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Relationship between Exports and Economic Growth in Mali: An Econometric Analysis[1]

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DEDICATION

I dedicate my dissertation work to my father whose dream was to see me study in India when I was 8 years old.
My mother for her support and investment in me.
My brothers and sisters (Luc, Ruth, Sanogo, Jacquelline, Juliette, Fafognon, Beugré Désiré) for your help and support.

Abstract

This study aims to examine the relationship between Exports and Economic Growth and their causality in the context of Mali. The model VAR is employed. Using time series techniques, the stationarity properties of the data sets are tested, followed by Johansen and Jesulius Cointegration analysis to examine long term relationship between the two variables. The study finds a cointegrating relationship between exports and economic growth. Moreover, Granger causality tests suggest that Economic growth causes Exports in case of Mali. The impulse response function has been traced out for both the variables and forecast variance decomposition to estimate of the shock in each variable to the response in both variables.

Keywords: Exports, Economic growth, VAR model, Granger Causality test, Impulse response function, variance decomposition.

CHAPTER 1

1.1 INTRODUCTION

The relationship between exports and growth has always been central to economic analysis. The Early literature examining the relationship between exports and economic growth (Balassa, 1978, 1985; Tyler, 1981; Krueger, 1985) supports the idea that export expansion significantly contributes to economic growth.

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Indeed, exports play an important role in modern economies as exports are considered as an engine of economic growth. The same argument has also been emphasized in the exports-led growth theory. According to this theory, exports is a key factor in explaining economic growth, i.e. export expansion stimulates economic growth by allowing an economy to take advantage of economies of scale and by encouraging investment in new technologies which, in turn, increase the rate of capital formation and hence technological change, which has favourable effects on the efficiency of resource allocation and capacity utilization.

Moreover, export-led growth hypothesis finds that export growth in labour-surplus economies leads to rapid growth in employment and real wages, an improvement in product quality due to increased competition from abroad, and finally, a contribution to the stock of foreign exchange reserves.

According to Trost and Bojnec (2016), export improves competitiveness particularly in international market penetration activity, helping to speed up engineering technology and to boost economic development.

However, economic theories also suggest that economic growth leads to export expansion. This can occur when domestic markets become well developed, for example, due to increased capital formation and technological change, which then enhances the international competitiveness of tradable goods and improves the performance of a country's export sector (Vernon, 1966 and Ghartey, 1993). Kaldor (1967) also points out that higher productivity brought about by technological improvement due to economic growth reduces unit costs and facilitates exports. Helpman& Krugman (1985) argue that export promotion and economic growth mutually reinforce in the process of economic development and therefore have a feedback relationship. Sharma &Dhakal (1994) argue that if domestic markets become too small to absorb production, producers must rely on exports when economic growth leads to rapid pace of production.

Mali is a landlocked country in West Africa and the second largest state in West Africa. The primary sector, particularly agriculture, essentially dominates Mali's economy. On the other hand, the secondary (industry) and tertiary sectors are underdeveloped. For example, in 2017, the contribution of the primary sector represented 38.34% of GDP, with a large share for agriculture (19% of GDP). In 2019, it was estimated at 38.43% of GDP. The secondary sector accounts for 19.3% of GDP, with an estimated contribution to the growth of less than one percentage point. The tertiary sector, which is the most dynamic, contributed 37.55% of GDP in 2017. Mainly dominated by trade, administrative activity, and other services, this sector was estimated to increase to 37.05% in 2019. Mali's average GDP growth is 5.3%, with an inflation rate and an unemployment rate of 2.5% and 8.1%, respectively. After the 2012 crisis, the Malian economy regained a good growth dynamic. Mali's economic growth averaged above 5.0% from 2015 to 2019. On the other hand, 2020 has been a particularly eventful year for Mali. The difficult socio-political and security situation combined with the adverse effects of the COVID-19 health crisis led to a contraction of GDP by 1.6%.

The Malian economy entered recession in 2020 under the combined effects of the pandemic, weak agricultural performance, and the socio-political crisis. This resulted in a GDP contraction of 1.6%. Real GDP rebounded slightly in 2021, with growth estimated at 3.1%, driven by the recovery of the key sectors of agriculture and services.

In terms of foreign trade, Mali mainly exports gold (more than half of the total exports), cotton, live animals, and fertilizer; it mainly imports petroleum oils, medicines, cement, and rice. Cotton and gold are the main exports and accounted for 89.6 percent of Mali's exports in 2020, while in 2019, they accounted for nearly 95.0 percent of exports.

Ranked as the leading cotton producer in Africa for several years, cotton production in Mali reached 750,000 tons in 2018 against 728,645 tons in 2017. It increased by 10.9% in 2019 to reach 771,750 tons.

Cotton is Mali's second export product. The cotton sector provides livelihoods for over four million Malians (more than a fifth of the population), and cotton accounted for 6.7% of exports in 2020. Cotton production expansion has increased Mali's foreign exchange earnings, and the country consistently ranks among the top cotton producers in Africa.

Third gold producer in Africa after South Africa and Ghana, gold is Mali's first and primary source of export earnings and represents 9.7% of GDP. The country's gold production increased from 46.5 tons in 2017 to more than 60 tons in 2018. Industrial gold production reached 65.7 tons in 2019, up 7.0% compared to 2018.

The distribution of Mali's export markets has not changed significantly since the last review. South Africa, which absorbs the bulk of Malian gold, remains the leading destination. From 2010 to 2014, it received over half of Mali's exports before dropping below that level in the case of goods.

Exports to China also declined relatively in 2015 and 2016. The European Union is the second most important destination for Malian exports, followed by Switzerland, whose share of demand increased significantly in 2015 and 2016. Other destinations remain broadly unchanged, with Senegal, Côte d'Ivoire, and Burkina Faso in the lead. On the import side, the European Union, particularly France, remains the primary source of imports, followed by Senegal, China, and the Ivory Coast.

According to IMF estimates, following the global crisis induced by COVID-19, Mali's exports fell by 16.8% in 2020, with imports declining at a slower pace (-3.1%). In 2021, the IMF expected a rebound of +16.7% for exports and +11.5% for imports, even if the situation remains volatile.

The improvement in terms of exchange that prevailed during 2019-2020, driven by a surge in the price of gold in the international market, eased in 2021. Combined with the recovery in import demand, this led to an increase in the current account deficit despite the decline in external financial flows.

This study not only aims to analyse the relationship between exports and economic growth but also to examine the validity of the hypotheses: exports led growth, growth led to export in the specific case of Mali.

1.2 Objectives of the study

The study has been taken up to fulfil the following objectives:

- To analyse the trend of exports and economic growth of Mali during the period from 1988 to 2020.
- To determine the presence of any long-run relationship between exports and economic growth of Mali
- To examine the direction of causality between economic growth and exports in Mali during the study period.
- To trace out the short-run responses of one variable due to shocks to the other variable.

1.3 Hypothesis of the study

Given the above objectives, the following hypotheses will be tested in the study:

1. There is no significant long-run relation between Exports and economic growth in the case of Mali.
2. Export does not cause economic growth in Mali
3. Economic growth does not cause export of Mali.

1.4 Methodology of the study

In order to fulfil the first objective of the study, simple time series graphs have been used and analysed.

The study's remaining objectives require applying techniques from time series econometrics. Before applying any method, it is necessary to carry out unit roots tests in the data. All data have been tested for the possible existence of any unit roots by applying Augmented Dickey-Fuller unit roots tests.

In order to fulfil the second objective, the cointegration test is applied to check the presence of any association between the two variables by using the Johansen-Juselius methodology.

The study adopts the Vector Autoregressive Model (VAR) for the third and fourth objectives. Granger Causality test is applied in the Vector Autoregression Regression (VAR) framework to determine the direction of causality between the two variables. The analysis is carried out in three steps.

Besides, Impulse Response Function is portrayed, which helps to trace the effects of a shock to one endogenous variable onto the other variables in the VAR. Variance decomposition has also been used to determine each variable's contribution in explaining other variable

The third chapter explains the methods mentioned above in more detail.

1.5 Significance of the study

The present study will be critical in the sense that this study aims to examine the specific relationship between exports and economic growth of Mali.

This study will contribute to the identification of which of two hypotheses, viz. "export-led growth" and "growth-led export", is valid for the Malian economy. Moreover, the findings of this study will allow policymakers to take and adopt appropriate economic and commercial measures or policies

1.6 Chapter Outline

The dissertation is organized into five chapters.

First chapter provides an introduction to the subject and an overview of the Malian economy and presents the objectives and the hypotheses to be tested.

Second chapter highlights the theoretical foundations related to the subject of exports and economic growth as well as a review of the relevant existing empirical literature concerning the relationship between exports and economic growth.

Third chapter point out the nature, sources, methodology and econometric tools used to conduct this study.

Fourth chapter shows through graphs the trend of exports and economic growth of Mali during the period 1988-2020, and the results resulting from the study.

Finally, the fifth chapter highlights the findings, implications and recommendations that result from the relationship between exports and economic growth in Mali over the period of this study.

CHAPTER 2
REVIEW OF LITERATURE

This chapter presents the literature review. First, a theoretical review of the theories linking exports and economic growth is provided. Secondly, an empirical review of the studies that have focused on the relationship between exports and economic growth has been presented.

2.1 Theoretical Literature

The relationship between exports and growth has been addressed from different theoretical perspectives:

2.1.1 Classical and neoclassical theories

Classical and neoclassical economists argue that international trade plays an important role in accelerating countries' economic growth. Thus, they consider international trade as an engine of economic growth.

According to the neoclassical growth theory, export expansion could stimulate economic growth by promoting specialization and raising factor productivity.

2.1.2 Vent for-surplus theory

Smith's theory was further developed by Myint (1958), as the 'vent1 for-surplus' theory and the 'productivity' theory of international trade. According to this theory, trade provides new effective demand for the output of the surplus resources which would have remained unused in the absence of trade. In other words, international trade may activate dormant or idle resources and draw them into economic activity for export production, resulting in an 'awakening of domestic resources through the creation of new wants that made people work harder and produce more products for export' (Nurkse, 1961).

2.1.3 Export-led growth theory

Export-led growth (ELG) theoretically appeared among neoclassical economists due to the success of export policies of the East Asian Tigers and free market (World Bank, 1993)

The export-led growth hypothesis (ELGH) postulates that export expansion is one of the main determinants of growth. It holds that the overall growth of countries can be generated not only by increasing the amounts of labour and capital within the economy, but also by expanding exports. According to its advocates, exports can perform as an "engine of growth".

2.1.4 Growth-led export theory

Similarly, growth economics is also an engine of export growth. This theory of growth-drove exports (GLE) conventionality has been supported by Kaldor (1964), Lancaster (1980), Krugman (1984) and Stavrinos (1987). As per them, economic growth prompts

improvement of abilities and innovation, bringing about expanded proficiency and similar benefits for the country, encouraging exports.

2.2 Review of Empirical Literature

Many Empirical studies have been done on the relationship between exports and growth:

For example, using Spearman's rank correlation, Michealy (1977) studied the relationship between exports and growth using cross-sectional data from 41 less developed countries. Michaely (1977) found a strong positive correlation between exports and GDP growth in developed countries. This study reveals that export growth drives economic growth in these countries.

By studying the relationship between exports and economic growth between 1960 and 1973, Balassa (1978) found that exports have a positive effect on economic growth.

Tyler (1981) examined the relationship between exports and economic growth using a sample of 55 middle-income developing countries from 1960-1977 and found a strong positive correlation between exports and economic growth.

Kavoussi (1984) studied the impact of export expansion on economic growth in a sample of 73 developing countries between 1960-1973. Using the correlation test, the results of this study showed that export expansion is associated with better economic performance in developing countries.

Ram (1987) analysed the relationship between export and economic growth in developing countries by using time series and cross-section data. This study suggests that the role of exports in growth seems predominantly positive.

Zhenhui Xu (1996) explored the causal relationship between exports and output by a cointegration test for 32 economies from 1960 to 1990. The results showed that among the sample of 32 developing economies, the export-led hypothesis proved for 17 countries and showed positive causality from exports to GDP growth, and ELG hypothesis was strongly supported by one-third of economies. Furthermore, nine countries proved two-way causality for exports and economic growth.

YousifKhalifa Al-Yousif (1997) investigated the relationship between exports and economic growth and applied his theoretical question to four Arab Gulf countries from 1973-93. He found a positive and significant relationship between the two variables.

Bahmani-Oskooee and Alse (1993) indicated some shortcomings in the previous studies on the causal relationship between exports and economic growth. They re-examined the relationship between export growth and economic growth in less developed countries (LDCs) by applying new methods of cointegration and error-correction models. The results showed a positive relationship between real exports and real output in LDCs. They also mentioned significant policy implications in this paper, that any export promotion strategy would contribute to economic growth in LDCs.

Lewer and Van den Berg (2003) examined a wide selection of these studies across cross-section, time series and panel techniques, using either growth of GDP or per capita GDP. The authors conclude there is a remarkable consistency in the size of the estimated coefficient despite the various measures and econometric methodologies that have been employed, suggesting that a one percentage point increase in the growth of exports increases economic growth by one-fifth percentage point, which over time can be a sizeable impact.

Vohra (2001) showed the relationship between export and growth in India, Pakistan, the Philippines, Malaysia, and Thailand for 1973 to 1993. The empirical results indicated that when a country has achieved some level of economic development, then the exports have a positive and significant impact on economic growth.

In Botswana, Sentsho (2002) tested the ELG hypothesis using annual time-series data from 1976 to 1997. Using the OLS method, he found that exports positively impact economic growth in the long run. The validity of the ELG hypothesis on 21 Sub-Saharan African countries was conducted in 2003. It has been revealed that in all those countries, exports were found to have a positive and significant effect on economic growth (Njikam, 2003)

Ismail and Harjito (2003) researched the cause and effect relationship between export and economic growth in ASEAN countries from 1966 to 2000. The research by these two scholars showed the reciprocal relationship between export and economic growth in Indonesia and Singapore.

Konya (2006) also studied the relationship between export and economic growth in 24 OECD countries from 1960 to1997.

Dritsakis et al. (2006) analysed the relationship between exports and economic growth in 3 export giants, including the European Union (EU), the USA, and Japan through the multivariate Johansen cointegration test and causality in terms of the error correction model (ECM). The results of the Johansen test confirm the long-term cointegration and bilateral causation between the exports and economic growth for the EU and USA, but no causal and cointegrating relationship was found for Japan.

Konya (2006) also studied the relationship between export and economic growth in 24 OECD countries from 1960 to 1997.

Chimobi and Uche (2010) studied the direction of causality between export and economic growth in Nigeria. They employed the Granger causality test using time series data from 1970 to 2005. The results revealed that economic growth granger causes export in the case of Nigeria.

Mishra (2011) reinvestigated the dynamics of the relationship between export and economic growth for India from 1970 to 2009. The Granger causality test has indicated a causal relationship running from GDP to export in the long run. The implication is that any increase in GDP would positively impact the growth of export. In general, India has provided evidence of growth-driven export over the sample period.

Gokmenoglu et al. (2015) empirically examined the export-led growth hypothesis's validity for Costa Rica's case from 1980 to 2013. According to the results of the study, for the period under investigation, export and economic growth have had a log-run relationship, and there has been unidirectional causality from economic growth to export

Hye (2012) looked for the relationship between exports and economic growth in the case of China from 1978 to 2009 by using the ARDL model and the modified Granger causality test. Their results support a positive bidirectional long-run relationship between exports and economic growth.

Trošt and Bojnec (2015) examined the relationship between export and economic growth in Slovenia using the quarterly data for 2001–2014. The results of the Granger causality test have shown causality from export to economic growth.

Sunde (2017) applied cointegration analysis, ARDL model, VECM model, and Granger causality tests to examine the relationship between exports and economic

growth in the case of South Africa from the period 1990-2014. Empirical results showed that exports have a positive effect on economic growth in the short and long terms.

Bakari et al. (2019a) searched the relationship between exports and economic growth in China. In order to achieve this purpose, annual data for the periods between 1960 and 2015 was tested using cointegration analysis, Vector Error Correction Model, and the Granger-Causality tests. According to the result of the analysis, exports have a positive effect on economic growth. These results prove that exports are the source of China's economic growth.

For example, in their paper, Riezman et al. (1996) used time-series data for the countries in the Summers-Heston (1991) data set to investigate the export-led growth hypothesis. They used the measure of conditional linear feedback while controlling for the growth of imports. Their findings provided modest support for the export-led growth hypothesis. Further, they found conditional import growth and a causal ordering from export growth to income growth in 30 of the 126 countries analysed.

Jung and Marshall (1985) used the granger causality test to examine the causality link between exports and economic growth in developing countries, including four African countries. Only four cases out of 37 provided support for the export-led growth hypothesis. Moreover, only 1 case (Kenya) out of 4 African countries included in the sample supported ELG.

Darrat (1986), tested the direction of causality, between exports and growth, in four countries widely believed to owe their high growth rates to export-biased policies. The four countries are Korea, Taiwan, Hong Kong, and Singapore and the period covered is 1960-1982. The results of the study do not support the export-led growth hypothesis.

Bahmani-Oskooee et al. (1993), tested the direction of causality in 20 developing countries for varying periods between the 1960's and the 1980's. The study included three countries (Korea, Taiwan, and Thailand) that are widely believed to follow exported policies. The study concluded that only Taiwan, out of these three countries, had the direction of causality from exports to growth. Korea and Thailand had a bi-directional causality. The study's overall conclusion, which attempted to test the hypothesis of export-led growth, was inconclusive.

Another example is the case of India. The empirical testing of the export-led growth thesis for 1950-1996 concluded causality between exports and growth.

Hatemi (2002) examines the causal relationship between export growth and economic growth in Japan by augmenting the Granger causality test from 1960 to 1999. The estimation result indicated a bilateral causality.

Subasat (2002) investigated the empirical linkages between exports and economic growth. The analysis suggested that more export-oriented countries, like middle-income countries, grow faster than the relatively less export-oriented countries. The study also showed that export promotion does not significantly impact economic growth for low- and high-income countries.

Mah (2005) studied the long-run causality between export and growth with the help of the significance of the error correction term, ECt-1. This study also indicated that export expansion is insufficient to explain the patterns of real economic growth.

Pazim (2009) tested the validity of the export-led growth hypothesis in three countries by using panel data analysis. It is concluded that there is no significant relationship between the size of national income and the amount of export for these

countries based on the one-way random effect model. The panel unit root test shows that the process for both GDP and Export at the first difference is not stationary, while the panel cointegration test indicates no cointegration relationship between the export and economic growth for these countries.

Ismail and Harjito (2003) researched the cause and effect relationship between export and economic growth in ASEAN countries in 1966-2000. The research by these two scholars showed the reciprocal relationship between export and economic growth in Indonesia and Singapore. Konya (2006) also studied the relationship between export and economic growth in 24 OECD countries from 1960 to1997.

Ahmad and Harnhirun (1996) investigated a causal relationship between exports and economic growth for the Association of South East Asian nations (ASEAN) member countries by employing Granger causality tests. This effort revealed that exports did not cause economic growth in the Granger sense in all member countries of ASEAN. Moreover, they found causality from economic growth to exports, supporting the hypothesis that growth led to exports instead of exports to growth.

In the case of Paraguay, after researching this country's economy for over ten years, Richards (2001) observed that the export growth rate of Paraguay was not as stable as its economic growth rate due to the entanglement in politics-related barriers.

CHAPTER 3
DATA AND METHODOLOGY

This chapter discusses the source of the data and the methodology adopted to achieve the various objectives of the study. The chapter is divided into three sections: in the first section, the nature and source of the data are discussed. The second section presents the methodology used in this study and the econometric specification of the model in the third section.

3.1 Nature and source data

The study is completely based on secondary data. This study uses annual time series data for the period ranging from 1988 to 2020 to examine the nexus between exports and the economic growth of Mali.

The main data source for the present study has been obtained from World development indicators, which is available online on the website: https://databank.worldbank.org.

The variables in the study are Exports (LnEXP) and Economic growth GDP (lnGDP) of Mali. Since variables exports and GDP are in nominal terms, variables have been converted into real terms by dividing each by consumer price Index and export value index respectively. All variables are used in logarithmic form.

3.2 Methodology of the study

The study adopts the Vector Autoregressive Model (VAR) to analyze the relationship between exports and economic growth in Mali. Granger Causality test is applied in the Vector Auto regression (VAR) framework to determine the direction of causality between the two variables. The analysis is carried out in three steps. First, the two variables LnGDP and LnEXP are tested for stationarity using the Augmented Dickey-Fuller test.

Second, the Cointegration test is applied to test the presence of any association between the two variables by using the Johansen-Jesulius methodology. Third, the Granger Causality test is performed to find the nature of causality. Besides, Impulse Response Function is portrayed, which helps to trace the effects of a shock to one endogenous variable onto the other variables in the VAR. Variance decomposition has also been used to determine each variable's contribution in explaining other variables.

3.3 Econometric model

In order to study the relationship between exports and economic growth, the following VAR model will be applied:

$$(LnGDP)_t = \sum_{i=1}^{n} \alpha(LnEXP)_{t-1} + \sum_{j=1}^{n} \beta(\text{LnGDP})_{t-1} + u_{1t}$$

$$(LnEXP)_t = \sum_{i=1}^{n} \alpha(\text{LnGDP})_{t-1} + \sum_{j=1}^{n} \beta(LnEXP)_{t-1} + u_{2t}$$

Where (LnGDP) refers to real gross domestic product and (LnEXP) real exports, the disturbances U_{1t} and U_{2t} are uncorrelated.

Econometric tools used in this study are:

3.3.1 Unit root test

The pre-requisite of a time series analysis is the stationarity of each individual time series over the sample period. The study uses the ADF unit root test to investigate the stationarity of each time series as Dickey and Fuller (1981) proposed. The Augmented Dickey-Fuller (ADF) test is used to check the presence of unit roots and determine the degree of differencing necessary to induce stationarity.

The ADF unit root test requires the estimation of the following regression:

$$X_t = \alpha + \beta\, x_{t-1} + \varepsilon_t$$

Where α is the intercept, ß is the co-efficient of lagged term, ρ is the number of lagged terms chosen to ensure that ε is white noise. The optimal lag length is chosen using the Akaike Information Criteria (AIC). Based on this estimate the hypotheses of the test are

$H_0: \rho = 1$, i.e., there is a unit root – the time series is non-stationary.

$H_1: \rho < 1$, i.e., there is no unit root – the time series is stationary.

3.3.2 Johnsen cointegration test

Cointegration analysis is used to investigate the long-term relationship between Exports and the economic growth of Mali. For this VAR based cointegration test, the methodology developed by Johansen (1988) and Johansen and Jesulius (1990) are deployed.

The variables if found to be cointegrated imply the existence of a linear, stable, and long-run relationship among variables. This means that the variables tend to move together in the steady state path in the long run. It involves two steps- "trace test" and "maximum Eigenvalue test" as follows:

(a) The trace test (λ trace) is represented as follows:

$$\text{Trace} = -T\sum_{r+1}^{n}(log\lambda i) \qquad (1)$$

In equation (1) the null hypothesis is that the cointegration vectors is r=0 as against the alternative hypothesis that the cointegration vectors $r \leq 1$.

(b) The maximum Eigen value test (λmax) is represented as follows:

$$\lambda_{max} = -T\, log(1 - \lambda_i) \qquad (2)$$

In equation (2) the null hypothesis is that the cointegration vectors r= 0 as opposed to the alternative hypothesis that the cointegration vectors r≤1. According to this

procedure based on the 'Maximum Likelihood method' and 'eigenvalue statistics', cointegration is said to exist if the values of computed statistics are significantly different from zero. The variables, if found to be cointegrated, implies the existence of a linear, stable, and long-run relationship among variables. This means that the variables tend to move together in the steady state path in the long run.

3.3.3 Granger Causality tests

Granger causality test is a useful, practical method for determining the direction of the causation between variables, and it may therefore be used in cointegration analysis when there is a lack of clear theoretical framework concerning the variables under investigation. This study uses Granger Causality Test suggested by C. W. J. Granger (1969) for testing the causality between Exports and the economic growth of Mali in the VAR framework. A time series, X, is said to Granger-cause another time series, Y if using past values of X improves the prediction of current values of Y. This can be tested by running a regression of Y on past values of Y and X. The null and alternative hypotheses of the test are:

H_0: No causal relation between exports (LnEXP) and economic growth (LnGDP)

H_1: Causality between exports (LnEXP) and economic growth (LnGDP)

The above hypothesis are tested in the context of the VAR of the following form of bivariate linear auto-regressive model of variables):

x_t(LnGDP) and y_t(LnEXP)

$$y_t = \sum_{i=1}^{n} \alpha x_{t-1} + \sum_{j=1}^{n} \beta y_{t-1} + u_{1t}$$

$$x_t = \sum_{i=1}^{n} \alpha y_{t-1} + \sum_{j=1}^{n} \beta x_{t-1} + u_{2t}$$

3.3.4 Impulse Response Function

Impulse response function shows the effects of any shock on the path adjustment of the variable in the VAR model. An Impulse Response Function traces out the effect or the response of the dependent variable in the VAR system, through time to an unanticipated change in itself or in the interrelated variables. It is studied after Granger Causality is established between the variables concerned.

3.3.5 Variance decomposition

Forecast error variance decomposition indicates the amount of information each endogenous variable contributes to the other endogenous variables in the VAR model. In other words, it explains the amount of the forecast error of each variable explained by exogenous shocks to itself and the other variables in the system. It reflects the proportion of forecast error variance of a variable explained by an unanticipated change against the other interrelated variables.

CHAPTER 4
ANALYSIS, RESULTS AND DISCUSSION

This chapter presents the results of the study and its interpretations.

The chapter is divided into two main sections: The first section presents Mali's economic growth and export trends over the period 1988-2020, and the second section highlights the study's results.

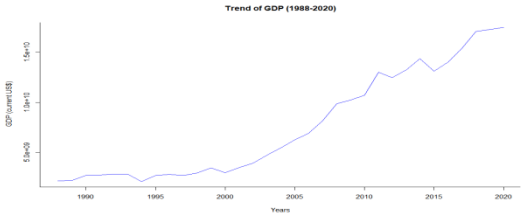
4.1 Trend of Economic growth and Exports of Mali, 1988-2020.

Figure 1 shows the trend of economic growth in Mali during the period 1988-2020. Mali experienced a substantial increase in its economic growth from 1988 to 2020. The lowest level of economic growth was estimated $2.1 billion in 1994, with an annual growth of 3.17%

Economic growth has dramatically increased over the period 2000-2010, economic growth has increased from $2.96 billion to $ 10.87 billion. This increase in economic growth is linked to the increase in primary and tertiary sector production. However, economic growth experienced a slight decline of -0.84% caused by the socio-political crisis in 2012 against 3.21% in 2011.

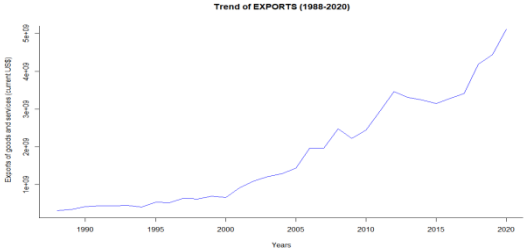
After the 2012 crisis, the Malian economy regained a good growth dynamic. Mali's economic growth averaged over 5.0% over the 2015-2019 period. Despite the recession in 2020 due to the pandemic, weak agricultural performance, and the socio-political crisis, Mali has recorded its highest level of growth and is estimated at $ 17.47 billion.

Figure 1: Trend of GDP (1988-2020)



The trend of exports of Mali during the period 1988-2020 is presented in Figure 2. Mali's exports increased considerably during 1988-2020. In 1988, exports represented 14.58% of GDP, and will represent 30% of GDP in 2020. This exponential growth in exports is explained by the reforms put in place by the Government of Mali, with the support of the International Monetary Fund and the World Bank, which has carried out several reforms to open up the economy and strengthen the role of the private sector in 1988, but also the elimination of export duties and taxes on a large number of products introduced a value-added tax (VAT) and established free zones have largely contributed. These reforms have primarily contributed to the growth of exports. The lowest level of exports was recorded in 1988 and estimated at $ 316 million. The financial crisis of 2008 also affected the growth of exports; exports experienced a fall of -11.05%. The collapse of commodity prices caused this fall of exports. The highest level of exports is observed in 2020 and is estimated at $ 5.11billion and represents 30% of GDP.

Figure 2: Trend of exports (1988-2020)



4.2 Results and Discussion

4.2.1 Descriptive statistics of the variables

Table 1 presents a summary of descriptive results on all the variables used in the study. The results show the number of observations for each variable, the mean, standard deviation, and minimum and maximum values for each of the variables in this study. As the results show in Table 1, LnGDP ranged from 21.93 to 23.50, with a mean of 22.69 and a standard deviation of 0.53. The results showed that the LnEXP ranged from 20.06 to 20. 51 with a mean of 20.33 and a standard deviation of 0.084. Results from table 1 reveal through JarqueBera statistic that lnEXP series are normally distributed. However, JarqueBera statistic indicate that LnGDP series are normally distributed.

Table 1: Descriptive statistics of the variables

Variables	**LNGDP**	**LNEXP**
Minimun	21.934624	20.059240
Maximun	23.495454	20.514587
1.Quartile	22.185460	20.281483
3.Quartile	23.198135	20.381631
Mean	22.687223	20.331588
Median	22.634123	20.317471
Sum	748.678354	670.942396
SE Mean	0.092196	0.014614
LCL Mean	22.499425	20.301821
UCL Mean	22.875021	20.361355
Variance	0.2805506	0.007048
Standard Deviation	0.529628	0.083950
JarqueBera	0.1922	0.02402
Skewness	0.107776	-0.454679
Kurtosis	-1.619915	1.819350
Observation	33	33

Source: Author's computation

4.2.2 Unit root test

The study used ADF unit root test to investigate stationarity of each time series as proposed by Dickey and Fuller. The results are shown in Table 2:

Table 2: Unit Root Test Results

Series	ADF test Statistic (3^{rd} difference)	*P*-value	Accept/Reject	Stationarity	Order of integration
LnGDP	-6.153*	0.01	Reject	Stationary	I(3)
LnEXP	-7.9573*	0.01	Reject	Stationary	I(3)

Source: Author's computation. * indicates significance at 5% level. It represents rejection of null hypothesis of unit root at 5% of the critical values.

The results of ADF unit root test show that the null hypothesis of the presence of a unit root is rejected for both the variable of study when they are transformed into their third differences. That is, both the series are stationary on third differencing. Therefore, LnGDP and LnEXP are integrated of order three, they are I (3).

4.2.3 Johnsen cointegration test

Cointegration analysis is used to investigate the long term relationship between Exports and the economic growth of Mali. The results are depicted in the following table below:

Table 3: Results of the Johansen's Test of Cointegration- Results for Exports and Economic growth (Assuming intercept (no trend)

Null hypothesis	Eigen Value	Test statistic	5% Critical value
λ trace test			
r=0	5.468976e-01	20.07	19.96*
r≤1	1.136718e-01	2.65	9.24*
λ max test			
r=0	5.468976e-01	17.42	15.67*
r≤1	1.136718e-01	2.65	9.24*

Source: Author's computation. * Implies rejection of the null hypothesis of no cointegration at 5% critical level

The results of the cointegration tests show that the null hypothesis of "no cointegration" is rejected using both trace test (λ trace) and maximum Eigen-value test ((λmax). This means that the two variables are cointergrated. It suggests the presence of a long term relationship between Exports and Economic growth.

4.2.4 VAR Lag Order Selection

One of the first steps in VAR model building and granger causality, impulse response, and variance decomposition analysis is selecting the VAR lag order. This study use lag-order selection criteria to choose the lag order, such as AIC, HQ, SC and FPE. The optimal lag length is chosen by using the Akaike Information Criteria (AIC). Based on AIC criteria, the optimal lag order is 8 to construct our VAR model.

Table 4: Results of VAR Lag Order Selection

Number lag	AIC(n)	HQ(n)	SC(n)	FPE(n)
1	-7.943387535	-7.885074314	-7.644667853	0.000356625
2	-8.3396320558	-8.2424433554	-7.8417659190	0.0002440882
3	-8.6223529989	-8.4862888184	-7.9253404074	0.0001778568
4	-8.7955731292	-8.5817579884	-7.7002676283	0.0001990314
5	-8.4785938115	-8.2259031905	-7.1841418559	0.0003431308
6	-9.8257538700	-9.5341877690	-8.332155459	0.0001318384
7	-9.8257538700	-9.5341877690	-8.3321554597	0.0001318384
8	-1.007598e+01	-9.745539e+00	-8.383236e+00	2.136076e-04

Source: Author's computation

4.2.5 Estimation of VAR model

Table 5: VAR Estimation Results

	Responsible LnGDP				LnEXP			
	Estimate	Std. Error t	T value	Pr(>|t|)	Estimate	Std. Error t	T value	Pr(>|t|)
LnGDP.1	-1.476364	0.328232	-4.498	0.00201 **	1.529e-01	1.512e-01	1.011	0.341428
LnEXP.1	0.334546	0.413478	0.809	0.44185	-1.103e+00	1.904e-01	-5.794	0.000408 ***
LnGDP.2	-1.435052	0.583338	-2.460	0.03931 *	7.799e-01	2.687e-01	2.903	0.019799 *
LnEXP.2	0.468562	0.675354	0.694	0.50745	-1.219e+00	3.110e-01	-3.919	0.004423 **
LnGDP.3	-1.290771	0.547664	-2.357	0.04618 *	5.468e-01	2.522e-01	2.168	0.062016
LnEXP.3	-0.081622	0.867747	-0.094	0.92737	-1.512e+00	3.997e-01	-3.782	0.005370 **
LnGDP.4	-1.088339	0.516178	-2.108	0.06804	3.503e-01	2.377e-01	1.474	0.178833
LnEXP.4	-0.321492	0.943937	-0.341	0.74219	-1.329e+00	4.347e-01	-3.057	0.015654 *
LnGDP.5	-0.701062	0.461237	-1.520	0.16701	3.364e-01	2.124e-01	1.584	0.151915
LnEXP.5	-0.202182	0.892196	-0.227	0.82641	-1.171e+00	4.109e-01	-2.850	0.021484 *
LnGDP.6	-0.435695	0.329980	-1.320	0.22324	2.304e-01	1.520e-01	1.516	0.167934
LnEXP.6	-0.557930	0.743948	-0.750	0.47476	-1.075e+00	3.426e-01	-3.138	0.013847 *
LnGDP.7	-0.253304	0.178169	-1.422	0.19290	3.076e-03	8.206e-02	0.037	0.971021
LnEXP.7	-0.388394	0.386719	-1.004	0.34463	-7.553e-01	1.781e-01	-4.241	0.002834 **
Const	-0.009652	0.025640	-0.376	0.71639	-4.686e-05	1.181e-02	-0.004	0.996931

Source: Author's computation. "***" " **" "*" indicates respectively significance at1% , 10% and 5%

4.2.6 Diagnostic tests

Various diagnostic tests are applied to check the efficiency of the estimated VAR model. We have used Jarque–Bera test statistic in order to check if residuals of the estimated equations of the VAR are normally distributed or not, ARCH test to check for heteroscedasticity errors, Portmanteau Test asymptotic for testing the presence of serial correlation in the error terms, Cumulative Sum (CUSUM) test for testing the stability of the model.

Results from table 6 reveal that the model is found to have any problem of serial correlation, there are no heteroscedasticity issues and residuals of the model are normally distributed.

Table 6: Results of Diagnostic test of VAR model

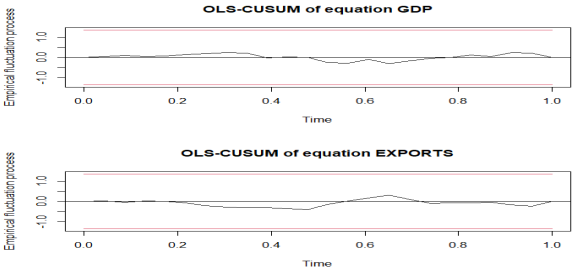
Test	Chi-squared	df	probability
Serial correlation test. (Portmanteau Test asymptotic)	36.274	36	0.4559*
ARCH test of heteroscedasticity	45.646	45	0.4451*
Normality Test	3.5723	4	0.467*

Source: Author's computation. * indicates significance at 5% level

Besides, figure 3 indicate a Graphical presentation of the cumulative sum (CUSUM) that shows the stability of the model within the sample period of 1988-2020.

Figure 3: OLS –CUSUM of Exports and Economic Growth.

4.2.7 Granger Causality tests.



To find out the direction of the causation between variables, the Granger Causality test has been used to determine the direction of the causation between exports and the economic growth of Mali. Table 7 shows the results of the Granger causality test.

Table 7: Results of Granger Causality test

Nullhypothesis	F-Test	p-value	Granger causality
EXP does not cause GDP	0.93284	0.5083*	No causality EXP → GDP
GDP does not cause EXP	4.3268	0.007263*	unidirectional causality GDP → EXP

Source: Author's computation. *indicates significant at 5%

The test result suggests a lag order of 8 as optimal lag based on the Akaike information criterion. The null hypothesis 'LnGDP do not granger-cause LnEXP' is rejected at a 5% significance level. However, there is no evidence of causation from LnEXP to LnGDP as

the null hypothesis cannot be rejected. Thus, the results suggest a unidirectional causal linkage between exports and economic growth. The nature of the causal relationship may be stated as Economic growth (LnGDP) causes Exports (LnEXP).

4.2.8 Impulse Response Function

Impulse Response Function traces out the response of the dependent variable in the VAR system to shocks in the error terms. The Impulse Response Function is presented through figures:

Figure 4 present the impulses of GDP in response to the shock in Exports: Impulse response from GDP has a positive effect on exports by increasing export at t=2 and decreasing considerably until t =4. After t=4 exports fluctuate by increasing and decreasing until t=10, after t=10, exports gradually increase.

Figure 4: impulse Response from LnGDP to LnEXP

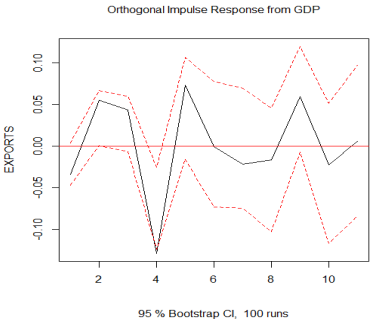
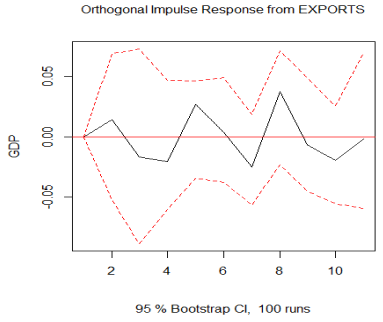


Figure 5 presents the impulses of Exports in response to the shock in GDP: The impulse response of exports has a positive effect on economic growth by causing a rise in GDP at t=2 and decline at t=4 then fluctuates by increasing and decreasing until t =10. After t=10, GDP increase considerably.

Figure 5: Impulse Response from lnEXP to LnGDP



4.2.9 Variance decomposition

Table 8 displays variance decomposition of the exports variable. In the second period, 48.79% of forecast error variance is explained by exports, whereas 51.20% has been explained by GDP on exports. GDP shock has much influence on export in the short run, as evidenced by the results. However, in period 3, the proportion of variation in

exports explained by its shock is 39, 58% and declined to 12, 73% in the 10th period. Therefore, the forecast error variance decomposition confirms the significant importance of economic growth in explaining variations in exports of Mali.

Figure 6: Forecast error variance decomposition for Export (LnExP)

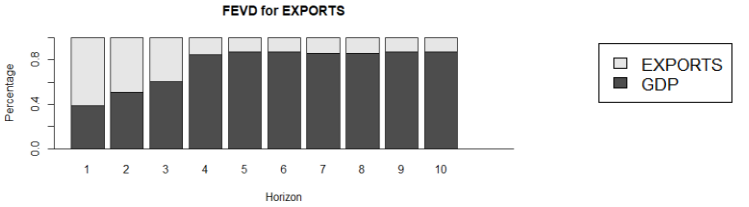


Table 8: Variance decomposition of Exports (LnEXP)

Period	LnGDP	lnEXP
1	0.3874205	0.6125795
2	0.5120228	0.4879772
3	0.6041641	0.3958359
4	0.8493010	0.1506990
5	0.8738680	0.1261320
6	0.8709135	0.1290865
7	0.8588167	0.1411833
8	0.8599232	0.1400768
9	0.8733954	0.1266046
10	0.8727332	0.1272668

Source: Author's computation.

Table 9 show the variance decomposition of the economic growth variable. In period 1, GDP has 100% of forecast error variance caused by GDP itself but exports does not influence GDP. In the second period, 99.58% of forecast error variance is explained by GDP itself, whereas exports on GDP explain 0,42%. Exports shock has less influence in GDP in the short run. However, in the long run, in period 4, the proportion of variation in GDP explained by its shock is 98, 52% and declined to 94, 99% in the 10th period.

Figure 7: Forecast error variance decomposition for GDP (LnGDP)

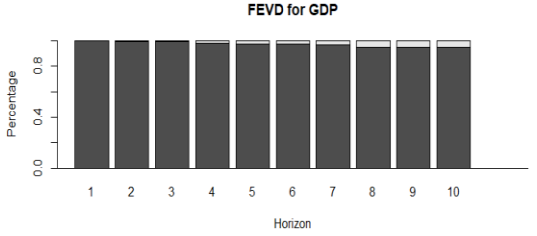


Table 9: Variance decomposition of GDP (LnGDP)

Period	LnGDP	lnEXP
1	1.0000000	0.000000000
2	0.9958289	0.004171123
3	0.9919773	0.008022712
4	0.9851759	0.014824104
5	0.9750944	0.024905559
6	0.9750247	0.024975315
7	0.9674701	0.032529929

8	0.9508157	0.049184347
9	0.9504023	0.049597695
10	0.9498858	0.050114240

Source: Author's computation.

CHAPTER 5
CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

5.1 Conclusion

This study aimed to analyse the causal relationship between exports and economic growth in Mali over the period of 1988-2020 in a VAR framework. ADF-test, Johansen cointegration analysis, VAR model, Granger causality test, impulse response, and variance decomposition were used to determine the relationship between exports and economic growth proxied by GDP of Mali. As a result of a stationary test, it was determined that all the variables were stationary at their third difference. The Johansen cointegration test reveals the presence of a long run relationship between exports and economic growth of Mali. Estimation of model show export negatively impact economic growth but is not statistically significant.

Moreover, the empirical analysis through the Granger causality test shows unidirectional causality from economic growth to exports in Mali. In other words, increasing economic growth led to the export growth of Mali. This result confirms the validity of the growth-led export hypothesis in the case of Malian economy. Further,impulse response and variance decomposition indicate that economic growth generates significant responses and contributes to variations in Mali's exports.

5.2 Limitations and Suggestions for Further Research of study.

The data collected for this study covers from 1988 to 2020, the minimum sample period required for the time series analysis. However, a larger sample size would be desired for other interpretations related to the issue examined in this study. In addition, this study focused only on the export relationship and Mali's economic growth. However, it is suggested that economic policies at the national, regional, and international levels should consider this study's limitations and conclusions.

5.3 Implications and Recommendations

This study not only reveals that exports have a negative impact on economic growth but also shows that economic growth led to increased export in the Malian economy.

The negative impact of exports on economic growth is explained by the nature of export products which are essentially made up of primary goods and are highly dependent on the price of the international market.

Moreover, the results of the study prove that Mali is not a country of export-oriented industrialization like that of the "Asian Tigers" whose international trade strategy is based on an export-oriented policy.

It is therefore appropriate, in the light of the results of this study, that policymakers adopt a policy of import substitution in order to promote the production of manufactured goods, industrial development, the reduction of the chronic deficit of the trade balance, and above all the economic growth in order to have a significant impact on export growth.

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APPENDIX A: STUDY RAW DATA

Years	REAL GDP	REAL EXPORT	LNGDP	LNEXPORT
1988	4124092248	811655751	22.14011	20.51459
1989	4151580564	768962363	22.14675	20.46055
1990	5072514811	644195524	22.3471	20.28351
1991	5061099099	778826617	22.34485	20.4733
1992	5609294769	710607412	22.44769	20.38163
1993	5599520662	514774664	22.44595	20.05924
1994	3358041674	665322441	21.93462	20.31578
1995	3848179869	654252093	22.07087	20.299
1996	3701519514	660430770	22.03201	20.3084
1997	3603662680	624298789	22.00522	20.25214
1998	3750576363	608413614	22.04518	20.22637
1999	4472642838	665057078	22.22125	20.31538
2000	3875906461	665698178	22.07805	20.31635
2001	4315418458	686024474	22.18546	20.34642
2002	4629647172	684490613	22.25575	20.34419
2003	5660575906	713421363	22.45679	20.38558
2004	6758883010	720804461	22.63412	20.39588
2005	7276367302	710991443	22.7079	20.38217
2006	7920911360	690310293	22.79277	20.35265
2007	9225131189	689885843	22.9452	20.35204
2008	1.02E+10	642888914	23.04493	20.28148
2009	1.03E+10	682673601	23.05982	20.34153
2010	1.07E+10	666446572	23.0925	20.31747
2011	1.26E+10	677846493	23.25871	20.33443
2012	1.15E+10	723614269	23.16336	20.39977
2013	1.23E+10	769612591	23.23181	20.4614
2014	1.32E+10	636137726	23.30435	20.27093
2015	1.19E+10	632096499	23.19813	20.26455
2016	1.29E+10	634097252	23.28424	20.26771
2017	1.39E+10	642304428	23.35801	20.28057
2018	1.54E+10	636654629	23.46026	20.27174
2019	1.59E+10	658685432	23.48917	20.30576
2020	1.60E+10	709366247	23.49545	20.37988

ABREVIATION

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criteria
ARCH	Autoregressive conditional heteroscedasticity
ARDL	Autoregressive distributed lag
CUSUM	Cumulative Sum
ECM:	Error correction model
ECT	Error correction term
EXP	Exports
ELG	Export-led growth
FEVD	Forecast error variance decomposition
FPE	Final Prediction Error
GDP	Gross Domestic Product
GLE	Growth-Led- Exports
HQ	Hannan-Quinn
IRF	Impluse Response Function
LnEXP	Logarithm of exports
LnGDP	Logarithm of Gross Domestic Product
OLS	Ordinary Least Squares
OLS –CUSUM	Ordinary least squares Cumulative Sum
SC	Schwartz Criterion
VAR	Vector Autoregressive
VECM	Vector Error Correction Model

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