American International Journal of Business Management (AIJBM)
ISSN- 2379-106X, www.aijbm.com Volume 3, Issue 5 (May 2020), PP 21-27

The Effects of International Trade on Trade Balance in Congo Brazzaville: A Comparative Analysis

Lagès Nadège Mouanguissa*[a], Fred Nelson Ossou Ndzila[b],
Abdul Alimamy Kamara[a]; Xiang Jun Wang[a]
a: School of Mathematics and Statistics, Huazhong University of Science and Technology, Wuhan, Hebei 430074, China
b: School of Economics, Shanghai University, China
**Corresponding author: Lagès Nadège Mouanguissa*

ABSTRACT:- This research aims mainly at examining the effect of international trade on the trade balance in the Republic of the Congo. Data on export-import products and trade balance between China and the Congo are monthly time series data stretching from January 2012 to April 2019, over 88 observations were analyzed by using the SPSS statistics 25. The results of multiple linear regression (MLR) model show that export products have a positive effect on the Congolese trade balance, while import products have negative effects except for imports of electrical machines, which positively affect Congo's trade balance in the period spanning 2012 to 2019. Economic theory states that the trade balance equals exports minus imports. The results obtained in our study show that the majority of the variables have the expected signs: the exports of crude oil and raw wood are positive which obeys to the economic theory so that the balance of trade is surplus or at least balanced, whereas the Signs of import results are a bit mixed as imports of iron items, textiles, and wood items have negative signs but imports of electrical machinery have a positive sign.

Keywords:- Congo Brazzaville, exports, imports, Multiple linear regression, trade balance

I. INTRODUCTION

The Republic of the Congo is a member of the Economic Community of Central African States (ECCAS), and the Central African Economic and Monetary Community (CEMAC). It is the 85th largest export economy in the world and China's 6th largest trading partner in Africa. According to the World Trade Organization report in 2017, the country's exports and imports were valued at the US $ 5.05 billion and the US $ 2.8 billion respectively. That same year, exports accounted for 94% of GDP (an increase of 12.3% year on year), while imports fell to 65.17% of GDP (down 41.6% year on year) and had a trade balance of $4.56 milliards in net export. The trade balance is the most important component of a country's balance of payments. It is the difference, in terms of monetary value, between exports and imports of goods and services in an economy over a given period. Exports are goods and services produced in the country and sold abroad, while imports are purchases of foreign goods and services. Though it is important for many developing countries to improve their trade balance-policies to close the gap between imports and exports, they must treat this international trade nuance with caution. According to, it is increasingly necessary to increase exports, both in value and Bonga, Shenje and Sithole (2015). This study is unique, because it scrutinizes the effects of exports of crude petroleum, rough wood, and imports of electrical machinery, metallic and wood articles as well as textiles on the trade balance in the Congo. This study has as specific objectives to see how the exports of crude oil and raw wood which are the two pillars of the Congolese economy contribute to influencing the balance of trade and create wealth. Also to see how the key variables of the Congolese economy's imports affect the trade balance.

II. THEORETICAL FRAMEWORK

International trade is the concept of exchange between people or entities from two different countries. Theories of international trade are diverse theories to explain the international trade that justifies cross-border trade; notably mercantilism (pre-Smith), the absolute advantage of Adam Smith, the comparative advantage of David Ricardo, the proportion of factors of Ohlin and the product life cycle by Vernon. Mercantilism suggests that trade balances should be favorable and exports should be higher than imports. The theory of absolute profit, generally associated with Smith refers to the ability to produce several goods or services that are at least costly (Bondarenko, 2018) so that trade will benefit the country. The theory of comparative advantage of David Ricardo is a modification of the concept of absolute profit theory according to which a country is said to have an advantage in the production of a good if it can produce a product at a lower opportunity cost than another country (Suranovic, 2017). The proportion of factors by Ohlin postulates a country has a comparative advantage in producing goods that use relatively large quantities of its abundant factors of production and a comparative

disadvantage for the production of goods that use relatively large quantities of its production of rare factors and, product life cycle theory of Vernon, claims products developed in technologically advanced countries, but production is gradually shifting to developing countries due to workforce. International trade offers the opportunity to downscale the market and access a wide range of technologies by making efficient use of production resources. According to standard trade theory, international specialization provides static and dynamic benefits. Traditional trade theory predicts static well-being gains in terms of cross-sectoral specialization based on comparative advantages, while the new trade theory looks at the dynamic gains induced by the combination of economies of scale and development of the varieties of products available for consumers (Bernard et al., 2007). Recent theories supporting the removal of trade barriers suggest a substantial reallocation within sectors/industries, as the less productive firms disappear with imports and the redistribution of market shares to more advanced productive firms in particularly to exporting factories (Melitz and Trefler 2012, and Redding 2014). As a result, the new trade theory predicts a productivity gain at the sectoral level due to heterogeneity at the facility level (Melitz 2003, Pavcnik 2002 and Bernard et al 2007). Incremental gains from participation in international trade result from the positive impact of larger markets on innovation (Melitz and Trefler, 2012), as highlighted in theories of social welfare gains based on trade between homogeneous firms. Trade integration makes it easier for firms to choose technology inputs through imports embodied by know-how or informed competitors, and protection that discourages the opportunity to limit growth. Trade theories with imperfect competition argue that policies that limit imports tend to increase the market power of domestic producers (Tybout, 2000). As a result, trade encourages the adaptation of modern technologies and processing techniques that increase the demand for skilled labor and encourage learning on the job. International trade is a source of exploitation of resources for a better standard of living between trading partners. However, many barriers to international trade, including transportation and tariffs, reduce the potential benefits to a large extent. Advances in information and communication technologies have significantly increased the volume of international trade. World merchandise exports reached $ 16 trillion, while commercial services closed at $ 4.77 billion at the end of 2016. Meanwhile, the gains from international trade are not uniform for all nations. The share of developed countries, followed by developing countries is 41% and the share of less developed countries in world trade is less than 1% (WTO, 2017).

III. METHODOLOGY

The data is mainly from the International Trade Centre (ITC). This study uses monthly time series data in the period spanning January 2012 to April 2019. The time-series data consists of export and import products and the trade balance between China and the Republic of the Congo. The price unit of export-import products and trade balance is in US Dollars.

The use of the regression model and the analysis thereafter is used to examine the relationship between the variables and establish the link between a dependent variable and independent ones. The analysis helps to determine how the value of a dependent variable changes when one of the independent variables is adjusted. A dependent variable that which depends on other independent variables to forecast the expected value of the dependent variable. While the independent variables are non-random, the dependent variable is random. Snee (1977) points out that regression analysis is a technique used for the process of forecasting, controlling, and learning a mechanism from the data. Thus, in this study, we will proceed to the verification of the hypotheses, to the interpretation of the results obtained and to the development of an equation of the multiple linear regression. A regression model built on a set of data should show that the model satisfies the statistical assumptions of a linear model, to make inferences. We need to have four hypotheses, which include the error terms normally distributed, the dependent and independent variables linear relationship, the error terms constant variance and the independent measures(Huguenard 2007). From the results obtained, we can check the values of the Pearson coefficient, the multiple coefficient of determination R^2 (that is explained by the overall regression model (Koehler 2005). By referring to Minitab Methods and Formulas, the higher the R^2, the better the model fits data. R is the positive squared root R^2 (Rubin 1994), the multiple correlation coefficient R, and the adjusted multiple coefficients of determination. A correlation is a measure of the linear relationship between variables.

3.1. Variables

Trade Balance (TB) is the difference, in terms of monetary value, between exports and imports of goods and services in an economy over a given period. It will be our dependent variable.

Export of crude petroleum (ECP); this is crude petroleum that comes directly from the exploitation of Congolese oil wells. Petroleum is the raw material on which the Congolese economy is based, hence the need to consider it as a variable directly affecting the trade balance of the Congo in terms of exchange.

Export of rough wood (ERW); wood is the second main resource of Congo, it is the second economic lung, it contributes enormously in trade and should have a strong impact on the trade balance.

Imports of Electrical machinery (IME); this variable is needed because the Congo imports a lot of electrical machinery from China for domestic production

Importation of iron articles (IAI); this variable takes into account any article made from iron already processed and sold in Congo from China.

Import of textile (IT): The textile trade in the Congo is highly dependent on imports because the Congo does not have textile factories, so we consider it in this study as imports from China.

The empirical model to be estimated takes the following form:

$$TB = \alpha_{it} + \alpha_{1t}ECP + \alpha_{2t}ERW + \alpha_{3t}IME + \alpha_{4t}IAI + \alpha_{5t}IT + \alpha_{6t}IAW + \varepsilon_{it}$$

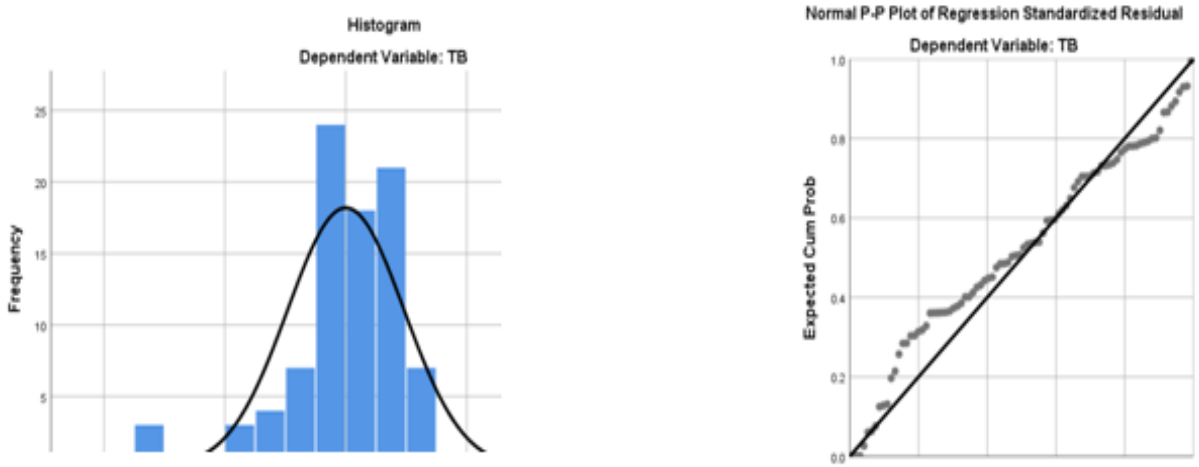
$\alpha_{1t}, \alpha_{2t} \ldots \ldots \alpha_{6t}$: are the coefficients of the variables estimated at period t.

α_{it} : The specific effect allowing unobservable differences that exist between statistical units.

ε_{it} : Error term

4. Research results

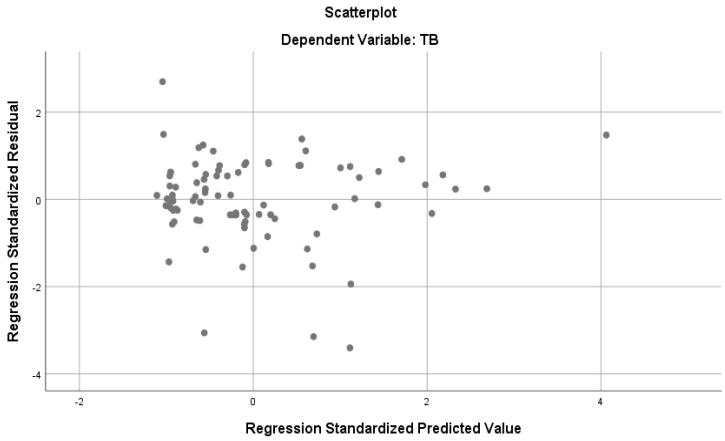
Results of testing the exports and imports products effect



Source: Authors from SPSS statistics 25

Figure 1: Histogram and normal P-P plot of distributed residuals

Figure 1 shows the histogram and normal probability graph covering the period from January 2012 to April 2019 of the data. It shows a roughly normal distribution, a bell-shaped curve. The curve on the histogram shows the shape of the distribution. Most of the points fall along the straight line and the normal probability graph is almost linear, indicating that the error terms are normally distributed. The normal distribution is represented by the straight line of the graph and the observed residues are represented by the points.



Source: Authors from SPSS statistics 25

Figure 2: Plot of *ZRESID against *ZPRED

Figure 2 shows the graph of standardized residuals versus standardized predicted values. The points are distributed randomly and uniformly throughout the plot. This trend shows that we are in the situation of assumptions of linearity and homoscedasticity satisfied.

Correlation Matrix

To establish the correlation matrix, we should base on the basic hypothesis that one variable would relate to other variables, which might be a negative correlation or positive correlation. The Pearson correlation is one of the applicable methods to estimate the relationship between two variables. In the case of the researches, the presume is that trade balance should belong to particular export and import products (ECP-Exports of Crude Petroleum, ERW-Export of Rough Wood, IME-Imports of Electrical Machinery, IAI-Imports of Metallic or IWA-Import of Wood Articles or IT-Import of Textiles).

Table 1: Correlations matrix for the collected data over the period of January 2007 to April 2014

Correlations[c]								
		TB	ECP	ERW	IME	IAI	IT	IAW
TB	Pearson Correlation	1	.998**	.230*	-.110	-.053	.055	.087
	Sig. (2-tailed)		.000	.031	.306	.623	.612	.419
ECP	Pearson Correlation	.998**	1	.209	-.086	-.013	.084	.117
	Sig. (2-tailed)	.000		.051	.425	.902	.439	.277
ERW	Pearson Correlation	.230*	.209	1	-.203	-.166	-.108	-.081
	Sig. (2-tailed)	.031	.051		.057	.123	.317	.451
IME	Pearson Correlation	-.110	-.086	-.203	1	.549**	.477**	.467**
	Sig. (2-tailed)	.306	.425	.057		.000	.000	.000
IAI	Pearson Correlation	-.053	-.013	-.166	.549**	1	.466**	.457**
	Sig. (2-tailed)	.623	.902	.123	.000		.000	.000
IT	Pearson Correlation	.055	.084	-.108	.477**	.466**	1	.325**
	Sig. (2-tailed)	.612	.439	.317	.000	.000		.002
IAW	Pearson Correlation	.087	.117	-.081	.467**	.457**	.325**	1
	Sig. (2-tailed)	.419	.277	.451	.000	.000	.002	
****. Correlation is significant at the 0.01 level (2-tailed).**								
***. Correlation is significant at the 0.05 level (2-tailed).**								
c. Listwise N=88								

Source: Authors from SPSS statistics 25

As shown in the correlation matrix, the correlation level between the TB variable (-0.110) and the IME variable is lowest compared with other correlations of the variables, and the value is also negative. Furthermore, the correlation between TB and ECP variable (+0.998) is positive and the highest one over the concerning group. Besides, there are four positive correlations between TB and ECP and ERW and IT and IAW, two negative correlations between TB and IME, and IAI.

In summary, ECP is positively correlated and significant at the 0.01 level. This implies that the ECP contributes 9.98% to the trade balance of the Republic of the Congo. The ERW is positively correlated and significant at the threshold of 0.05; this implies that the ERW contributes 2.3% in the trade balance of the Congo. The IME and the IAI have an inverse relationship, which means that the more the IME and IAI increase, the trade balance decreases. We also note that IT and the IAW have a positive relationship with the trade balance.

The SPSS software uses Durbin-Watson to test the conformity of the factors which affect the trade balance. The results are shown below:

Table 2: Durbin-Watson for the trade balance

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.999[a]	.998	.998	10024.720	1.775
a. Predictors: (Constant), IAW, ERW, ECP, IT, IME, IAI					
b. Dependent Variable: TB **Source: Authors from SPSS statistics 25**					

We performed our analysis by using the multiple linear regression method, the Durbin-Watson test was performed to verify the error independence assumption. Durbin-Watson must be between 1.5 and 2.5 to indicate

that the values are independent. In table 2 of our study, the Durbin-Watson value is 1.775, which indicates that the assumption that the error terms are independent has been fulfilled.
The value of the multiple coefficient of determination, R^2, is 0.998 in the model presented in table 2. This shows that there is a 99.8% change in the trade balance due to imports of wood articles, exports of rough wood, exports of crude petroleum, import of textile, imports of electrical machinery and, imports of iron articles. The adjusted R^2 tells us about the quality of the model. Ideally, its value should be identical or very close to the value of the multiple coefficient of determination R^2. In our study, the adjusted R^2 and R^2 have the same value as 0.998. So we know that the higher the coefficient of multiple correlation, R or multiple coefficient of determination, R^2 and adjusted R^2, the better is the model that fits the data.

Analysis of Variance (ANOVA)

Table 3: Analysis of variance

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4579816196517.549	6	763302699419.591	7595.428	.000[b]
	Residual	8140096706.440	81	100495021.067		
	Total	4587956293223.989	87			
a. Dependent Variable: TB						
b. Predictors: (Constant), IAW, ERW, ECP, IT, IAI, IME						
Source: Authors from SPSS statistics 25						

The result of the ANOVA table shows that there is a significant relationship between the six predictor variables and the dependent variable at the 0.05 level of significance, where $p < 0.05$. The result is significant for imports of woods, exports of rough wood, exports of crude petroleum, imports of textiles, imports of electrical machinery and, imports of iron's articles, where $F(6.81) = 7595.428$, $p < 0.05$.
The results of coefficients for all of the products in the period are displayed as follows:

Table 4: The regression results for the dependent variable the trade balance

Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
		B	Std. Error	Beta		
	(Constant)	-9730.385	2569.466		-3.787	.000
	ECP	1.001	.005	.998	203.134	.000
	ERW	.828	.251	.016	3.295	.001
	IME	.804	.660	.008	1.219	.227
	IAI	-4.459	.931	-.029	-4.788	.000
	IT	-32.613	15.011	-.012	-2.173	.033
	IAW	-54.979	20.743	-.015	-2.650	.010

a.Dependent Variable: TB
Source: Authors from SPSS statistics 25

From the interpretation of the ANOVA table, we can conclude that our model is good. It allows us to write the following regression equation by taking the values of the coefficients in the coefficient table to develop a regression equation. The model can be expressed in the following equation:

$$TB = -9730.385 + 1.001ECP + 0.828ERW + 0.804IME - 4.459IAI - 32.613IT - 54.979IAW + \varepsilon_{it}$$

Table 4 presents the regression results for all exports and imports products from January 2012 to April 2019. It can be seen that: Exports of crude petroleum ($\alpha_{1t} = 1.001$) value indicates that its exports increase by one unit while the trade balance increases by 1,001 units. Variables were measured in thousands of USD. For every additional $ 1000 earned on Congo's crude petroleum exports, the additional trade balance of $ 1.001 million is generated. This interpretation is valid only if exports of rough wood, imports of electrical machinery, imports of iron articles, imports of wood articles and imports of textiles are kept constant.

Rough wood exports ($\alpha_{2t} = 0.828$) value means that as exports of rough wood increase by one unit, the trade balance increases by 0.828 units. Variables were measured in thousands of USD. So for every additional $ 1000 earned on Congo's rough wood exports, the additional trade balance of $ 0.828 million is generated. This interpretation is valid only if crude petroleum exports, imports of electrical machinery, imports of iron articles, imports of wood articles, and imports of textiles are kept constant.

Imports of electrical machinery($\alpha_{3t} = 0.804$) value means that as imports of machinery increase by one unit, the trade balance increases by 0.804 units. The variables were measured in thousands of USD. For every additional 1000 USD earned on imports of electrical machinery, the additional trade balance of 0.804 000 USD is generated. This interpretation is valid only if crude petroleum exports, exports of rough wood, imports of iron articles, imports of wood articles, and imports of textiles are kept constant.

Imports of iron articles ($\alpha_{4t} = -4.459$) value means that as imports of iron articles increases by one unit, the trade balance decreases by 4,459 units. The variables were measured in thousands of USD. For every 1000 USD spent on imports of iron goods, the additional trade balance of 4.598 000USD is deducted. This interpretation is valid only if crude petroleum exports, exports of rough wood, imports of electrical machinery, imports of wood articles, and imports of textiles are kept constant.

Imports of textile ($\alpha_{5t} = -32.613$) value means that as imports of textile increase by one unit, the trade balance decreases by 32,613 units. The variables were measured in thousands of USD. For every additional $ 1000 spent on textile imports, the additional trade balance of $ 32,613,000 is deducted. This interpretation is valid only if crude petroleum exports, exports of rough wood, imports of electrical machinery, imports of iron articles, and imports of wood articles are kept constant.

Imports of wood articles ($\alpha_{6t} = -54.979$) value means that as imports of wood products increase by one unit, the trade balance decreases by 54,979 units. The variables were measured in thousands of USD. Thus, for every $ 1,000 spent on imports of iron products, the additional trade balance of $ 54,979,000 is deducted. This interpretation is valid only if crude petroleum exports, rough wood exports, imports of electrical machinery, imports of iron products, and imports of textiles are kept constant.

IV. CONCLUSION

In this study, an equation was developed through multiple linear regression analysis. The regression model shows the effects of exports of crude petroleum and rough wood, imports of electrical machinery, textiles iron and wood articles on the trade balance. The balance of the trade can be written as follows:

$$TB = -9730.385 + 1.001ECP + 0.828ERW + 0.804IME - 4.459IAI - 32.613IT - 54.979IAW + \varepsilon_{it}$$

In conclusion, the six predictive variables that are export of crude petroleum, the export of rough wood, imports of textiles, imports of iron articles, imports of wood articles, have visible effects on the trade balance. Exports have a positive effect on the Congolese trade balance, imports have negative effects except for imports of electrical machines, which positively affect Congo's trade balance. Our hypotheses seem to have been verified and we can therefore probably assume that this model could be generalized to any liberated trade balance. The results obtained in our study show that most of the variables have the expected signs: the exports of crude oil and rough wood are positive, which obeys to the economic theory so that the trade balance is favorable or in excess or at least balanced, while the signs of import results are somewhat mixed as imports of iron, textiles, and wood products have negative signs, but imports of electrical machinery have a positive sign. And globally, we can say that our results are close to the mercantilist theory according to which the trade balance is equal to the positive exports and negative imports.

Funding

This work supported by the Key Project of National Science Foundation of China (11531006)

REFERENCES

[1]. Bernard, A.B, Eaton, J, Jensen, J. B, and Kortum S., Plants and Productivity in International Trade, [J] The American Economic Review, 2003, Vol. 93, No. 4, Pp. 1268–1290.

[2]. Bernard, A.B, Jensen, J. B, Redding, S. J, and Schott P.K., Firms in International Trade, [J] Journal of Economic Perspectives, 2007, Vol. 21, No. 3, Pp. 105–130.

[3]. Bondarenko P., Absolute advantage. https://www.britannica.com/topic/absoluteadvantage (May 14) [Accessed 28th June 2018]

[4]. Bonga W.G, Sithole R and Shenje T., Export Sector Contribution to Economic Growth in Zimbabwe: A Causality Analysis, [J] The International Journal of Business & Management, 2015, Vol 3, Pp. 452 - 464

[5]. Gopinath G, Helpman E, and Rogoff K., (Eds.) Handbook of International Economics, 2014, Vol. 4, Elsevier, 4, Pp. 1–54.

[6]. Koehler M, What is Video Good For? Examining How Media and Story Genre Interact, [J] Journal of Educational Multimedia and Hypermedia, 2005, 14(3), Pp. 249-272

[7]. Matson J.E and Huguenard B.R., Evaluating aptness of a regression model, [J] Journal of Statistics Education, 2015, 15(2).

[8]. Melitz M. J. and Trefler D., Gains from Trade when Firms Matter, [J] Journal of Economic Perspectives, 2012, Vol. 26, No. 2, Pp. 91–118.

[9]. Melitz M.J., The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity, [J] Econometrica, 2003, Vol. 71, No. 6, Pp. 1695–1725.
[10]. Pavcnik N., Trade Liberalization, Exit, and Productivity Improvements: Evidence from Chilean Plants, [J] Review of Economic Studies, 2002, Vol. 69, No. 1, Pp. 245–276.
[11]. Levin R.I and Rubin, D.S., Statistics for management, 6th edition, 1996, Englewood Cliffs, N.J.: Prentice-Hall.
[12]. Snee R. D., Experimental designs for quadratic models in constrained mixture spaces. [J] Technometrics, 1975, Pp. 149–159.
[13]. Tybout J.R., Manufacturing Firms in Developing Countries: How Well Do They Do, and Why? [J] Journal of Economic Literature, 2000, Vol. 38, No. 1, Pp. 11–44
[14]. WTO. World Trade Statistics Review, World Trade Organization, 2017, p.5

***Corresponding author:** *Lagès Nadège Mouanguissa*
School of Mathematics and Statistics, Huazhong University of Science and Technology, Wuhan