The Relationship Between International Trade and Economic Growth in Mali: Co-integration and Causality Analysis

Adjouro Togo

School of International Economic, Shanghai University , 99 Shangda Road, Shanghai 200444, China

Abstract

The relationship between international trade and economic growth remains until today one the most controversial issues among economists. Despite several empirical studies, they found mixed results in the case of Mali. Therefore, this paper aims to investigate the causal relationship between international trade and economic growth in Mali over the time period of 1986-2015. In order to achieve it, Johansen Co-integration test , Vector Error Correction Model (VECM) and Granger causality test are used. The Johansen Co-integration test indicates the presence of long-run relationship among all the variables. The VECM reveals that the variables exports and labor significantly impact economic growth in the long run while in the short, only gross capital formation is found to have a positive and significant impact on economic growth. Lastly, the Granger causality test reveals that except the variable imports, there is unidirectional causal relationship running from variables exports, gross capital formation and labor to economic growth in Mali. The key findings of this paper are that exports and imports negatively impact economic growth but only the impact of exports is significant in the long-run. The variables gross capital formation and labor respectively have positive impact on economic growth in the short run and long-run. Therefore, this paper recommends to policymakers to increase infrastructure investment in order to reduce trade cost and diversify exports away from primary commodities to manufacture .
Keywords: International trade, Economic growth, Johansen cointegration test, Granger causality test, Mali

1. Introduction

The relationship between international trade and economic growth remains one of the most controversial subjects among economists and policymakers. However, despite several theoretical and empirical studies, there is still no general consensus about the relationship and the direction of causality between them. Theoretically, for the proponent of trade liberalization, international trade affects economic growth through economies of scale, allocation of resources to research and development or human capital sector, diffusion of technological knowledge (Rivera and Romer, 1991; Grossman and Helpman, 1990,1991; Lucas, 1988; Rebelo, 1991.). Contrary to them, Young (1991) and Lucas (1988) show that trade liberalization might reduce economic growth in country specialized in the production of old or low technology good. Huchet-Bourdon and Vijil (2013) also indicate that trade may impact growth negatively when country's exports are highly concentrated on low-quality products. Empirical studies also provide mixed results. While some economists have demonstrated that international trade promotes economic growth (Frankel and Romer, 1999; Dollar and Kraay, 2001; Bruckner and Lederman, 2012; Asfaw, 2015; Milton and Ajan Okim, 2017; Olufemi, 2014), others found the relationship negative (Rodriguez and Rodrik, 1999; Vincent and Oliver, 2010; Dauman and Ozyurt, 2011). It is against the background of mixed results that this paper aims to investigate the relationship between international trade and economic growth in Mali during the period from 1986 to 2015. Mali is a landlocked country in West Africa spread over 1.241328 square kilometers. After the failure of import substitution policies established in 1960, the Government of Mali under structural adjustment program of International Monetary Fund (IMF) and World Bank has implemented since 1986 trade liberalization policies. This has been following by the signature of several trade agreements (World Trade Organization, West African Economic and Monetary Union WAEMU and Economic Community of West African States ECOWAS) and the implementation of the WAEMU Common External Tariff (CET) in January 2000. A direct benefit of these liberalization policies was the increase of the share of trade (exports + imports) to the GDP from 54 percent in 1986 to 70 percent in 2012 and the rise of the value of Mali's exports of goods and services from US$274 million in 1986 to US$3343 million in 2012. The average economic growth has grown about 3 percent a year from 1986 to 1993 and 5 percent a year from 1994 to 2012. Therefore, it is important to determine the impact of this trade performance on economic growth in Mali.

The rest of this paper is organized as follow: section 2 provides theoretical and empirical reviews, section 3 presents the overview of international trade in Mali, section 4 presents data and methodology, section 5 presents the empirical results and finally section 6 concludes the paper.

2. Literature review

Despite several studies on the relationship between trade and economic growth, there is no either theoretical or empirical consensus among economists. Theoretically, for the proponent of trade liberalization, international trade affects economic growth through several channels. International trade will enhance growth if resources are allocated to the sector producing factor accumulation which could be R&D in Grossman and Helpman (1990) or

human capital as in Lucas (1988) or physical capital as in Rebelo (1991). World economic integration can improve the long-run rate of growth if it encourages the worldwide exploitation of increasing return to scale in the research and development (Rivera-Batiz and Romer, 1990). Grossman and Helpman (1994) also show that openness to international trade facilitates access to technological knowledge available in other nation and mitigate redundancy in industrial research. Contrary to them, some economists show that trade liberalization might reduce economic growth in country specialized in the production of the old good or low-technology goods (Young, 1991; Lucas, 1988). Grossman and Helpman (1991) show that country with an abundant natural resource, unskilled labor and a relative paucity of skilled worker will growth faster in autarky. Huchet-Bourdon and Vijil (2013) also indicate that increase trade share to GDP may be detrimental to growth when country's exports are highly concentrated on a low-quality product or on a few products.

The empirical studies also provide mixed on the relationship between trade and economic growth. Frankel and Romer (1999) demonstrate that a one percent increase in the ratio of trade to GDP increases income per capita by at least one-half percent. Bruckner and Lederman(2012) also show that a one percentage point increase in the ration of trade to GDP increase growth by 0.5 percent per year in the short run and 0.8 percent after ten years in the long run. Using comparative data set for 93 countries, Edward (1997) show that more open countries grow faster. Paudel (2014) using dynamic panel growth model and found that the impact of trade liberalization on economic growth differs across countries and depend on the stage of economic development. Dauman and Ozyurt (2011) on the empirical work on international trade flow and economic growth in 26 Brazilian states reveals that trade openness is more beneficial to the country with high level of initial per capita income. Shaheen and Ali (2013) found that trade liberalization has a significantly impact economic growth of Pakistan over the period 1975-2010. Saibu (2014) examines the causal relationship between trade openness and economic growth in Nigeria and found a unidirectional relationship between them. Najeri and Ajayi also did in 2013 an empirical study of growth through trade in Nigeria from 1975 to 2012 and found that total trade, foreign direct investment flow, and exchange rate are positively contributing to growth while the degree of openness is negatively contributing to growth in Nigeria.

Using VECM approach, Abubakar (2013) investigates the impact of foreign trade and foreign direct investment on economic growth in Nigeria. His findings revealed that foreign direct investment and exports positively influence economic growth while the impact of import is negative.

Enu and Dodzi (2013) used a Johansen co-integration analysis to examine the effect of foreign trade on economic growth in Ghana from 1980 to 2012. They found a positive relationship between exports and economic growth on one hand and the negative relationship between imports, foreign direct investment and economic growth on the other hand.

In South Korea, Tsegaye employed Cobb-Douglas production function under the Vector Error Correction (VEC) model and Granger causality test examined the causal relationships between trade and economic growth. The study indicates that uni-directional long-run causality exists between exports and economic growth in Korea while it is bi-directional for imports. Moreover, this study has found uni-directional short-run causality running from exports and imports to economic growth; validating both Export-Led Growth (ELG) and Import-Led Growth (ILG) hypotheses in Korea.

Eltahir (2013) applied the co-integration approach and the VECM Granger causality test to determine the long run and causal relationship between trade openness and economic growth in Egypt. His finding revealed that all variables are co-integrated and showed the existence of a bidirectional causal relationship between imports as well as trade and GDP growth but a unidirectional causality for exports.

Empirical studies in Mali

The empirical studies of the relationship between international trade and economic growth in Mali are scanty. Most of them are multi countries studies and provides mixed results: using a Granger causality test, Amadou in 2013 published an article on the causal relationship between trade openness and economic growth in WAEMU countries. He found that except Ivory Coast, trade openness doesn't cause economic growth in the rest of WAEMU countries. In 2005, Nadia examined the impact of the degree of openness on economic growth in six West African countries including Mali. Using the co-integration technique, its results suggest that countries without direct access to a port are less outward oriented than coastal countries and consequently do not have a strong national economy to cope with foreign competition. Okuwa et al (2016) have also analyzed the relationship between international trade and economic growth in West Africa from 1991-2001 and found that a one percent increase in exports variables will increase economic growth by 5.11 percent. Iyoha and Okim (2017) used panel data regression analysis and found a positive relationship between exports and economic growth in ECOWAS countries. Applying dynamic panel regression methods, Vincent and Oliver (2010) demonstrate that structural variables (natural barriers to trade and natural resource endowments) explain the poor growth performance in Sub-Saharan Africa countries.

Employing Pooled Mean Group estimation technique, Zahonogo investigates the impact of trade openness on economic growth in 42 Sub Saharan Africa countries. The results indicate that trade openness has beneficial

effects on economic growth when a trading threshold exists below and that when a trading threshold is above, the benefice decline.

3. Overview of international trade in Mali

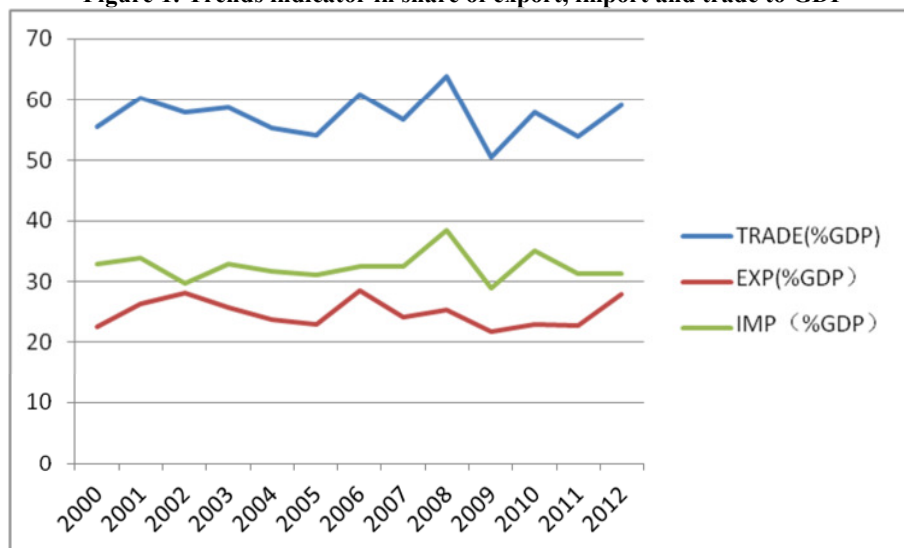### 3.1. A Brief review of Mali's trade policy reform

Historically, Mali has had two trade policies since its independence in 1960. From 1960 to the beginning of the 1980s, Mali adopted the import substitution strategy in order to protect local industries against external competition. Several tariffs and non-tariff measures such as exports and imports monopoly, high tariffs, export subsidies, control over imports and many prices, quantitative restrictions have been put in place. Due to the inherent limits of this strategy (in particular poor management of bloated, state-subsidized government enterprises) compounded by Mali's natural economic difficulties as a land-locked LDC, the Government of Mali under structural adjustment program of International Monetary Fund (IMF) and World Bank has implemented trade liberalization policies since 1982. From 1982 to 2000, several reforms have been undertaken. All exports and imports monopolies, all quantitative restrictive and most export taxes were abolished, import licensing was replaced by an automatic registration system effective, the national currency (CFA franc), the value-add tax has been introduced. Since the implementation of the WAEMU Common External Tariff (CET) in January 2000, Mali's trade policy is become more open and transparent and is essentially based on duties and taxes. On the import side, customs duty and fiscal imports duty are replaced by single duty with four rates: zero percent for staple goods, 5 percent for basic commodities including basic raw materials, capital goods and specific inputs, 10 percent for input and intermediate goods and 20 percent for final consumer goods. As result, the simple average tariff decreased respectively from 22.1, 14.6, and 12.1 percent in 2009. In addition goods, no originating in the WAEMU or ECOWAS are subject to the supplementary import duties: the community-wide solidarity taxes (PCS) and the WAEMU's statistical fee (RS) at a level of 1 percent and the ECOWAS PC at a level of 0.5 percent. The general VAT in Mali is 18 percent and several goods, mainly alcoholic beverages, petroleum products, and cigarettes, inter alia, are subject to special tax (ISCP). Sugar imports have been exempt from the special import tax (TCI) since 2010.

One the export side, the rate of the VAT is zero, only gold and cotton are subject to a special tax (ISCP) of 3 percent.

3.2. Mali's trade performance

Since the implementation of the WEAMU Common External Tariff (CET) in 2000, Mali's trade has increased dramatically and the share of total trade (exports plus imports) of goods and services to the GDP was almost 60 percent. According to the World development indicator database, the value of Mali's merchandise exports increased from US$545 million in 2000 to US$2375 million in 2011 while its merchandise imports increased from US$806 million to US$3352 million in 2011. The merchandise trade balance recorded in 2011 a deficit of US$977 million. The value of exports of services of Mali increased from US$99 million in 2000 to reach US$410 million in 2012, while its imports of services increased from US$334 million to reach US$1064 million in 2012. There was a large trade in services deficit of US$730 million. Figure 1 below presents the share of trade (exports plus imports) of goods and services to the GDP from 2000 to 2012.

Figure 1: Trends indicator in share of export, import and trade to GDP

From the figure 1 above, it can be seen that international trade is particularly important in Mali's economy. Since 2000, the share of the total trade of goods and services has always been positive and constituted on average 51 percent of GDP. The share of exports to the GDP increased significantly from 22 percent in 2000 to 27 percent in 2012 while its share of imports decreased slightly from 32 percent in 2000 to 31 percent in 2012. This surge of exports has narrowed the trade deficit from 10 percent of GDP in 2000 to 4 percent in 2012.

Despite improvements made in the aggregates, Mali's trade structure has highlighted a tendency to be dependent on commodities and raw materials for exports and manufactured goods for imports, thereby leading to deterioration in the terms of trade.

Figure 2 and 3 below show the structure of merchandises exports and imports. It can be seen that Mali's exports are dominated by three commodities (Gold, Cotton, and livestock), which accounted an average of 90 percent of total merchandise export earnings over the years. In the others side, Mali's most imports are manufactured goods especially petroleum products, machines, and vehicles motors, cement, medicaments which represent respectively 24, 7, 5 and 4 percent of total merchandise import earnings in 2012.

Figure 2: Composition of merchandises exports
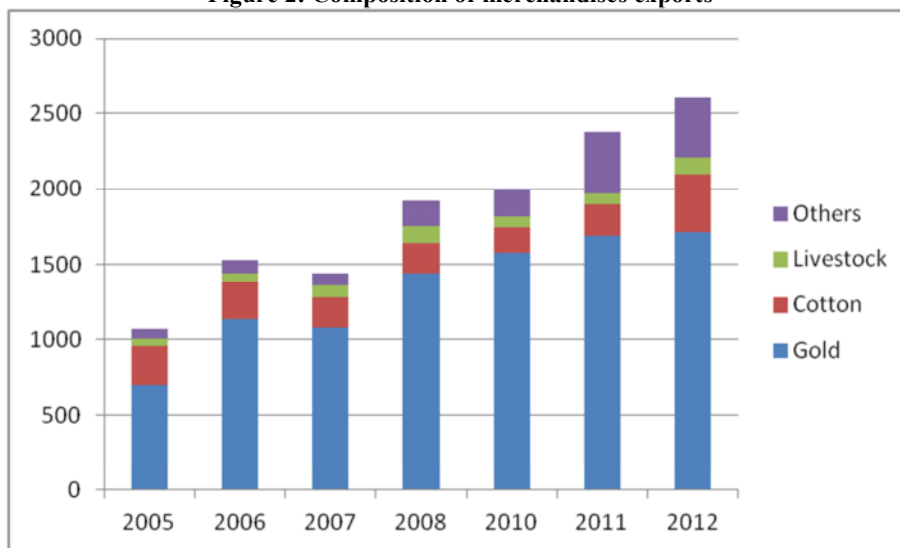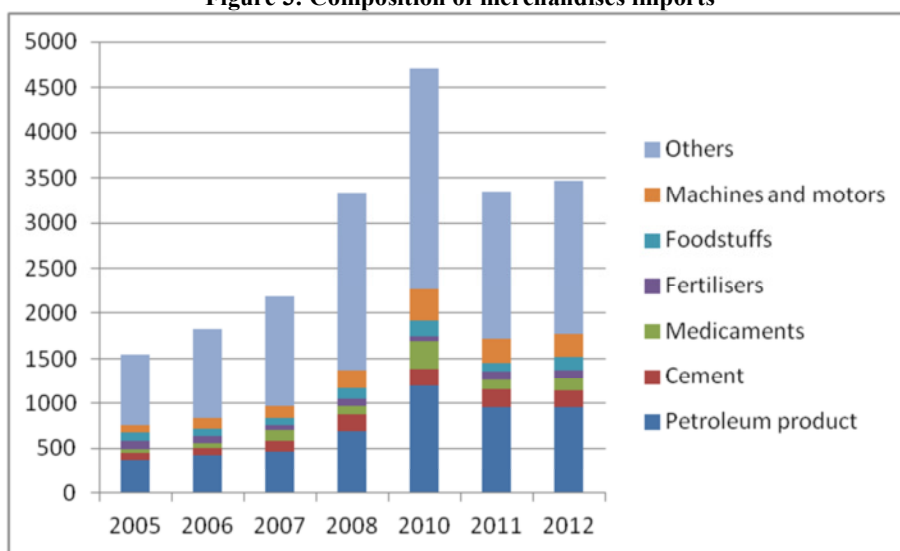

Figure 3: Composition of merchandises imports

4. Data and Methodology

4.1. Data

The data used in this paper are annual time series data covering the period of 1986-2015. All data are obtained from World Bank International Monetary Fund (IMF), World Bank Development Indicators, United Nations on

Trade and Development (UNCTAD) and Central Bank of West African States (BCEAO) databases.

4.2. Method

In order to determine the relationship between international trade variables and economic growth in Mali, we applied the Johansen Co-integration test, Vector Error Correction Model (VECM) and Granger causality test. Like Tsegaye on his work of trade and economic growth in South Korea, this paper also employed Cobb-Douglas production function. Therefore the model is specified as:

$$GDP_t = \beta_0 + \beta_1 EXP_t + \beta_2 IMP_t + \beta_3 GCF_t + \beta_4 LAB_t + U_t \qquad (1)$$

Where

GDP= Growth Domestic Product as a proxy for Economic growth

LAB= Population between 15 to 64 age range as a proxy of Labor

GCF= Gross Capital Formation as a proxy of Capital

EXP and IMP= Exports and Imports of goods and services (%GDP) as a proxy for technological innovation

U_t = White noise error term

β_0 = Constant term

β_1 - β_4 = Coefficient of the independent variables

The non-linear function specified above can be easily estimated by converting equation (1) into a linear regression after taking the logarithm of both sides of the function as stated in equation (1). We obtain:

$$LnGDP_t = \beta_0 + \beta_1 LnEXP_t + \beta_2 LnIMP_t + \beta_3 LnGCF_t + \beta_4 LnLAB_t + U_t \qquad (2)$$

5. Empirical results

5.1 Unit Root Test

This paper used Augmented Dickey-Fuller (ADF) test to check the stationarity of the variables and to determine the order of the integration for each of them. From the table 1 below, it can be seen that all the variables Gross Domestic Product (GDP), Exports of goods and services, Imports of goods and services, Gross Capital Formation (GCF) and Labor are non stationary at level but become stationary at the first difference, which implies that all the variables are integrated of order one (I). However, our variables fully satisfy the prerequisite condition of the Johansen co-integration test.

Table 1: Augmented Dickey Fuller Test for Unit Root

Variables	ADF Test Statistics		Critical Values (5%)		Order of Integration
	Level	First Difference	Level	First Difference	
LnGDP	-0.179959	-6.135301	-2.967767	-2.971853	I(1)
LnEXP	-0.786447	-6.295561	-2.967767	-2.971853	I(1)
LnIMP	-0.373306	-7.341955	-2.967767	-2.971853	I(1)
LnGCF	-0.867977	-7.288895	-2.967767	-2.971853	I(1)
LnLAB	0.469937	-5.229756	-2.971853	-2.971853	I(1)

Source: Author's computation

5.2 Johansen Co-integration test

The Johansen co-integration test is conducted in order to examine the presence or absence of co-integration among the variables. The presence of co-integration will then be an indication or confirmation of a long run economic relationship among variables. The table 2 below shows the results of the Johansen co-integration test. The trace test reveals the existence of one co-integrating equation at 5 percent level of significance and the Max-eigenvalue test also confirms the result. At none, we reject the null hypothesis at 5 percent level of significance, which means that at none the variables are co-integrated which also mean there is the existence of long-run equilibrium relationship between them. Because our variables are co-integrated, we can examine the long run effect of international trade variables on economic growth. From the normalized co-integrating coefficient in table 3, we can see that only exports and labor significantly impact economic growth in the long run. The impact of exports is negative which means that a 1.165378% increase of exports will decrease economic growth by 1%. On the other hand, labor has a positive and significant impact on economic growth which implies that economic growth will increase by 1 percent if labor increases by 1.565689%. According to the variables imports and capital, the finding revealed that they negatively influence economic growth in the long run but the impact is not significant. This implies there is no relationship between imports and gross capital formation in Mali in the long run.

Table 2: Johansen Co-integration Test

Trace test				
Co-integrating rank	*Eigen value*	*Trace Statistic*	*Critical Value 5%*	*Prob.**
*None ***	0.749019	**81.47262**	69.81889	0.0044
At most 1	0.534864	42.76607	47.85613	0.1384
At most 2	0.445426	21.33417	29.79707	0.3371
At most 3	0.158148	4.826644	15.49471	0.8270
At most 4	0.000229	0.006415	3.841466	0.9356
Maximum Eigen (λ-max) value test				
Co-integrating rank	*Eigen value*	*Trace Statistic*	*Critical Value 5%*	*Prob.**
*None ***	0.749019	**38.70655**	33.87687	0.0123
At most 1	0.534864	**21.43190**	27.58434	0.2510
At most 2	0.445426	16.50752	21.13162	0.1966
At most 3	0.158148	4.820229	14.2640	0.7644
At most 4	0.000229	0.006415	3.841466	0.9356

Table 3: Normalized co-integration coefficients: 1 co-integrating equation

LGDP	*LEXP*	*LIMP*	*LGCF*	*LLAB*
1.000000	*-1.165378**** *(0.13271)* *[-8.78134]*	*-0.101776* *(0.13433)* *[-0.75763]*	*-0.071886* *(0.10684)* *[-0.67283]*	*1.565689**** *(0.34404)* *[4.55089]*

*,** and *** show the significance at respectively 10%, 5% and 1% level
Source: Author's computation

5.3 Vector Error Correction Model
The VECM is used to explore the short run dynamics among the variables. Error correction model allows the introduction of the previous disequilibrium as independent variables in the dynamic behavior of existing variables. From the table below, we can see that the coefficient value of ECM is negative (-0.858379) and highly significant at 5 percent critical level which confirms the existence of long-run equilibrium relationship between economic growth and international trade variables used in this paper. In addition, only Gross capital formation significantly impact economic growth in the short run. Its coefficient (0.301147) is positively signed and significant at 5 percent level of significance, which implies that 1 percent increase in Capital will lead to 30 percent increase in economic growth. The coefficients of exports, imports, and labor variables are negative with a respective value of -0.436924, -0.008374 and -3.797373 but not significant at 5 percent level, which implies that exports, imports, and labor not significantly impact on Mali economic growth in the short run. The coefficient of R2 value is 0.570317 which implies that 57 percent of the total variation in economic growth is explained by changes in the endogenous variables. Subsequently, 43 percent is unexplained due to error term. The adjusted coefficient of determination (R2) value of 0.447551 implies that 45 percent of the total variation in economic growth is explained by the change in the endogenous variables when the coefficient of determination is adjusted for the degree of freedom. The F-statistic value of 4.645545 is highly significant at 1 percent level of significance with a pro-value of 0.003744. This implies that the model is a good fit. The Durbin- Watson statistic value of 1.943735 indicates absence of auto-correlation in the estimated model.

Table 4: Estimates of Vector Error Correction Model

Vector Error Correction Estimates Sample (adjusted): 1988-2015 Included observations: 28 after adjustments Dependent Variable: *D(lnRGDP)*				
Variable	*Coefficient*	*Std. Error*	*T-Statistic*	*Probability*
C	*0.230272*	*0.10195*	*2.25867*	*0.0347***
D(lnRGDP(-1))	*-0.380559*	*0.228632*	*-1.664504*	*0.1109*
D(lnEXP(-1))	*-0.436924*	*0.271130*	*-1.611496*	*0.1220*
D(lnIMP(-1))	*-0.008374*	*0.189485*	*-0.044193*	*0.9652*
D(lnGCF(-1))	*0.301147*	*0.140129*	*2.149074*	*0.0434***
D(lnLAB(-1))	*-3.797373*	*3.357792*	*-1.130914*	*0.2708*
ECM(-1)	*-0.858379*	*0.269546*	*-3.184532*	*0.0045****
R-squared = 0.570317 **Adjusted R-squared = 0.447551** **F-statistics = 4.645545** **Prob(F-statistics) = 0.003744** **DW statistics = 1.943735**				

*, ** and *** show the significance at respectively 10%, 5% and 1% level. D.W stat is the Durbin-Watson statististic

Source: Author's computation

5.4 Granger Causality Test

The Granger causality test is used to determine the direction of causality between international trade variables in this paper and economic growth. From the results in table 4, we see that there is unidirectional causality running from variables exports, gross capital formation and labor to economic growth with respectively 5%, 1% and 10% level of significance. This implies that exports, gross capital formation and labor cause economic growth in Mali. According to imports, the results showed no causal relationship with economic growth.

Table 4: *Granger causality test results*

Null hyphothesis	Obs	F-statistic	P-value
LnEXP does not Granger Cause LnGDP	28	4.16553	0.0286
LnGDP does not Granger Cause LnEXP		1.47303	0.2501
LnIMP does not Granger Cause LnGDP	28	0.66544	0.5237
LnGDP does not Granger Cause LnIMP		1.56101	0.2314
LnGCF does not Granger Cause LnGDP	28	5.99450	0.0080
LnGDP does not Granger Cause LnGCF		0.93273	0.4079
LnLAB does not Granger Cause LnGDP	28	2.76255	0.0841
LnGDP does not Granger Cause LnLAB		0.03528	0.9654

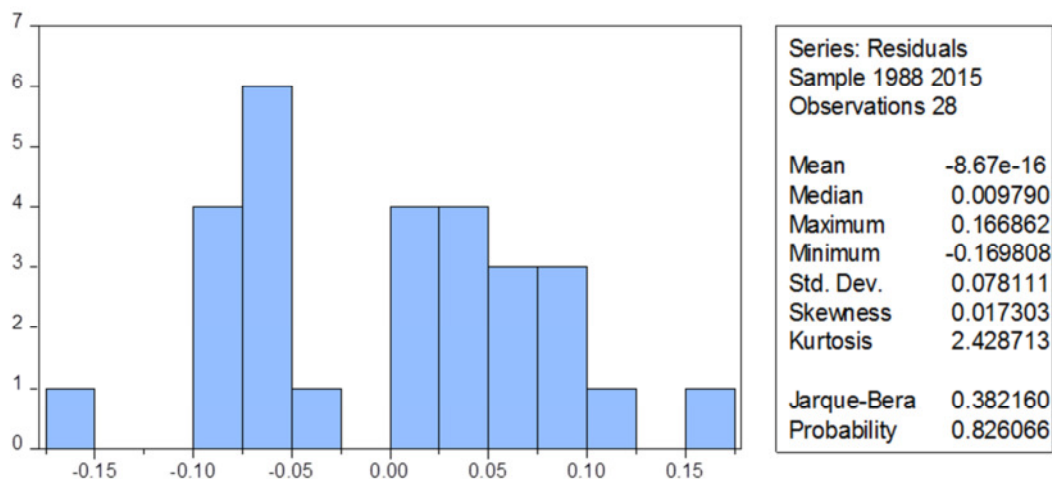*Source: Author's computation*

5.5. Residual diagnostic test

The residual diagnostic tests are used to verify that our empirical work is acceptable and that our estimate is well treated. From the table below, we can conclude that the model as a whole has no problem. The correlation and heteroskedasticity tests both accepted the null hypothesis (both probability values are more than 5 percent). Thus the model presents neither serial correlation nor heteroskedasticity.

Additionally, we have the distribution graph of the normality for our error term. Like the other stability tests, we see that the model has no anomaly in its distribution. The probability 0.826066> 5%, therefore allows us to accept the null hypothesis and to certify that the distribution is normally made in the model.

Table 5: Additional tests for the stability

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.938280	*Prob. F(2,19)*	0.4087
Obs*R-squared	2.516874	*Prob. Chi-Square(2)*	0.2841
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.641542	*Prob. F(10,17)*	0.7600
Obs*R-squared	7.671513	*Prob. Chi-Square(10)*	0.6609
Scaled explained SS	3.082611	*Prob. Chi-Square(10)*	0.9794

Source: Author's computation

Series: Residuals	
Sample 1988 2015	
Observations 28	
Mean	-8.67e-16
Median	0.009790
Maximum	0.166862
Minimum	-0.169808
Std. Dev.	0.078111
Skewness	0.017303
Kurtosis	2.428713
Jarque-Bera	0.382160
Probability	0.826066

Source: Author's computation

6. Conclusion and Policy recommendations

This paper was aims to investigate the causal relationship between international trade and economic growth in Mali over the time period of 1986-2016.Using Cobb-Douglas production function, Johansen co-integration analysis, VECM method, and Granger causality test has been used in order to attain this aims. After found that all variables are stationary at first difference, the Johansen co-integration test indicates the presence of long-run relationship among all the variables. The VECM result showed that in the long-run, there is a significant relationship between export, labor and economic growth in the long run while in the short run gross capital formation only has an impact on economic growth. The variable import is found to have no impact nether in short and long run on economic growth. The result of VECM is confirmed by Granger causality test which indicated that there is unidirectional causality running from export, labor and gross capital formation to economic growth. Lastly, the residual diagnostic tests showed that the model has no problem which implies that there is neither serial correlation nor heteroskedasticity. We concluded that due to natural barriers and dependence of primary commodities, openness to international trade is not benefit to Mali economic growth in the long run. Therefore, this paper recommends to policymakers to massively invest in infrastructure in order to reduce trade cost which hampered trade performance and diversify exports away from primary commodities to manufacture.

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