free trade agreements. However, although the significant increase in Tunisian exports during the 1986-2017 period trade deficit has declined sharply during the recent years.

Taking under consideration the negative economic consequence of trade deficit and the importance of exports in economic development, this paper aims (1) at analyzing the determinants of Tunisia's exports to 40 SSA countries for the 1995-2016 period, and to quantify the export potential of Tunisia with its SSA trading partners. Despite the fact that the exports of Tunisia to Sub-Saharan African (SSA) countries have grown steadily over the last decade, there is still a huge potential to increase the volume of exports and to improve Tunisia' term of trade (African Development Bank, 2014).

This study deals with the market diversification of Tunisia's exports. Indeed, almost 80% of Tunisia's exports are towards the European Union (EU) countries. However, the EU is vulnerable to exogenous chocs. This is particularly observed during the 2008 global financial crises and the European sovereign debt crisis. Therefore, as a developing economy, Tunisia should diversify its exporting markets and the SSA countries are the natural candidates in terms of their trade complementarity with Tunisia (Millogo and Oulmane, 2012; African Development Bank, 2014).

We use a panel data gravity model including in addition to bilateral exports from Tunisia to SSA countries, the economic, geographical, cultural and institutional characteristics of 40 countries in Sub-Saharan Africa. We estimate the model over the 1995-2016 period using

the PPML approach. Based on the econometric results, it is then possible to simulate potential bilateral exports between Tunisia and these African partners.

To our knowledge, few studies using gravity model have focused on evaluating trade potential between African countries. For example, Gbetnkom and Avom (2005) examine trade between West African Economic and Monetary Union (WAEMU) countries and calculate trade potential between member states after the economic reforms of the 80s and 90s, using the Tobit estimator over the 1990-1994 and 1996-2000 periods. They find that regional integration increases trade significantly between WAEMU member countries. They also observe the existence of an important trade potential between the economies of the sub-region. Millogo and Oulmane (2012) quantify trade potential in the Arab Maghreb Union by estimating a gravity model with several econometric techniques (OLS, within, Between, Hausman-Taylor, instrumental variables, and AR(1) model). They conclude that there is an untapped potential in trade in North Africa and the flows observed represent only 46% of the predictions. Avom and NjiKam, (2015) compute trade potential among the ten countries of the Economic Community of Central African States over the 1995–2010 period by estimating a gravity model using OLS. They conclude that there is a strong trade potential for most countries. On the other hand, low levels of diversification and industrialization greatly reduce potential trade.

Empirical research on trade flows examining African North –South trade relations are scarce. So far, only the paper by Ghazi, and Msadfa (2016) deals with export potential between Morocco and its 40 African partners. Specifically, they estimate a gravity model using cross-sectional data and panel data over the 2000-2014 period. They show that despite a relatively low complementarity of trade between Morocco and African countries, there is still a potential for boosting Morocco's exports in the African continent. We aim to fill this gap by offering new insights on African North-South trade relations using Tunisian data and by providing evidence on the crucial role of institutional quality in explaining trade flows between African countries.

This paper contributes to the existing literature in four distinctive ways. First, this is the first attempt to analyze and explain Tunisia's bilateral trade patterns with SSA countries. Second, our paper examines exports' potential of Tunisia with its SSA partners and its findings should provide important policy implications for Tunisia and other countries with a similar trade structure, that seek to improve trade balance. Third, in contrast to previous studies, we employ the PPML approach to estimate the gravity model to take into account the problem of heteroscedasticity and zero trade flow, which, may bias the results if not addressed. Fourth, we augment the previous models with an aggregate index, capturing the different dimensions of

institutional quality, to shed light on the importance , for regional integration, to develop an appropriate institutional framework in Sub-Saharan Africa, which has not received much attention in previous studies.

The paper is structured as follows: In section 2, we examine the profile of Tunisia's foreign trade. Section 3 presents the econometric framework based on an augmented gravity model, the data, the main determinants of Tunisia's trade flows to SSA countries, as well as the methodology for calculating export potential. Section 4 contains the econometric results as well as the economic interpretation. Finally, section 5 concludes and offers some policy recommendations.

2. A trade perspective for Tunisia

In this section, we first provide an overview of the evolution of Tunisian foreign trade over the 1986-2016 period. Then, we analyze the evolution of its structure, and eventually, discuss the complementarity index of Tunisia's exports with SSA countries.

2.1. Trade evolution over the 1986-2016 period

Figure 1 below illustrates the evolution of Tunisian exports and imports of goods and services from 1986 to 2017. Exports increased from 2.722 billion US$ in 1986 to 8.491 billion US$ in 2000 and 17.635 billion US$ in 2017. Nevertheless, this increase has not been regular over time, as this figure shows. The volume of Tunisia's total exports to the world was initially quite low immediately after the introduction of the structural adjustment program in 1986. It remained at a relatively low level until 2003, when it steadily increased to over 25 billion of dollars in 2008. Export flows fell sharply in 2009 by 21%. The decline in 2009 can be explained by the fall in demand in traditional export markets during the 2008-2009 global financial crisis. Tunisian exports have since rebounded to reach 22.60 billion US$ in 2011. However, the recovery was disrupted by social and political instability during the 2011-2016 post-revolution period and the European economic slowdown due to debt crises.

The value of imports has also increased considerably, from 3.364 billion US$ in 1986 to 22.583 billion US$ in 2017. The growth rate of Tunisia's exports to the world and the world's imports from Tunisia has followed very similar trajectories until 2011. In 2012, imports from the world to Tunisia increased by 1.9%, while exports to other countries witnessed a negative growth rate (-1.6%). This separation was maintained until 2017, and the value of imports into Tunisia continued to exceed the value of exports by more than 4 billion USD, resulting in a persistent and large trade balance deficit.

**Figure 1. Trends in Tunisia's trade flows (in billions of dollars)**

Source: The World Integrated Trade Solution, World Bank, database

2.2. Trade Direction

Figure 2 shows the geographical orientation of Tunisia's foreign trade between 1995 and 2016. Note that Tunisia's foreign trade is concentrated in a main region; the euro zone. European Union (EU) member countries are Tunisia's largest trading partners, accounting for 80% of Tunisia's total trade. Within these countries, France, Italy and Germany are the most important trading partners. Beyond the EU, North Africa is in the second place with a share of 10%. Asia and America rank third and fourth with shares below 5%. Finally, trade with Sub-Saharan Africa appears relatively negligible.

Figure 2. Geographical orientation of Tunisia's foreign trade between 1995 and 2016 (in % of total trade)
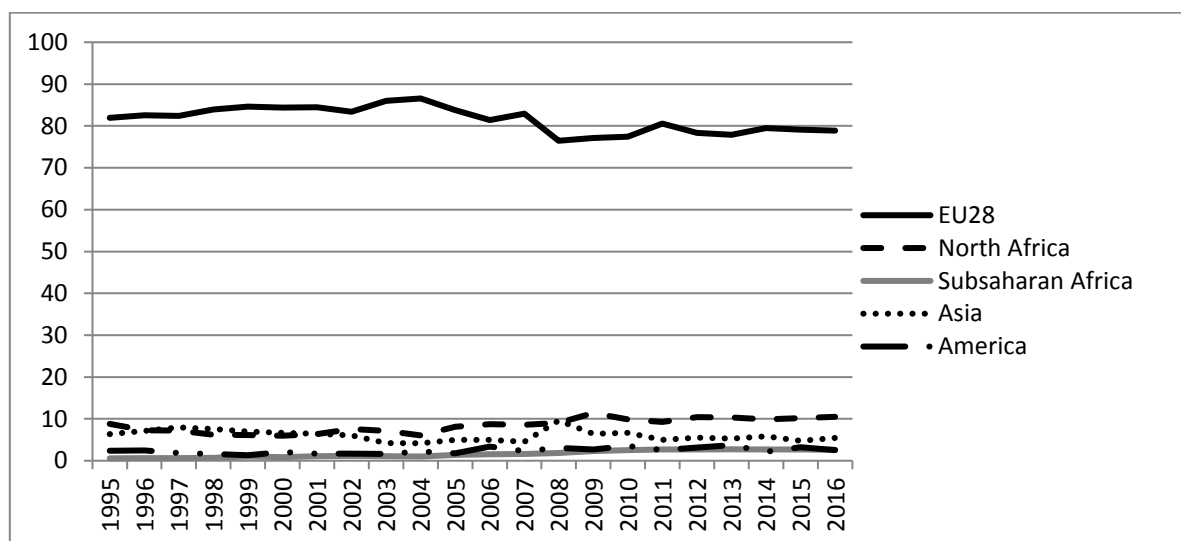
Source: Authors' calculations, based on UNCTAD data

2.3. Trade Structure

Table 1 and 2 illustrate the evolution of Tunisia's exports and imports structure by product group. Exports are dominated by manufactured goods whose share in total exports has been maintained around 70% over the 2005-2016 period. The share of textiles in Tunisian exports was around 45% in 1995. Since then, it has fallen steadily to reach 18.83% in 2016. The share of machinery and transport equipment has increased rapidly since 1995. It has increased from around 9% in 2005 to 37% in 2016. Agricultural, chemical and food and fuel products occupy only a marginal place in Tunisia's exports.

As for imports, the largest share is also reserved to manufactured products with a share maintained around 70% over the 2005-2016 period. Machinery and transport equipment are in second position with a share of around 30% during the same period. Textiles was the third dominant sector in 2005 accounting for 23.57% of total imports, however, this share has been diminishing continuously until 2016.

Table 1. Evolution of export structure by product group (in % of total exports)

Product Group	1995	1998	2001	2004	2007	2010	2013	2016
Agricultural Raw Materials	0,65	0,60	0,71	0,68	0,48	0,50	0,45	0,71
Chemical	11,90	12,65	10,00	8,82	9,06	10,58	8,62	7,75
Food	9,77	9,46	7,89	11,07	9,52	7,73	9,71	10,32
Fuel	8,47	6,44	9,24	9,58	16,20	14,18	15,22	5,65
Manufactures	79,39	82,27	80,73	77,53	69,77	76,02	73,12	81,68
Ores and Metals	1,72	1,24	1,39	1,07	1,37	1,56	1,50	1,62
Textiles	45,73	45,58	42,63	37,45	26,93	21,68	19,03	18,83
Machinery and Transport Equipment	9,45	12,96	15,40	16,76	18,97	28,42	31,23	37,97

Source: The World Integrated Trade Solution, World Bank, database

Table 2. Evolution of the structure of imports by product group (in % of total imports)

Product Group	1995	1998	2001	2004	2007	2010	2013	2016
Agricultural Raw Materials	4,19	3,04	2,84	2,76	2,22	2,13	1,77	2,00
Chemical	8,93	8,62	8,76	9,58	9,62	10,03	11,41	11,31
Food	12,54	10,30	8,32	8,61	9,80	9,35	10,62	11,14
Fuel	7,28	5,23	9,63	10,31	12,85	12,61	17,83	11,07
Manufactures	72,75	78,80	76,20	75,43	70,69	72,27	66,40	72,19
Ores and Metals	2,99	2,42	2,31	2,65	3,44	3,58	3,34	3,52
Textiles	23,57	24,71	21,58	18,96	14,55	11,40	9,61	10,36
Machinery and Transport Equipment	25,98	30,69	30,98	30,31	29,56	34,83	30,52	34,07

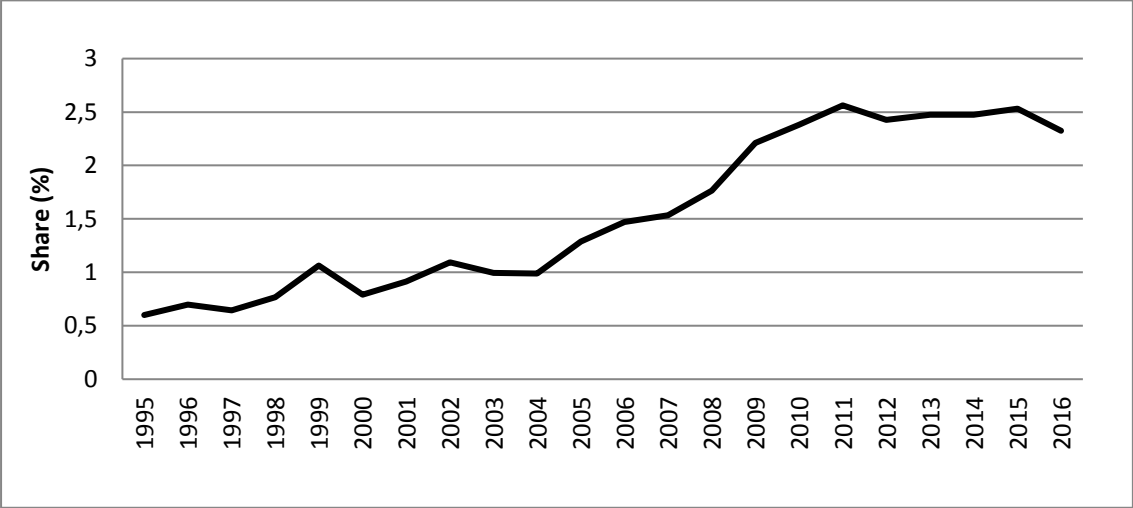Source: The World Integrated Trade Solution, World Bank, database

2.4. Trade with Sub-Saharan African countries

WITS data show that Tunisia's total exports to Sub-Saharan Africa increased by a factor of almost 9.6, from 32.8 million US$ in 1995 to 315.6 million US$ in 2016. Despite this considerable growth, the share of intra-regional trade (between Tunisia and Sub-Saharan Africa) remains unsatisfactory compared to those recorded with the other regions. Figure 3 shows that trade between Tunisia and Sub-Saharan Africa accounts for only a small proportion of Tunisia's total exports. In 1995, Tunisia's exports to Sub-Saharan Africa accounted for 0.5% of Tunisia's total trade, which reached 2.6% in 2016.

Figure 4 shows the evolution of Sub-Saharan Africa's trade from 1995 to 2016. An impressive growth in trade flows can be noticed over the entire period. In fact, total exports increased from 43.591 billion $ in 1995 to 121.455billion $ in 2016. Imports also rose sharply,

multiplied by a factor of 3.4. This expansion of trade indicates that this region has enormous growth potential and offers huge opportunities for Tunisian export growth.

Figure 3. Evolution of the share of Tunisian exports to Sub-Saharan Africa (as a percentage of Tunisia's total exports)

Source: The World Integrated Trade Solution, World Bank, database

Figure 4. Evolution of Sub-Saharan Africa's trade from 1995 to 2016
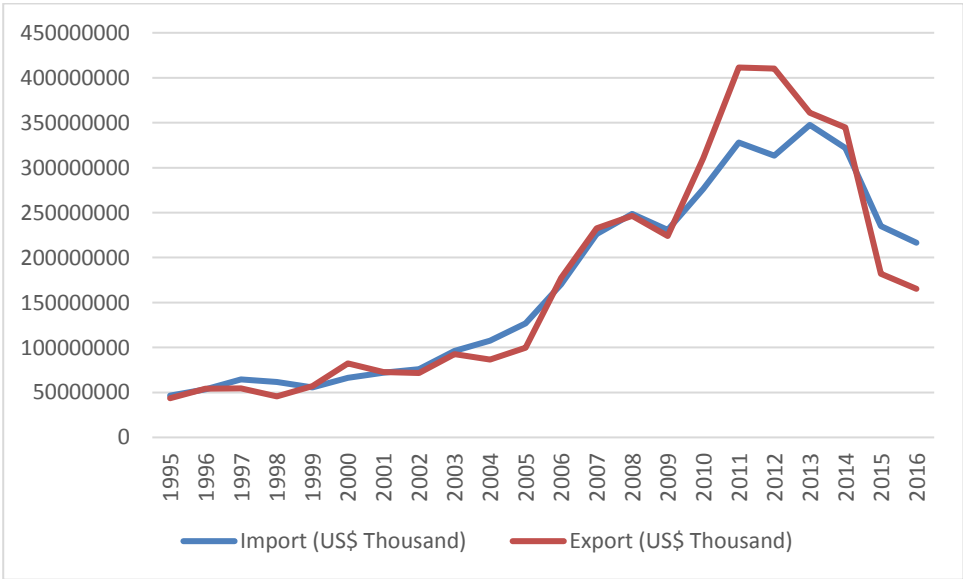
*Source: The World Integrated Trade Solution, World Bank, database*

The stylized facts above highlight two major issues: The first concerns Tunisia's export portfolio, which is heavily concentrated on a small number of trading partners, making Tunisian trade more vulnerable to external economic shocks. The second lies in the fact that, despite the considerable growth of Tunisia's trade flows to the rest of the world over the last twenty years, exports to fast-growing markets, particularly Sub-Saharan Africa, have barely followed the total export expansion of Tunisia.

Tunisia's relatively weak trade with the SSA region suggests that the economic structures of the two partners do not have the complementarities required for trade to develop further. In order to deal with this issue, we consider in the next sub-section the complementarity index of Tunisia and its partners, especially SSA countries.

2.5 Analysis of complementarity

The Complementarity Index reflects the degree of differentiation in the import and export patterns of the countries of a given regional community. In other words, it helps to determine whether two countries are natural trading partners or not. The value of the index is between 0 and 1. The higher the index, the more complementary the trade structures of the corresponding countries are, and the more important trade potential is between them. Figure 5 shows the relationship between Tunisia's average complementarity indices as an exporting country and the proportion of Tunisia's trade with its main regional partners over the 1995-2013 period. What is remarkable in this representation is the strong divergence of the proportions of trade with the European Union and with Sub-Saharan Africa despite relatively similar indices of complementarity. Structurally, Tunisian exports are complementary for the European Union as well as for Sub-Saharan Africa, which makes it possible to predict the importance of the commercial potential with this region.

Figure 5. Complementarity index and proportion of trade
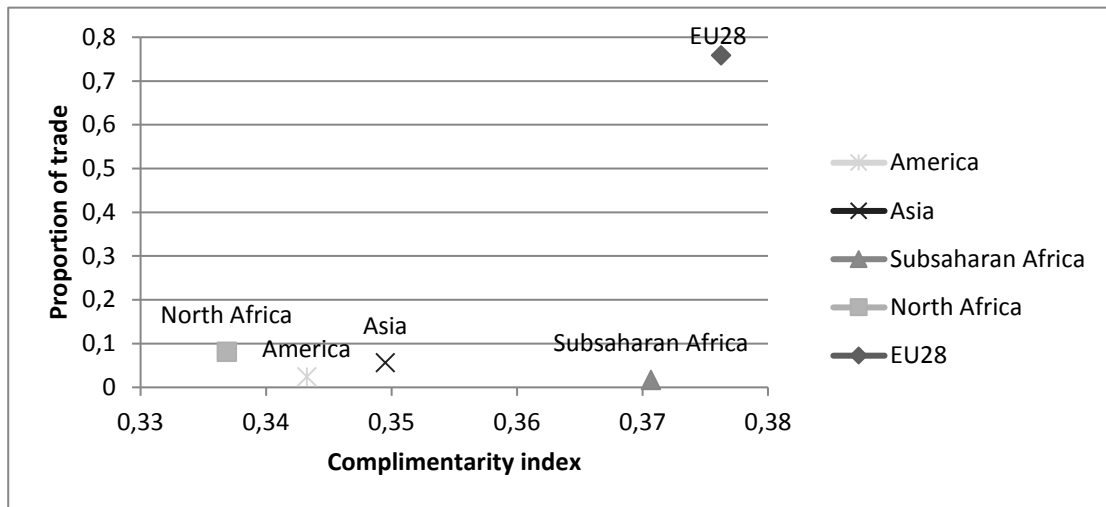
Source: Authors' calculations, based on UNCTAD data

Figure 6 that illustrates the evolution of Sub-Saharan Africa's import structure over the 2005-2016 period, seems to confirm, once again, the interest of moving towards this region. Indeed, it indicates a relative predominance of imports in manufactures fluctuating around 60% of the total imports against imports of agricultural products, oil and mining products of the order of 10 and 20%. This structure is rather adapted to Tunisian exports, dominated by manufactured products.

Figure 6. Evolution of Sub-Saharan Africa's import structure (as % of total imports)
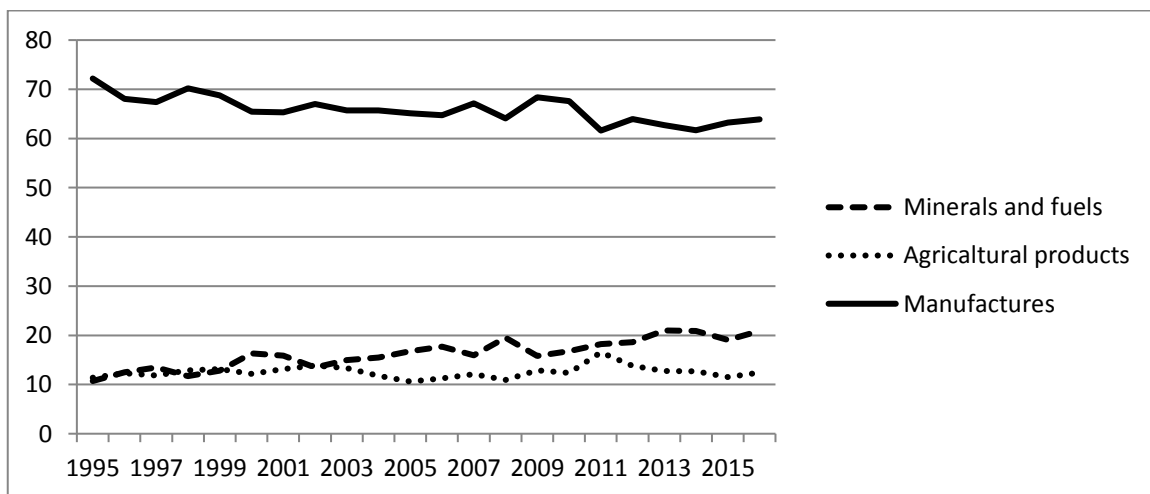
Source: The World Integrated Trade Solution, World Bank, database

The previous stylised facts **require** to be further investigated. This is the goal of section 3, which presents the econometric framework.

3. Econometric framework

The purpose of this section is first to identify the main factors explaining the relatively low level of Tunisian exports to Sub-Saharan Africa using a gravity model, and second to assess, on its basis, the export potential with this region. We begin by introducing the theoretical framework and the empirical specification of our gravity model, then we describe the variables used in the estimation and their sources, and finally we present the estimation method.

3.1. The gravity model

The gravity model has been the workhorse model in trade research because of the model's empirical success. Empirically, the gravity model has not only been used to analyze trade flows, but it has also been employed to explain other bilateral international flows, such as portfolio investment, foreign direct investment and migration. At first, Tinbergen (1962) and Pöyhönen (1963) employed a gravity model to examine the determinants of trade. The equation used considers that the volume of trade between partner countries is an increasing function of their size as measured by national income, and a decreasing function of transport costs approximated by the distance between national capitals. Along with the theoretical development, the gravity equation has been augmented to investigate several determinants of trade, such as development level (Frankel ,1992) free trade agreements (Busse, and Groening, 2012; Im, 2016), exchange rate (Yang and Gu, 2016), border effects (Olper and Raimondi, 2008), environment and arable land area (Erdem and Nazlioglu, 2008), port infrastructures (Bottosso *et al.*, 2018); and many others.

Given the absence of a complete and adequate theoretical explanation of trade flows, we adopt here a more pragmatic approach to examine the determinant of export flows. This approach is based on an econometric specification for exports that draws on the results of earlier empirical researches using gravity model (Bilgin and Demir, 2017; Alvarez *et al.*, 2018).

Specifically, the log-linear equation used in this study for Tunisia's exports to SSA countries is as follows:

$$\text{Ln}\left(X_{tun_jt}\right) \ = (\beta_0) \ + \beta_1 \text{Ln}\,(Y_{tunt}) + \beta_2 \ \text{Ln}\,\left(Y_{jt}\right) \ + \beta_3 \ \text{Ln}\left(DIST_{tun_j}\right) + \beta_4 INST_{jt} + \ \beta_5 LANG_{tunj}$$

$$+\beta_6 COL_{tun_j} + \beta_7 FTA_{tunj\,t} + \ \beta_8 AS_j + \Lambda_{tun_j} + \Lambda_t + \varepsilon_{tun_jt} \qquad\qquad (1)$$

, where Λ_{tun_j} is an effect specific to each pair of countries and common to all years, Λ_t is an effect specific to year t and common to all pairs of countries to capture common shocks and ε_{tun_jt} is an error term.

The exports of Tunisia to the country j at time t, denoted by X_{tunjt} are set to depend on: the gross domestic product of Tunisia at time t, Y_{tunt}; the gross domestic product of country j at time t Y_{jt}.; the geographical distance between the two partners $DIST_{tun_j}$, the quality of institution in the destination country at time t, $INST_{jt}$ and a vector of dummy variables that may influence export. This vector includes an index of language similarity, $LANG_{tunj}$, which takes 1 if the two partners share a common language,[1] a dummy variable that takes the value of 1 if the two partners have the same colonial history, COL_{tun_j}, a binary variable that takes one if the partner country has access to sea[2] and a free trade agreement dummy $FTA_{tunj\,t}$.

3.2. Explanatory variables and expected signs

GDP is used as a proxy of the level and the variety of production of the exporting country. Its coefficient should be positively correlated with the volume of bilateral trade. GDP of partner country (Y_j) is an indicator of the capacity to import of the importing country. An increase in the GDP of importing country should raise bilateral trade according to previous studies.

Distance $(DIST_{tun_j})$ is a proxy for factors that may limit bilateral trade such as transportation costs, delivery times, communication costs, transaction costs... In a gravity model this variable is considered as a resistance factor to trade flows and should have a negative impact on bilateral trade.

Sharing of a common language between partner countries should have a positive impact on the volume of their bilateral trade. Likewise, historical links, and in particular relations between ex-colonies tend to facilitate trade between certain countries. Several studies have demonstrated the importance of cultural and historical factors in determining trade flows. They assume a positive correlation between the similarity of these factors and the importance of trade flows. The proximity to the sea also tends to facilitate bilateral trade. Several studies have highlighted the positive effect of sea access on regional exports and the role played by maritime

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[1] Specifically, the variable takes one if the partner country has Arabic or French as an official language.
[2] Many studies included additional binary variables to account for the border effect. In our study we don't examine the relationship between trade and sharing the same border because none of the partner countries share a common border with Tunisia.

networks in fostering international trade (Bottasso *et al.*, 2018). Therefore, a positive sign is expected for the variable AS_j.

The dismantling of tariff and non-tariff barriers to trade as a part of a free trade agreement increases the volume of trade between members and promotes greater specialization of countries on the basis of their comparative advantages. Taking into account the effect of free trade agreements on Tunisian exports, we introduce a binary variable that takes the value 1 if there is a free trade agreement between the two partners at time t, and 0 otherwise.

In addition to economic, geographical, cultural and historical factors, several recent studies highlight the important role of institutions. Anderson and Marcouiller (2002) show that the poor quality of institutions in the recipient country acts as a hidden tax on trade flows and reduces imports by increasing risks and the uncertainty inherent in international transactions. More recently, Berkowitz *et al.* (2006), Levchenko (2007) and Nunn (2007) have shown that the quality of institutions in exporting and importing countries is an important determinant of trade flows. Finally, Crozet *et al.* (2008) show, using a business model with heterogeneous firms, that the poor quality of institutions in the destination country may increase the insecurity associated with corruption and consequently discourages the entrance of exporting firms.

The quality of the institutions in the destination country can generally result in sunken entry costs, as exportation to a country with weak institutions may require a heavy initial investment. This is particularly the case for risk-averse investors facing uncertainties about potential returns, and seeking additional information before making the investment decision. One could also think of additional investments linked to heavy regulations or a lack of regulatory transparency (Berthou, 2008).

Numerous empirical studies confirm the negative effect of the poor quality of institutions on trade flows (Berkowitz *et al.*,2006; Levchenko, 2007; Nunn, 2007; Avom and Fankem 2014; Ben Ali and Mdhillat, 2015; Álvarez *et al.*, 2018). Here, we introduce an indicator linked to the quality of the destination country institutions in order to test how heterogeneity between the countries in this respect affects the flow of exports. We use institutional quality data provided by Kaufmann *et al.* (2017). In particular, we use indices of government effectiveness, Regulatory Quality, the control of corruption, the rule of law and political instability. All these institutional aspects can be linked to the risk-related potential returns of the exporting companies. Thus, they are likely to influence the irretrievable entry cost. In particular, exporting to a more instable country may require a very careful examination of the destination market before starting production and export activities. Therefore, a low score should require a higher initial investment from investors who are risk averse. Each index is

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initially ranked from -2.5 to 2.5, a better score corresponding to a better quality of the corresponding institution. We follow Berthou's methodology (2008) and we add 2.5 to each index, before dividing it by 5 so that all indices are finally ranked from 0 to 1. Finally, we calculate an aggregate index, which is equal to the arithmetic mean of the individual indices. Thus, a positive sign of the variable "INST" is expected. The higher the average of all six aspects of governance the more exchanges there are.

3.3. Data source

This study includes Tunisia's exports with 40[3] SSA countries (see Appendix 1 for the complete list). The analysis covers a 21-year period from 1995 to 2016. The dependent variable is the nominal volume of Tunisian exports (in current dollars)[4]. The export data are available from the IMF's DOTS database. Gross domestic product (GDP) data are extracted from the World Bank's World Development Indicators database (2017). Data on bilateral distance, common language and common colonizer are extracted from the CEPII database. Data on Free Trade Agreements come from the World Trade Organization database. Indicators of institutional quality are those of Kaufman *et al.* (2017) from the World Governance Indicators database (WGI).

3.4. Estimation method

Two main econometric problems are associated with the estimation of the gravity equation: heteroscedasticity and the presence of zero trade values in the sample. Santos Silva and Tenreyro (2006) show that the presence of heteroscedasticity my leads to biased estimates when estimating the log-linearized equation by OLS. They argue that the transformed residuals (by the log-linearization) will generally be correlated with the explanatory variables. In addition, log-linearization is operationally incompatible with the existence of zeros in the database as the zero-trade values disappear from the sample by taking the log. To solve these problems, they recommend using the PPML approach which permits to deal with

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[3] Eight other countries in Sub-Saharan Africa (Eritrea, Eswatini, Central African Republic, Democratic Republic of Congo, Lesotho, Somalia, Republic of South Sudan, and Sudan were excluded from the sample due to unavailability of data over the entire study period. South Africa was also excluded in order to have a sample of countries of comparable development level.

[4] We follow Baldwin and Taglioni (2006) and use trade and GDP data expressed in nominal terms. Baldwin and Taglioni (2006) recommend not to deflate nominal GDP and trade volume by a price index because the gravity equation is derived from the expenditure function and therefore requires nominal data.

heteroscedasticity. Besides, this technique integrates all the observations and avoids a potential selection bias (De Sousa and Lamotte, 2009). This bias is likely to be present in our sample as it includes zero values in Tunisian export data with SSA countries.

In addition, to the advantages mentioned above, the PPML method also addresses the problems related to multicollinearity and serial correlated error that may result from high correlation between country time dummies and explanatory variables in the gravity equation (Alvarez *et al.*, 2018). Therefore, we follow Santos Silva and Tenreyro, (2006), Suvankulov (2016) and Alvarez *et al.* (2018) in relying on the PPML as the most appropriate econometric method.

3.5. The methodology for calculating export potential

In order to evaluate the export potential of Tunisia to SSA countries. We adopt the approach proposed by Fontagné *et al.* (2002) that proceeds in three steps: First, we adjust the simulated trade flows as follows:

$$X_{ij}^* = \frac{\hat{X}_{ij}\left(\sum_j X_{ij} - X_{ij}\right)}{\sum_j \hat{X}_{ij} - \hat{X}_{ij}} \qquad (2)$$

(i): Tunisia , (j):
$\overline{X}_{ij}$: observed value
$\hat{X}_{ij}$: simulated value
X_{ij}^*:adjusted

Second, we calculate export potential (EP) as the arithmetic mean of adjusted simulated exports and simulated exports

$$EP_{ij} = \frac{X_{ij}^* + \hat{X}_{ij}}{2} \qquad (3)$$

Finally, we compare the potential value of exports (PE) with the observed value (OV). If the ratio of observed exports to potential exports, as a percentage, is less than 100, there is an unexploited export potential.

4. Econometric Results
4.1. Results of the gravity model

The estimation results of the gravity model using the PPML method over the 1995-2016 period are reported in Table 1. According to the coefficient of determination R^2, the diagnostic tests (the REST and Wald tests) and the expected signs of explanatory variables, results are relatively satisfactory. Indeed, the coefficient of determination is of 0.878, which implies that 87.8% of export variations are explained by the explanatory variables of the model. The RESET

test as well as the Wald test confirm that our gravity equation is well-specified. The GDP coefficient of Tunisia is significant at 1% and has a positive sign. Tunisia's exports to country j increase by 2.78% when the GDP of Tunisia increases by 1%. The effect of Tunisian GDP on the country's export is high. This result shows that the national GDP is heavily allocated to the production of exportable goods by Tunisia.

Table 3. PPML results for the augmented gravity equations

VARIABLES	Coefficients	T-Statistic
$Ln(Y_{tun})$	2.787***	0.000
$Ln(Y_j)$	0.363*	0.059
$Ln(DIST_{tun\,j,t})$	-2.633***	0.000
FTA_{tun_j}	-0.875**	0.017
FM_j	0.633	0.164
$LANG_{tun\,j}$	1.043	0.288
$COL_{tun\,j}$	3.596***	0.000
$INST_j$	4.297***	0.008
Constant	-11.19	0.670
R^2	0.878	
Wald test p-value	0.000	
Reset test p-value	0.439	

Note: *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, against the hypothesis that the coefficient equals zero.

The GDP of the importing country has a positive and significant coefficient (at the 10% level). Thus, a 1% change in the importing county's GDP results in a 0.36% change in goods from outside. This elasticity is much lower than the effect of a corresponding increase in Tunisian GDP on the supply of goods for export. This result is consistent with that obtained by Gbetnkom and avom (2005), Avom and Mignamissi (2013) and Ghazi and Msadfa (2016). This means that an increase in the GDP of SSA countries translates into a small increase in demand for Tunisian exports. Two factors may explain this fact. On the one hand, the heavy dependence of SSA countries on EU exports (He and Shi, 2010; Avom and Mignamissi, 2013; Njikam and Avom, 2013), and on the other hand, the significant weight of the informal sector in the economy. According to a United Nations report published in 2011, only 60% of African trade is reported and registered. According to a recent study by the IMF in 2017, the informal market accounts for between 20 and 65 percent of the gross domestic product (GDP) of SSA countries.

The distance between the economic centers of the partner countries strongly reduces the flow of exports. Thus, a rise in the distance of 1% leads to all things being equal, a more than proportional drop in exports of 2.63%. Distance appears to be the major obstacle to trade between Tunisia and its partners in the region, particularly Sub-Saharan Africa, due to the poor quality of regional infrastructure.

The coefficient associated to the common colonizer is positive and significant (at the 1% level) indicating that the post-colonial links tend to facilitate exchanges between Tunisia and its partners in Sub-Saharan Africa. The coefficient of the common language variable is positive, as expected, but is not significant (at any of the usual significance levels). This result can be explained by the fact that the countries of Sub-Saharan Africa speak several languages (French, English, Spanish and Arabic), including their national languages.

The maritime boundary variable is not significant (at any of the usual significance levels) which means that Tunisia's exports to the SSA region are not strongly affected by the geographical position of the two partners in relation to the sea. This can be explained by the fact that the maritime transport sector is still underdeveloped especially at the levels of the scarcity of shipping lines linking Tunisia with its SSA partners.

The FTA variable has a significantly negative coefficient (at the 5% level). This result implies that Tunisia's free trade agreements with various countries in the region have not been able to stimulate intra-regional trade over the 1996-2016 period, which reflects a significant trade diversion (strongly negative coefficient). These results show that the agreements reached are empty shells and that African countries are less inclined to South-South relations. Several studies have shown that intra-African trade is very low and is between 10 and 12%; 80% of African exports go to Europe (United Nations, 2011). In short, African countries exchange more with developed countries than trading amongst themselves.

The coefficient of the quality index of the institutions is positive and significant (at the 1 % level), which is in accordance with the study of Kucharčuková, Babecký and Raiser (2010). Therefore, the quality of the institutions in the importing country has a positive and strongly significant effect on Tunisian exports. An increase in the average quality score of institutions by 0.1 points the SSA countries leads to an increase of 42.9% in Tunisian exports. This result also implies that institutional failure seems to be a significant barrier to trade between Tunisia and its partners in Sub-Saharan Africa.

4.2. Results of export potential

The results are reported in Table 2. They indicate that at the aggregate level, Tunisia seems to be reaching its potential level in some SSA countries. However, Tunisia still has new destinations with significant opportunities in this region. Specifically, three groups of countries can be identified from our analysis.

Table 4. Potential Exports of Tunisia

Importing countries	Observed exports (in thousands of dollars)	Potential exports (in thousands of dollars)	Observed exports as a percentage of potential exports
Mozambique	101.06	4384.97	2.3
Kenya	199.71	2520.38	7.92
Sao Tome and Príncipe	5.10	32.01	15.95
Rwanda	1606.07	4517.48	35.55
Swaziland	33.04	82.83	39.89
Liberia	850.52	1839.51	46.24
Niger	7177.06	15134.56	47.42
Togo	4854.42	9829.44	49.39
Ethiopia	50200	77474.16	64.8
Guinea-Bissau	118.99	172.5	68.98
Burkina Faso	11000	14711.18	74.77
Mali	6537.73	8722.6	74.95
Namibia	74.71	97.47	76.65
Uganda	125.78	153.11	82.15
Mauritania	15800	19112.26	82.67
Nigeria	12700	13558.99	93.66
Angola	6038.1	6100.98	98.97
Senegal	47500	45762.25	103.8
Sierra Leone	1375.05	1294.47	106.23
Benin	7469.96	6770.15	110.34
Gabon	17300	15113.51	114.47
Cameroun	18400	15228.19	120.83
Malawi	104.6	79.47	131.68
Equatorial Guinea	4278.87	3157.89	135.5
Comoros	469.07	337.68	138.91
Seychelles	6299.62	4472.89	140.84
Gambia	2016.55	1353.53	148.98
Madagascar	3121.11	1933.22	161.45
Burundi	80.13	42.36	189.16

Chad	7079.4	3628.16	195.12
Guinea	11100	5626.98	197.26
Zimbabwe	10.31	4.89	210.66
Mauritius	1761.01	743.71	236.79
Cabo Verde	265.3	78.72	336.99
Congo	8011.56	1957.78	409.22
Botswana	128.37	19.61	654.69
Cote d'Ivoire	35800	5413.49	661.31
Zambia	1298.21	141.47	917.69
Tanzania	134.4	8.6	1563.42
Ghana	13900	133.86	10384.05
Total	305325.86	291747.26	104.96

Note: *, ** and *** indicate the statistical significance at the 10%, 5% and 1% levels respectively.

• A first group of partners bringing together the highest export potentials. For these countries, Tunisia's market share is less than 50% of its potential. This group is made up of 8 countries, namely Mozambique, Kenya, São Tomé and Príncipe, Rwanda, Swaziland, Liberia, Niger and Togo. For example, exports from Tunisia to Mozambique, Kenya and São Tomé and Príncipe account for only 2.3%, 7.93% and 15.96% of estimated trade respectively. Therefore, exports to these countries could be multiplied respectively by a factor of 43.35, 12.6 and 6.22.

• A second category of partners for which there is limited export potential. In relation to these countries, Tunisia has a market share of over 50% of the potential share. Eight countries constitute this second group: Angola, Burkina Faso, Ethiopia, Guinea-Bissau, Mali, Mauritania, Namibia, Nigeria and Uganda.

• A third group is the rest of SSA countries. The export potential of Tunisia in these countries is lower than observed exports.

The export potential detected in the first group of countries seems reasonable according to the high level of the complementarity index[5]. The literature suggests a strong link between intra-regional trade intensity and complementarity index. In the EU and NAFTA, for example, the intra-regional trade rate is slightly higher than that indicated by the indices of complementarity. This is also true in the case of Sub-Saharan Africa with a complementarity index of 9% and a proportion of intraregional trade of 12%. For Mercosur, the level of intra-regional trade slightly exceeds the complementarity index. Nevertheless, the ratio between the two variables is 0.8, which remains close to unity (Achy, 2007). On the other hand, trade

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[5] According to UNCTAD data, the average complementarity index, in 2013, between Tunisia (as an exporter) and SSA countries for which there is a high export potential (Liberia not included) is approximatively of 0.39.

between Tunisia and the countries of Sub-Saharan Africa appears as a rather paradoxical case. The average complementarity index is estimated at 37%, while trade between the two partners does not exceed 1.6%[6]. This finding corroborates the results obtained by the gravity model, according to which Tunisia's export potential with many countries in Sub-Saharan Africa remains largely untapped. It follows that the existence of the high complementarity between Tunisia and its African partners in the first group should allow Tunisia to intensify its exports to the sub-Saharan region.

With regard to partners with whom there is a limited export potential, there are two possibilities. Either they naturally offer a small opportunity for Tunisian export growth due to the low volume of their imports from Tunisia (Malawi and Burundi for example). Or, there would be no potential to exploit given the relative importance of the partner in question in Tunisia's exports (Cameroon, Gabon and Senegal for instance).

5. Conclusion

The export-led growth assumption postulates that an expansion of exports in developing countries would generally lead to improved economic growth (Kugler, 1991) but would also help these countries build up exchange reserves (Chenery and Strout,1966). During the 1986-2016 period, Tunisia's total trade has multiplied by a 7.5 factor. However, despite this marked improvement in trade flows, Tunisia has experienced an alarming increase in its trade deficit attributed among other things to the increased political and social instability since 2011 and, in particular, the collapse of the European Union's demand, which remains its main trading partner.

The aim of this paper was to show that in order to reduce this persistent deficit authorities must diversify their trade towards fast-growing emerging markets in order to compensate for the weak demand of the European Union, which remains the first partner for Tunisia. In this sense, integration with the countries of Sub-Saharan Africa is a potential opportunity to revive Tunisian exports, especially that this region has been one of the most dynamic areas in recent years.

Based on these considerations, this paper has examined the flow of Tunisian exports to SSA countries. This analysis allowed us to identify the main factors determining these flows in order to predict what these flows should be for each partner of the countries of the region and

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[6] Author's calculations over the period 1995-2013, based on UNCTAD Data.

to map Tunisia's future exports. To achieve this end, we estimated an augmented gravity model that included economic, geographical, cultural and institutional characteristics of 40 countries in the sub-Saharan region beyond the bilateral exports from Tunisia to countries in Sub-Saharan Africa. On the basis of the estimation results we have simulated the potential bilateral exports between Tunisia and these African partners. The estimation of a gravity model by the PPML method over the 1995-2016 period has led to the following results:

First, our estimates provide evidence of the relevance of the gravity model for Tunisia. Indeed, export flows are positively influenced by the dimensions of the partner and domestic markets and are negatively related to distance, according to traditional theoretical analysis.

Second, with regard to the determinants of Tunisian trade flows to Sub-Saharan Africa, the common language seems to have no significant effect, but post-colonial links tend to facilitate exchanges between Tunisia and its partners in Sub-Saharan Africa. In addition, Tunisian trade with this region is not affected by the geographical position of the two partners and their connection to the sea. However, bilateral agreements have a negative effect on trade flows, which could be explained by the fact that these agreements, concluded by Tunisia with certain countries of the region, have not made it possible to stimulate intra-regional trade in goods over the study period, but a trade diversion seems to outweigh these deals. These agreements seemed to us rather empty shells, because the countries of Sub-Saharan Africa maintain economic relations oriented towards the developed countries rather than South-South relations. The quality of the institutions of the importing country has a positive effect on Tunisian export flows. This implies that institutional failure seems to be a significant barrier to trade between Tunisia and its partners in Sub-Saharan Africa.

Third, in terms of export potential, we have detected significant differences in bilateral potential levels. Three groups of countries have been identified. First, a group of 8 countries for which there is a very strong export potential where Tunisia has a market share of less than 50% of the potential share. Then, a second group, made up of 8 countries, for which there is a limited export potential where Tunisia has a market share of more than 50% of the potential share. Finally, a third group for which Tunisia has no export potential consisting of countries with which exports exceed the potential.

The political implications of this study are that Tunisia must develop and diversify its trade towards fast-growing emerging markets, in particular the Sub-Saharan Africa region and must review its regional and bilateral free trade agreements with the countries of this region in a bid to improve the balance of trade and achieve sustainable economic development.

Moreover, the growth of Tunisia-Sub-Saharan Africa trade is limited by a number of factors, mentioned in the analysis of trade determinants, such as production capacity, distance and institutional failure in SSA countries. Therefore, building production capacity, the development of trade-related infrastructure (establishment of road, rail, air and waterway networks) and improving the quality of institutions in SSA countries would stimulate Tunisia's exports to SSA partner countries.

However, any multi-country cooperation requires the existence of appropriate financing mechanisms. This issue of funding mechanisms is one of the main challenges for the integration of Sub-Saharan Africa. Indeed, SSA countries have adopted an inconvertible exchange rate in a context characterized by the lack or the inadequacy of regional institutions able to provide financing for trans-African trade, something that could hinder and discourage the commercial initiatives of many companies. This problem of financing commercial operations requires the development and strengthening of payment systems, and the encouragement of the installation of services companies financing business operations, and the encouragement and establishment of a prosperous environment for their development within the financial systems of SSA partners where appropriate.

APPENDIX

Appendix 1. List of countries included in the data set

1. Angola	16. Equatorial Guinea	30. Rwanda
2. Benin	17. Guinea-Bissau	31. Sao Tome and Principe
3. Botswana	18. Guinea	32. Senegal
4. Burkina Faso	19. Kenya	33. Seychelles
5. Burundi	20. Liberia	34. Sierra Leone
6. Cameroon	21. Madagascar	35. Swaziland
7. Cabo Verde	22. Malawi	36. Tanzania
8. Chad	23. Mali	37. Togo
9. Comoros	24. Mauritania	38. Uganda
10. Congo, Republic	25. Mauritius	39. Zambia
11. Cote d'Ivoire	26. Mozambique	40. Zimbabwe
12. Ethiopia	27. Namibia	
13. Gabon	28. Niger	
14. Gambia	29. Nigeria	
15. Ghana		

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