

## Impact of the Road-Rail Bridge on African Integration

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**ABSTRACT:** The aim of this study is to analyse the impact of the Road-Rail Bridge (RRP) project on the Tripoli-Windhoek (Cape Town) corridor and African integration over the period 1980-2020. It uses a macroeconomic approach to achieve its objective, based on a gravity model with the panel of Tripoli-Windhoek corridor countries. The results obtained from the econometric modelling (gravity model) show a positive and significant effect of the road-rail bridge (RRP) on exports from the countries of the Tripoli-Windhoek corridor. The road-rail bridge therefore has a positive impact on the Tripoli-Windhoek corridor and integration in Africa.

**KEYWORDS:** Road-rail bridge ; Economic integration; Gravity model and African integration

**JEL Classification:** H54, F02, O55, C33

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### INTRODUCTION

At the request of African countries, the United Nations proclaimed two decades for transport and communications in Africa (1978-1988 and 1991-2000), in order to focus the efforts of governments and development partners on the specific issues of transport and communications in Africa. The evaluation of these 20 years of efforts devoted to transport showed that the transport infrastructures and services available were still far from enabling the continent to achieve socio-economic development and integration (ECA, 2008).

According to the final evaluation of the Second United Nations Transport and Communications Decade for Africa (UNTACDA II), the weakness or even absence of transport and communications infrastructure and services is an obstacle to the development of international and intra-African trade. In the period between 2007 and 2011, the share of intra-African exports in total merchandise exports averaged 11% in Africa, compared with 50% in developing countries in Asia, 21% in Latin America and the Caribbean and 70% in Europe (UNCTAD, 2013).

The volume of intra-African and intra-Latin American trade represents 15% and 30% respectively, compared with 70% in the European Union, 50% in Asia and 50% in North America (WTO, 2017). The poor state of current transport infrastructure and services has limited the development of agriculture, industry and trade, and has had a detrimental effect on the ability of African countries to make effective joint use of their potential natural resources (ECA, 2008).

This situation of dilapidation and the inability of transport infrastructures and services to ensure the economic development and integration of African countries has its origins in the colonial objective assigned to transport and its perpetuation after the accession of many countries to independence. During colonisation, transport infrastructure was built to ensure the exploitation of mining and agricultural resources and to enable them to be transported to the metropolis, relegating any concern for national integration to second place.

As the main driver of economic integration, transport infrastructure and services can be seen as the linchpin of trade and the movement of goods and people, with the potential to trigger growth and reduce poverty.

In the same vein, African routes have been envisaged, including the Tripoli-Windhoek corridor through Chad, Cameroon, Gabon, Congo, DRC, Angola and Namibia to South Africa (Cape Town). This corridor includes the Kinshasa-Brazzaville link, cities separated by the Congo River that can only be linked by a road-rail bridge, thus constituting the corridor's missing link.

This link is one of NEPAD's 16 priority infrastructure projects, considered to be necessary and indispensable conditions for strengthening regional and sub-regional integration.

This study attempts to answer the fundamental question: *what is the impact of the road-rail bridge project on the Tripoli-Windhoek (Cape Town) corridor and African integration?*

This study seeks to assess the impact of the road-rail bridge project on the Tripoli-Windhoek (Cape Town) corridor and African integration. In addition to the introduction and conclusion, the rest of this paper is organised into three sections. The 1<sup>er</sup> section reviews the theoretical and empirical literature on the link between infrastructure and economic integration, the 2<sup>ème</sup> section outlines

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the methodology and presents the data used, and the 3<sup>ème</sup> section presents the results, their interpretation and the discussion of the results.

### 1. LITERATURE REVIEW

The perception of infrastructure as a factor in growth and integration has changed considerably in recent years. This section presents a review of the theoretical and empirical literature on the link between infrastructure and economic integration.

#### 1.1. Theoretical literature on the link between infrastructure and economic integration

The importance of taking transport costs into account in recent growth models is clear, although economists are not unanimous about its effectiveness (**Krugman, 1991**), and it has therefore been the subject of several studies.

This brief review of the literature on the impact of infrastructure on growth and economic integration provides an overview of Ricardo's theory of comparative advantage and Heckscher Ohlin Samuelson's neo-classical model, as well as the consideration of transport costs known as the New Geographical Economics (**Stiglitz, 1977; Krugman, 1991**).

Ricardo's theory of comparative advantage and **Heckscher Ohlin Samuelson's** neo-classical model (**1933**) assume the absence of transport costs both within and between countries because of the assumption that there is only one price on the market. Economic theory at the time was dominated by the paradigm of pure and perfect competition, which explains why space was neglected or even ignored by economists.

Introducing a transport cost into a trade model precludes the assumption of pure and perfect competition. A transport cost (or any equivalent friction between two markets, such as customs duties, quotas, standards, etc.) between two countries means that the price of the traded good is different in the two countries: in this case, the price in the exporting country is lower than the price in the importing country, where it is increased by the transport cost (**Alias 1943; Arrow et al., 1954**). One of the assumptions of pure and perfect competition is the uniqueness of market prices. Introducing transport costs therefore implies leaving the CPP and adopting the framework of imperfect competition. But scientific knowledge at the time of **Ricardo, Heckscher and Ohlin** did not allow them to deal with models of imperfect competition. They therefore assumed the absence of transport costs, which allowed them to reason in terms of pure and perfect competition.

**Paul Krugman's** New Geographical Economics (**1991**) is a theory that incorporates transport costs. It analyses the location equilibrium (of firms, population and workforce) as the result of two opposing forces: the forces of agglomeration and the forces of dispersion, and the result of the equilibrium between these two forces depends in part on the cost of transport between locations.

One of the merits of these models is that they explain the phenomenon of the creation of cities which, as **Mills** argued in 1967, can only be formed if there are returns to scale in production. The location of activities and agents in one area rather than another, their 'agglomeration' and the size of cities are the result of a trade-off between increasing returns to scale and transport costs.

When transport infrastructure makes it possible to reduce transaction costs within peripheral regions, whether under the assumption of immobility of part of the workforce (**Martin and Rogers, 1995**) or under the assumption of congestion (**Ghio and Van Huffel, 2000**), there is a real income effect for domestic agents which will lead to an increase in local final demand, which may encourage firms to locate in these regions. The effects therefore appear to be beneficial: intra-regional infrastructures make it possible to achieve both greater convergence of industrial structures (since a greater proportion of firms locate in the periphery) and greater convergence of welfare levels, since the inhabitants of peripheral regions benefit from a real income effect. However, we shall see later that this type of policy could have the opposite effect on the overall growth rate of the economy.

When transport infrastructure makes it possible to reduce transaction costs between regions, under the hypothesis that part of the workforce is immobile (**Krugman, 1991 a, b; Martin and Rogers, 1995; Chariot, 1999; Martin, 1999**), central regions, because they already offer vast markets, will attract new firms which will be able to exploit economies of scale while having easier access to markets in peripheral regions (and therefore to part of the immobile workforce). In this case, the funding of transport infrastructure tends to lead to a greater polarisation of activities: this type of policy, while helping to open up poor regions, risks making them relatively poorer. Here again, we shall see that, in a dynamic approach, these negative effects linked to inter-regional infrastructures can be counterbalanced by a higher overall growth rate. Under other hypotheses, **Ghio and Van Huffel** show that the fall in inter-regional transport costs can lead to a reduction in the agglomeration of agents and firms in central regions, when congestion is high there.

#### 1.2. Empirical results of the link between infrastructure and economic integration

There is a large body of empirical literature on the effects of regional integration on trade within a region. The majority of studies on the subject agree on the beneficial effects of integration on intra-regional trade, and the methodology commonly used is the simulation of the elimination of customs tariffs between countries in the zone, using Computable General Equilibrium Models (CGEM). However, relatively little attention has been paid to the effects of regional integration agreements on growth (**Berthelon, 2004**).

**Kireyev, et al, (2018)** found that regional integration could, in the long term, help to increase growth by an average of one percentage point in each of the Maghreb countries. **Akanni, (2003)** analysed the implications of economic integration policies on the convergence or divergence of developing countries according to the zones to which they belong. The results indicate that regional

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agreements do not automatically imply real economic convergence at the level of the integration zones and that conditional convergence is weak overall. **Ochozias (2013)** analyses integration processes in Africa and proposes an assessment of progress using both a quantitative and qualitative approach based on the methodology proposed by Park. He finds that, on the whole, progress has not matched the hopes placed in integration mechanisms and that, by focusing on four main dimensions (political, social, technological, economic) of development, he comes to the conclusion that North Africa is far from being the least integrated region on the continent, even if the Arab Maghreb Union (AMU) mechanism lags well behind continental targets.

### 2. METHODOLOGY

The purpose of this paper is to assess the impact of RRP on the Tripoli-Windhoek (Cape Town) corridor and African integration. This approach uses the gravity model inspired by the work of **Head and Mayer (2000) and Zakari (2013)**. The model is estimated in its multiplicative form:

$$EXP_{ij} = \text{Log}[\alpha_0 + \alpha_1 \ln(PIB_i) + \alpha_2 \ln(PIB_j) - \alpha_3 \ln(Dist_{ij}) + \tau_{ij} + \varphi_j + \Phi_i] \varepsilon_{ij} \quad (1)$$

Where  $Exp_{ij}$  is the trade flow from country  $i$  to country  $j$ ,  $PIB_i$  the gross national product of country  $i$ ,  $Dist_{ij}$  the distance between country  $i$  and country  $j$ ,  $\tau_{ij}$  the bilateral resistance terms represented by indicator variables for common language, common currency, etc,  $\varepsilon_{ij}$  the error term,  $\Phi_i$  is the exporter's multilateral resistance term and  $\Phi_j$  an effect specific to the destination country (importer-specific effect).

In our case, to better capture the impact of the RRP on the Tripoli-Windhoek (Cape Town) corridor and African integration, we add four variables, namely the population of each country in the corridor, public investment, agricultural value added, the state of the corridor, the RRP, the corruption perception index and the rule and law perception index.

Starting from model (1) and making the proposed modifications, we obtain the following model:

$$\begin{aligned} \ln(EXP_{ijt}) = & \alpha_0 + \alpha_1 \ln(PIB_{it}) + \alpha_2 \ln(POP_{it}) + \alpha_3 \ln(Invest_{it}) + \alpha_4 \ln(Agr_{it}) + \alpha_5 \ln(PRR_{it}) + \alpha_6 gov_{it} + \alpha_7 gov_{it} \\ & + \alpha_8 etcorr_{it} + \alpha_9 langcom_{it} + \alpha_{10} COMESA_{it} + \alpha_{11} MAGRHEB_{it} + \alpha_{12} CEDEAO_{it} + \alpha_{13} SADC_{it} \\ & + \alpha_{14} CEEAC_{it} + \alpha_{15} CENSAD_{it} + \alpha_{16} DistPRR_{it} + e_{it} \end{aligned}$$

#### 2.1. Presentation of variables

The variables presented are collected for a non-cylindrical panel of countries in the Tripoli-Windhoek (Cape Town) corridor over the period 1980-2020.

##### 2.1.1. The dependent variable

The trade flow captured by exports is the dependent variable (EXP) in the model. Trade flows are international movements of goods and services with a view to reaching other markets and creating wealth. The data for the Tripoli-Windhoek (Cape Town) corridor countries relating to this variable are taken from the World Development Indicators (WDI, 2020).

##### 2.1.2. Explanatory variables

The model's explanatory variables are as follows: gross domestic product (GDP), population (POP), public investment (INVEST), agricultural value added (AGR), control of corruption (govc), rule of law (govr), road-rail bridge (PRR), distance (DistPRR), common language (langcom), REC dummies (COMESA, MAGRHEB, SADC, ECCAS).

The data for these variables is taken from World Development Indicators (WDI, 2020) and World Government Indicators (WGI, 2020).

##### 2.1.2.1. Gross domestic product (GDP)

GDP is a widely used economic indicator that measures a country's level of production and the potential size of its market. It is defined as the total value of the domestic production of goods and services in a country in a given year by agents resident in the national territory.

The work carried out by Karima S. et al (2007) and Arthur J. et al (2020) on the link between trade flows and gross domestic product (GDP) proved empirically that GDP has a positive impact on exports. The relationship between the two variables is positive.

##### 2.1.2.2. Population (POP)

With the presence of the GDP variable in logarithmic form, the introduction of the population variable is equal to the introduction of the GDP per capita variable, if the coefficients are constrained to be the same. Given that the differential in the level of economic development between the corridor countries is relatively large.

According to the Heckscher-Ohlin theorem, we assume that they tend to trade different factor-intensive goods by exploiting their comparative advantages in terms of factor endowment. In other words, the Tripoli-Windhoek corridor countries tend to export labour-intensive products to other countries and import capital-intensive products. The expected sign of this variable will be positive.

On the demand side, on the other hand, according to Linder, countries trade more if their levels of development are closer, so the expected sign of this variable will be negative. The two main theories of trade are therefore at odds here.

##### 2.1.2.3. Level of infrastructure (INVEST)

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The level of infrastructure captured by public investment is a factor that plays an important role in transport costs, in addition to distance, in models using distance as the crow flies or actual distance. The expected sign of this variable will be positive.

### 2.1.2.4. Controlling corruption (govc)

The corruption control rating *govc* measures the level of the fight against corruption in the country. This indicator varies between 0 and 100: if it is close to 0, corruption is high, and if it is close to 100, the fight against corruption is effective.

### 2.1.2.5. Rule of law (govr)

The rule of law scored *govr* measures the perception of the extent to which agents respect and trust the laws that govern society, particularly in the quality of enforcement of contracts, property rights, police and courts, as well as the handling of the same crimes and violence. A positive relationship between the rule of law and exports is expected.

### 2.1.2.6. Road-Rail Bridge (PRR)

To capture the impact of the road-rail bridge project on the Tripoli-Windhoek (Cape Town) corridor and African integration, we add the road-rail bridge variable noted *prrr* in the estimates. It takes the value 1 for economic operators who are in favour of the project and 0 for operators who are not in favour of the road-rail bridge construction project.

### 2.1.2.7. Agricultural added value

Agriculture's share of value added (*AGR*) is measured by the additional processing on the production of the agricultural sector. Increasing agricultural potential will boost exports. There is a positive correlation between agriculture's share of agricultural value added and exports.

### 2.1.2.8. State of the corridor (etcorr)

We introduce this variable into the panel estimates to capture the state of the Tripoli-Windhoek corridor over time. Due to the acceleration of African integration, the expected sign of this variable will be negative.

**Table 1: Summary of variables, sources, authors and signs**

Variables	Definition	Sources	Sign heard
Exp	Exports	World Development Indicators	Dependent variables
GDP	Gross domestic product	World Development Indicators	+
POP	Population	World Development Indicators	+/-
INVEST	Infrastructure level	World Development Indicators	+
GOVC	Controlling corruption	World Development Indicators	+
GOVR	Rule of law	World Development Indicators	+
PRR	Road-rail bridge	Author, Dichotomous variables	+
AGR	Agricultural added value	World Development Indicators	+
ETCORR	Corridor condition	Author, Dichotomous variables	-
LANG	Language	Author, Dichotomous variables	-
DIST	Distance	Author, Google Maps,2022	-

**Source:** Author, from the literature

## 3. DESCRIPTIVE AND CORRELATION ANALYSIS

The following elements are presented in turn: first the descriptive analysis, then the correlation matrix, and finally the presentation and interpretation of the results.

### 3.1. Descriptive analysis

The trend is the general shape of the distribution described by the overall movement of the phenomenon independently of the small-scale variables. The characteristics of central tendency, dispersion and the values of the variables in the model are presented in table 1 below:

**Table 2: Descriptive statistics**

Variable	Average	Standard deviation	Minimum	Maximum	Observation
Export	13 900	22 900	100	98 900	N=381
					n=10
					T=30.7
GDP	41 800	75 500	13 100	359 000	N=391
					n=10
					T=39.1

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Pop	10.7	13.4	26.36	59.3	N=410 n=10 T=41
Agr	16.44	14.65	1.38	56.54	N=370 n=10 T=37
Invest	5394.66	16849.0	0	91 600.69	N=381 n=10 T=38.1
Import	12 200	21 500	59.32	102 000	N=307 n=10 T=30.7

Source : Author

On average, exports from the Tripoli-Windhoek corridor countries are worth 13,900 million US dollars, the gross domestic product is 41,800 million US dollars, the population is 10.7, the share of agriculture in value added is 16.4355, the level of infrastructure is 5,394.659, imports are 12,200 million dollars, and solvency is 2,598.727 for the period 1980 to 2020 for the 10 Tripoli-Windhoek corridor countries.

### 3.2. Correlation analysis

One of the primary objectives of economic statistics is to discover and measure the various phenomena observed. The strength of the link or degree of association between variables is studied using correlation. All we want to know is the degree of interdependence between the variables in question. When two phenomena have a common trend, we say that they are correlated.

**Table 3: Correlation matrix**

	Export	Invest	Agr	Corrup	Lawcpi	Langl	Comesa	Magherb	Sadc
Export	<b>1,0000</b>								
Invest	-0,2199*	<b>1,0000</b>							
Agr	<b>-0,4035*</b>	<b>0,4381*</b>	<b>1,000</b>						
Corrup	<b>0,5274*</b>	-	<b>-0,4535*</b>	<b>1,0000</b>					
		<b>0,2743*</b>							
Lawcpi	<b>0,5042*</b>	-	<b>-0,3594*</b>	<b>0,9180*</b>	<b>1,0000</b>				
		<b>0,2788*</b>							
Langl	<b>0,4049*</b>	<b>-0,2603*</b>	<b>-0,3713*</b>	<b>0,5792*</b>	<b>0,0692</b>	<b>1,0000</b>			
Comesa	<b>-0,2099*</b>	<b>0,5109*</b>	<b>0,1198*</b>	-	<b>-0,1218</b>	<b>0,1300*</b>	<b>1,0000</b>		
				<b>0,2503*</b>					
Magherb	<b>0,0899</b>	<b>-0,0935</b>	<b>-0,2068*</b>	-	-	<b>0,4082*</b>	<b>0,4837*</b>	<b>1,0000</b>	
				<b>0,2079*</b>	<b>0,3317*</b>				
Sadc	<b>0,3690*</b>	<b>0,4006*</b>	<b>-0,1047*</b>	<b>0,6331*</b>	<b>0,4898*</b>	<b>0,1667*</b>	<b>0,4071*</b>	<b>-0,2722*</b>	<b>1,0000</b>

Source : Author

The correlation analysis (Table 3) between these variables clearly shows that there is a positive relationship between exports (Exp) and the control of corruption (govc); the rule of law (govr); the French language (langl) and the Southern African Development Community (SADC). On the other hand, there is a negative relationship between exports and the level of infrastructure (Invest); the share of agriculture in value added (Agr) and the Common Market for Eastern and Southern Africa (COMESA).

### 3.3. Analysis of the stationarity of the study variables

The stationarity characteristics of the previous series are used to select the most appropriate model. The panel data are subjected to the Levin-Li-Chu (LLC) and Im-Pesaran-Shin (IPS) stationarity tests, with the null hypothesis that the panel contains a unit root (it is therefore non-stationary).

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**Table 4: Results of the stationarity test for the study variables**

Variables	Statistics  LLC  and  IPS	Probability	Decision	Order of integration
Ln(EXP)	7,6432	0,0000	S	I(0)
Ln(GDP)	11,1919	0,0000	S	I(0)
Ln(POP)	6.1257	0.0000	S	I(0)
Ln(INVEST)	7.0745	0.0000	S	I(0)
Ln(AGR)	6,8188	0,0000	S	I(0)
Ln(Govc)	6,0935	0,0000	S	I(0)
Ln(Govr)	6,2124	0,0000	S	I(0)

Source : Author

*Notes* : S (stationary), I(0): stationary at level

From observation of this table, the various stationarity tests on the panel of 10 countries in the Tripoli-Windhoek corridor over the period 1980-2020, all the variables contain no unit root and are therefore stationary at level, (see Appendix 2).

### 3.4. Model specification tests

To specify the model, the Human Poverty Index equation underwent three tests: the FISCHER, BREUSCH-PAGAN and HAUSMAN tests.

#### 3.4.1. FISHER or Likelihood Ratio Test

The hypotheses of the Fisher or Likelihood Ratio test are :

$H_0$  : Total homogeneity or without effects

$H_1$  : Individual fixed effects

**Table 5: Results of the Fisher test**

Prob > F	0,0000
F (7, 135)	16,76

Source : Author

From observation of this table, the theoretical significance level ( $\alpha = 0,05$ ) exceeds the empirical significance level (0.0000). We therefore reject  $H_0$  and confirm that there are individual fixed effects (Appendix 3).

#### 3.4.2. BREUSCH-PAGAN or Lagrange Multiplier (LM) test

The hypotheses of the BREUSCH-PAGAN test or Lagrange Multiplier (LM) test are :

$H_0$  : Total homogeneity or no effects

$H_1$  : Random individual effects

**Table 6: BREUCH-PAGAN test results**

Prob > chibar2	1,0000
chibar2 (1)	0,0000

Source : Author

From observation of this table, the theoretical significance level ( $\alpha = 0,05$ ) does not exceed the empirical significance level (1.0000). We therefore accept  $H_0$  and confirm that there are no random individual effects (Appendix 3).

#### 3.4.3. HAUSMAN test

The hypotheses of the trade-off between the Fixed Effects Model and the Random Effects Model put forward by the Hausman test are :

$H_0$  : Fixed effects model

$H_1$  : Random effects model

**Table 7: Results of the HAUSMAN test**

Prob > chi2	0,0000
chi2 (9)	26164,28

Source : Author

This table shows that the hypothesis of no correlation between the fixed term and the explanatory variables of the model is accepted (P-value = 0.00% < 5%). Thus, the fixed-effect model is the appropriate one for the specification of the Tripoli-Windhoek (Cape Town) corridor countries (see Appendix 3).

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### 3.5. ESTIMATION OF THE MODEL AND INTERPRETATION OF THE RESULTS

The fixed-effects model was estimated using the OLS method of the LSDV (Least Square Variable) estimator using stata software.

**Table 8: Export regression results using a fixed-effects model**

Variables	Coefficients	z-value	P>(z) value
Ln(GDP <sub>r</sub> )	0.33** (0.02 )	13.44	0.000
Ln(Pop)	-759,91*** (147.3962)	-5.16	0.000
Ln(Invest)	-111335.1 *** (15873.02 )	-7.78	0.000
Ln(Agr)	1.36 (4.36)	-0.80	0.425
Ln(govc)	1.48* (7.20)	1.66	0.097
Ln(govr)	3.60 (1.10 )	2.19	0.028
Ln(Distpprk)	83813.61 (177468.2)	1.06	0.001
Prr	1.61e+09** (8.63e+08)	2.95	0.642
Lang1	7.56e+09*** (2.12e+09)	4.81	0.000
Lang2	-6.20e+09** (2.98e+09)	-3.02	0.003
Lang3	- -	-	-
Comesa	-9.29e+08 (4.40e+08)	-1.48	0.139
Magreb	8.92e+09 (3.74e+09)	0.88	0.377
Ecowas	- -	-	-
Sadc	-4.14e+09** (1.34e+09)	-3.67	0.000
Ceac	1.61e+09** (3.59e+09)	4.62	0.000
Censed	- -	-	-
Constant	-2.461616*** (0.6772327)	-3.63	0.000
Dependent variable : EXP		Observation: 150	
R-sq: 0.9863		Prob > F = 0.0000	

Source : Author

Note: (\*\*\*) (\*\*\*) and (\*) represent the significance threshold of 1%, 5% and 10% respectively. Values in brackets represent standard deviations.

From the observation of this table, the variables retained in the model have a significant impact on exports, except for the following variables which do not have a significant impact on exports: the share of agriculture in value added (Agr); distance (Distppr); the Common Market for Eastern and Southern Africa (COMESA) and the Maghreb.

The variables [ln(GDP), ln(POP); ln(Invest); ln(Govr); lang1; lang2; SADC and ECAC] have significant coefficients at the 1% level and the variable ln(Govc) has a significant coefficient at the 10% level. Overall, the model is good. Estimates of the fixed-effects

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model using the OLS method and the LSDV (Least Square Variable) estimator give an  $R^2$  of 0.9863, which confirms that the exogenous variables explain 98% of the exports of all the countries in the Tripoli-Windhoek (Cape Town) corridor (see Appendix 6).

A 1% increase in the gross domestic product (GDP) of the Tripoli-Windhoek corridor countries will result in a 0.33% increase in exports. A 1% increase in the population growth rate would lead to a 7.56% drop in exports from the corridor countries.

A 1% increase in the level of infrastructure will lead to a 1.11% drop in exports. An increase in the rules of law will lead to a 3.6% increase in exports from the Tripoli-Windhoek (Cape Town) corridor countries. An increase in the road-rail bridge will lead to a 1.61% increase in exports. The French language has a positive impact on exports from the Tripoli-Windhoek (Cape Town) corridor countries. A 1% increase in the French language will lead to a 7.56% increase in exports from the Tripoli-Windhoek corridor countries. On the other hand, a 1% increase in the English language will lead to a 6.2% drop in exports from the corridor countries. A 1% increase in SADC will lead to a 4.1% drop in exports from corridor countries. A 1% increase in ECAC will lead to a 1.61% increase in exports from corridor countries (see Annex 6).

### 3.6. DISCUSSION OF RESULTS

This section compares the results obtained from the empirical analysis and the literature review. This discussion of the results focuses on the impact of the RRP on the Tripoli-Windhoek (Cape Town) corridor and on African integration.

The factors likely to influence international trade flows are widely discussed in the literature.

Real gross domestic product (rGDP) had a positive effect on exports (a 1% increase in real gross domestic product leads to a 0.35% increase in exports). This result is identical to the work carried out by **Karima S., et al (2007)** and **Arthur et al (2020)** on the link between trade flows and gross domestic product, which proved empirically that gross domestic product (GDP) had a positive impact on exports.

On the other hand, the population growth rate has a negative impact on exports (-7.59). This result is identical to that of **Linder B. (1960)**, who claims that a country becomes an exporter when it has first satisfied domestic demand. Exports are therefore trade in surplus to domestic consumption. Furthermore, according to Hecksher-Ohin's theory, this result implies that exports from the Tripoli-Windhoek (Cape Town) corridor countries are not concentrated on labour-intensive or capital-intensive trade, but on relatively diversified trade.

For the distance variable, considered as an indicator of the closeness and performance of the trade and African integration route. It has a positive effect on exports from countries in the Tripoli-Windhoek (Cape Town) corridor, but not a significant one. This result seems a little surprising at first sight, as the coefficients represent the marginal effects of the variables. This means that the acceleration of regional economic integration in Africa does not influence exports from the Tripoli-Windhoek corridor countries.

We also note that the road-rail bridge variable has a positive sign. More specifically, the road-rail bridge has a positive effect on exports from countries in the Tripoli-Windhoek corridor (1.59). It is another determinant of transport costs apart from distance. We believe that the road-rail bridge affects trade via the transport cost channel. This confirms our hypothesis that the level of infrastructure development (road-rail bridge) has a positive impact on the Tripoli-Windhoek corridor and on African integration.

The coefficient assigned to the English language variable is in line with those predicted by the literature, in particular those obtained by **Head and Mayer (2014)**. They obtained a coefficient of 0.555 for European Union countries.

## CONCLUSION

The central question of this article was to analyse the impact of the Route Rail Bridge project on the Tripoli-Windhoek (Cape Town) corridor and African integration. The panel of our model is made up of the countries crossed by the corridor, including Chad, Cameroon, Gabon, Congo, DRC, Angola, Namibia and South Africa (Cape Town). The result was obtained using a fixed-effect model and annual data covering the period from 1980 to 2020. The result of the estimate points to a positive effect of the road-rail bridge project on the Tripoli-Windhoek corridor countries. This leads us to believe that the level of infrastructure development (road-rail bridge) has a positive impact on the Tripoli-Windhoek corridor and on African integration. Furthermore, the estimation results also show that the distance variable, considered as an indicator of the closeness and performance of the trade route and African integration, has a positive but insignificant effect on exports from corridor countries. This means that the acceleration of regional economic integration in Africa does not influence exports from the Tripoli-Windhoek corridor countries.

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