

Full Length Research Paper

## Exports and economic growth in Togo

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The pursuit of high and sustained economic growth is one of the major concerns of States, especially those in the process of developing their economic development. Thus, in the pursuit of economic growth, several studies have often been conducted on a number of macroeconomic policies for the determination of sources of growth. The objective of this paper is to evaluate the impact of exports on the growth of the Togolese economy. As a result of the empirical evaluation, the findings show a positive and significant impact of exports on the Togolese economic growth in the short and long run. In the short run, the change in the exports per capita growth rate as well as the public expenditure per capita growth rate has positive and significant coefficients at the 5% threshold. In the long run, the coefficients of the exports per capita growth rate, of the public expenditure per capita growth rate are positive and significant at the 5% also. On the other hand, in order to determine the impact of economic growth on exports, the results show a positive and significant impact of exports on the Togolese economic growth in the short and long run. Thus, in the short run, changes in the GDP per capita growth rate, the capital per capita growth rate, the effect of devaluation and the shared of credit granted to the private sector have positive and significant coefficients at the threshold by 5% and in the long run, the coefficients of the GDP per capita growth rate, the capital per capita growth rate, the effect of devaluation are positive and significant.

**Key words:** Exports, economic growth.

### INTRODUCTION

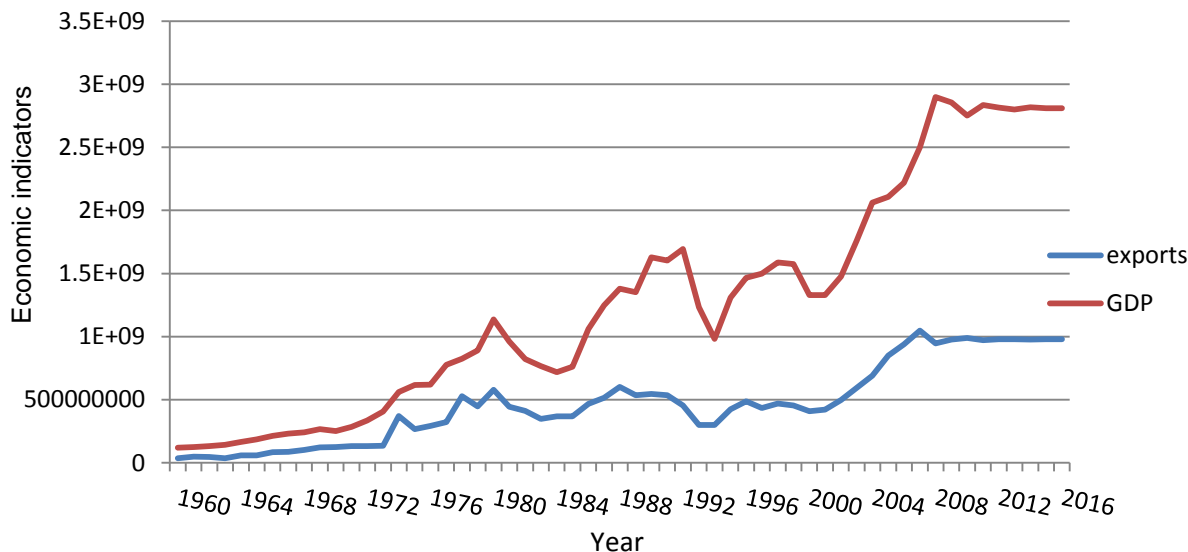
The pursuit of the high and the sustained economic growth is one of the major concerns of States, especially the developing countries to achieve their economic development. Thus, in the pursuit of the economic growth, several studies have often been carried out on a number of macroeconomic policies in order to identify sources of growth, notably fiscal policy, monetary policy, the policy of foreign direct investment promoting and the policy of

foreign trade liberalization. Consequently, research has been carried out on the relationship between exports and economic growth in view of the importance of exports in different economies (Pettinger, 2013; Jarreau et Poncet, 2012, Sheridan et al. 2012; Aljarrah, 2008; Kemal et al., 2002; Abdulai and Jacquet, 2002; Awokuse, 2005; Awokuse, 2003; Demirhan and Akcay, 2005; Ahmad, 2001; Jordaan and Eita, 2007; Din, 2004; Afzal, 2006;

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**Figure 1.** Evolution of exports and GDP from 1960 to 2016. Source: Author; Construction from World development indicators 2016.

Shirazi and Manap, 2004). (Figure 1). A study conducted in Togo by Johnson in 2006 concluded that there is a circular relationship between these two aggregates despite the absence of cointegration between exports and economic growth. Moreover, it shows that there is no cointegration between labor input, exports, public expenditure and economic growth. The same study carried out by Ribeiro (2001) on the Portuguese economy based on the hypothesis of economic growth driven by exports did not lead to any causal relationship between the variables defined in this economy, in particular between exports and economic growth. Previous studies on the relationship between exports and economic growth in Togo have existed for some thirty years and remained restrictive on the substance, which is restrictive because of the number of variables selected and the number of years chosen. In addition to the aforementioned elements, there are mixed results in literature, which leads us to question the hypothesis of exports as an engine of economic growth specifically in the Togolese case, while pointing out the importance of exports to the economic growth of the country. The contribution of this study is empirical and aims to enrich the literature on the role of exports in the economy of a country. In particular, it makes it possible to give guides to the Togolese government on the importance of exports and the ways of improving the actions of exports on the growth of the country. Moreover, the objective of this paper is to evaluate the impact of exports on the economic growth of Togo. Specifically, the objectives are to:

- i) Verify the existence of a relationship between exports and economic growth in Togo;
- ii) Determine the relationship between exports and growth.

The assumptions used in our study are twofold: first, exports have a positive effect on economic growth, and second, the sectoral orientation of exports has disagreements over the country's economic growth.

## THEORETICAL FRAMEWORK

The starting point of debates on the relationship between economic performance and exports is due to the work of the fathers of economic thought. The role of international trade in economic development has been an issue and continues to shed much light. The argument about the role of exports as one of the determinants of economic growth is not new. This has emerged in the economic theories of the classics as Adam Smith and David Ricardo, for whom international trade plays an important role in economic growth, especially the existence of economic gains from specialization. It is also recognized that exports bring gains to certain economies that cannot produce the good and are forced to import. The export-led economic growth paradigm has received particular attention following the success of the countries of South East Asia, which have adopted the export-led economic growth strategy during the 1970s and 1980s, if this is compared to the failure of alternative import policies adopted by several African and Latin American countries during certain years. Classical economists like Adam Smith and David Ricardo in their works emphasizing the importance of international trade for a country in its economic development, argue that a country can greatly benefit if Specializes in the production and export of certain products to other foreign countries which are at a disadvantage in the endowment of certain products. In his book "The Wealth of Nations", Adam Smith

proposes that a country may specialize in the production and export of products in which it has an absolute advantage. The concept of absolute advantage can be explained by input coefficients. The input coefficients represent the amount of time or labor required to produce a unit of output. Considering two countries A and B, country A will have an absolute advantage if:  $a_{LX} < b_{LX}$  where  $a_{LX}$  is the input coefficient for output of product X in country A and  $b_{LX}$  is the input coefficient for production of Product X in country B (Yarbrough and Yarbrough, 2002). Further on, David Ricardo elaborates the concept of comparative advantage. In his book "The Principle of Political Economy," Ricardo introduces the general concept of comparative advantage. According to him, a country gains in trade by exporting products and services in which it has a comparative advantage in productivity. And considering two countries A and B: country A will have a comparative advantage if  $a_{LX} / a_{LY} < b_{LX} / b_{LY}$  where  $a_{LY}$  is the input coefficient for production of product Y in country A, and  $b_{LY}$  is the coefficient of input for the production of product Y in country B (Yarbrough and Yarbrough, 2002).

Moreover, with the development of economic thought, several shortcomings have been detected in the classical theory of international trade. On the frontline of imperfections is the failure to take into account the deterioration in terms of trade, which has become the main focus of trade between developing and developed countries. As Cypher and Dietz (1998) noted in their criticisms: "especially for the poor, developing countries, we found that the generalized argument in favor of the free trade policy coming from the classical theory on trade cannot be accepted once the long-term historical trend of the terms of trade is taken into consideration". Secondly, it is not possible to predetermine an area of the country in which it will have its comparative advantage. As a result, many developing countries face serious difficulties in finding their place on the world market. The finding was reported by Hausmann and Rodrick (2002). According to them, the economic development of developing countries can become an attempt and an erroneous process to discover their own strength in global competition.

The assumption of export-led economic growth is based on the idea that increased output in the export goods sector generates static and dynamic economies of scale, particularly in the manufacturing sector, production costs are transmitted to the economy as a whole to give a higher rate of growth. These productivity gains can occur at the level of products, plants or companies. From this perspective, the stimulation of exports can replace import substitution and public investment as a driver of growth.

The Heckscher-Ohlin-Samuelson (HOS) model, with its restrictive assumptions of constant yields and identical production functions across countries, neglects dynamic productivity gains from expanding exports, although relative resource allocations and favorable relative prices for factors of production and goods raise general welfare through international trade. What are taken into account

are the expansion of the most productive sectors and the replacement of imports by the less productive sectors. When several factors of production are mobile from one economy to another, however, the supply of factors is less constraining for growth, although relative prices continue to influence the internal allocation of resources and flow business. In this context, the Ricardian model or its modern version of intra-industrial trade or industrial organization makes it easier to identify the contribution of exports to a country's economic growth.

In this model, the conditions of production for the same product vary from one economy to another, and the same is true for labor productivity, so that any event that can favorably influence the production conditions is likely to raise productivity, lower production costs and stimulate growth. In particular, the expansion of markets forces companies to adopt efficient techniques of production and to differentiate their products so that trade intensifies within each industry. Lowering production costs and differentiating products then become the determinants of international trade and the sources of economic growth. In such a dynamic perspective, each firm has a comparative advantage in producing a certain product and the liberalization of trade gives rise to intra-industrial rather than inter-industrial specialization as predicted by the HOS model. Exports contribute to raising the productivity of the economy as a whole and to maintaining economic growth. Economic growth depends on an "export" effect.

In addition, several other empirical studies have identified the relationship between exports and economic growth. Alkhateeb et al. (2016) investigated the relationship between exports and economic growth in case of Saudi Arabia. The study uses the most efficient unit root, cointegration and causality tests to find the true relationships between exports and economic growth. They found the long-run cointegration relationships in their export-growth model. Further, they have found feed-back effect in export-growth relationships and suggest the further export-promotion to foster economic growth in Saudi Arabia. Other similar studies have been conducted by other researchers (Ucan et al., 2016; Mahmoodi and Mahmoodi, 2016; Albiman et al., 2016; Bakari and Mabrouki, 2016).

Sheridan et al. (2012) investigates the relationship between disaggregated exports and growth to address why many developing countries rely on primary goods as their main source of export income when evidence suggests they could earn higher returns by exporting manufactured goods. Using regression tree analysis, he finds that although increasing manufacturing exports is important for sustained economic growth, this relationship only holds once a threshold level of development is reached. The results imply that a country needs a minimum level of education before it is beneficial to transition from a reliance on primary exports to manufacturing exports. In the same way, Saleem and Sial (2015) investigates the exports-growth nexus using annual

time series data for the period 1973-2013 for Pakistan. The empirical results show that real exports, real gross fixed capital formation, human capital, and real GDP are cointegrated when real GDP, real exports and real gross fixed capital formation are the explained variables. The short-run and the long-run coefficients conform to theoretical anticipation and demonstrate that exports, human capital and capital formation have a substantial and positive effect on GDP growth of Pakistan. Many others studies examined the relationship between export growth and GDP growth and found the presence of cointegration between these two variables (Hye and Siddiqui, 2011; Abbas, 2012).

Kilavuz and Topcu (2012) tested the effect of different classifications of export and import on economic growth in 22 developing countries in the 1998–2006 period, the findings revealed that only high-tech manufacturing industry export, investment and low-tech manufacturing industry import have a positive and significant effect on growth.

## METHODOLOGICAL APPROACH

To analyze empirically the impact of exports on the growth of the Togolese economy, we start from an increased production function of exports. This model is inspired by the work of Amadou (2009), Keong et al. (2002) explaining economic growth as a function of exports and a number of variables. Nevertheless, our work takes into account a number of variables that may influence the relationship between exports and economic growth in the country. However, some variables have been added and others have been withdrawn, taking into account their necessity in explaining the realities of the country.

### Model to be estimated

The model used is based on a production function whose general form is:

$$Y = F(K, L, X) \quad (1)$$

Let Y be the global production, K capital, L labor, and X exports. Exports are not part of the production function but their incorporation makes it possible to take into account international and national factors that affect the output but are not captured by the factors K and L. By dividing (1) by L, we obtain the output per capita (y) as a function of capital, of exports per capita (k and x respectively):

$$y = f(k, x) \quad (2)$$

The differentiation of the Equation (2) gives:

$$dy = y_k dk + y_x dx \quad (3)$$

Where  $y_i$  denotes the partial derivative of y in relation to the factor i (with  $i = k, x$ ).

By dividing the two members of the Equation 3 by y, we obtain:

$$dy/y = y_k/y \cdot dk + y_x/y \cdot dx \quad (4)$$

Equation 4 can be rewritten as follows:

$$\frac{dy}{y} = y_k \cdot \frac{dk}{k} + y_x \cdot \frac{dx}{x} \quad (5)$$

$\frac{dy}{y}$ ,  $\frac{dk}{k}$ ,  $\frac{dx}{x}$ , represent respectively the growth rates of output per capita, capital per capita and exports per capita.  $y_k \cdot \frac{dk}{k}$ ,  $y_x \cdot \frac{dx}{x}$  Are respectively the elasticities of y in relation to k and x.

By written:

$$\dot{y} = \frac{dy}{y}, \dot{k} = \frac{dk}{k}, \dot{x} = \frac{dx}{x} \quad \text{et } b_1 = y_k \cdot \frac{k}{y}, \quad b_2 = y_x \cdot \frac{x}{y}$$

Equation 5 becomes:

$$\dot{y} = b_1 \dot{k} + b_2 \dot{x} \quad (6)$$

By adding a constant and a random term, we obtain the following equation which can be estimated:

$$\dot{y}_t = b_0 + b_1 \dot{k}_t + b_2 \dot{x}_t + \mu_t \quad (7)$$

$b_0$  represents the constant,  $\mu_t$  the random term,  $b_1$ ,  $b_2$  the parameters to be estimated and t the whether.

To take into account the specificities of the country, we will add the devaluation which will be a variable dummy (mute) to capture its effect when it took place in 1994 as well as the growth rate of public expenditure per capita and the share of credit granted to the private sector.

Thereafter the final equation is written:

$$\dot{y}_t = b_0 + b_1 \dot{k}_t + b_2 \dot{x}_t + b_3 \dot{g}_t + b_4 dev + b_5 pcsp + \mu_t \quad (8)$$

Theoretically, the signs of  $b_1$ ,  $b_2$ ,  $b_3$ ,  $b_4$  and  $b_5$  should be positive, as an increase in the capital stock, an increase in exports, an increase in public expenditure, devaluation to boost exports, and the share of credit to the private sector should have a positive effect on real GDP growth per capita.

$\dot{y}$  : The GDP growth rate per capita

$\dot{k}$  : The capital growth rate per capita

$\dot{x}$  : The exports growth rate per capita

$\dot{g}$  : The public expenditure growth rate per capita

$dev$  : The devaluation effect

$Pcsp$  : The share of credit granted to the private sector.

## Variables definition

### Economic growth rate

In this study, the dependent or explained variable is economic growth, which is defined as the real change in gross domestic product. Here the rate used will be the growth rate of GDP per capita.

### Capital

The gross capital formation here represents an indicator essentially measuring the material investment for a given year. It consists in the formation of physical capital, represented by the productive equipment that grows in the factory park, machinery and equipment used by businesses and farmers. For a given firm, the increase in the capital stock caused by the purchase of durable goods could encourage entrepreneurs to increase labor power in order to maximize their output. According to neoclassical theory, the increase in the capital inputs allows the increase output. Therefore, the increase in the capital stock can have a positive impact on economic growth.

**Exports**

In our study we use the growth rate of exports per capita. According to the literature, the expansion of exports has a significant catalytic effect in improving productivity growth. Balassa (1985), in his work, showed that in general, the production of export goods focuses on economic sectors which are already much more efficient. Consequently, the expansion of exports makes it possible to concentrate investments in this sector. Moreover, export growth may also be constrained by trade with the outside world, taking into account capital goods that can be imported to increase economic growth.

**Public spending**

According to the work of Al-Yousif (1997), by Jonhson (2006), public spending is not an argument of the production function but their importance is important for a better specification of the model.

**Devaluation**

According to the theory of devaluation which can be explained by the graph of the curve in J, when the trade balance is degraded thus causing the deterioration of the current account, devaluation makes it possible to restart exports and hence economic growth. Thus, according to the theory of short-term devaluation, devaluation accentuates the deterioration of the trade balance through the price effect and in the long run an improvement in the trade balance, exports and hence economic growth by the bias of the quantity effect.

**Share of credit granted to the private sector**

As the private sector is mainly engaged in for-profit activities, the increase in credit to this sector will allow the development of its activities and therefore a positive impact on growth.

**Econometric treatment**

**Data source**

The data used for the estimates are annual. They come from the World Bank's databases (World development indicator 2015). The period covered is from 1961 to 2014.

**Estimation technique**

Since the series are temporal, we first run the stationarity tests on the different variables to detect the presence or absence of unit roots before making the estimates. We will also use the Johansen co-integration test as well as an error-correcting model to verify the short and long term relationships between exports and the growth of the Togolese economy.

**Stationarity and cointegration tests**

Since our study uses variables whose data are in the form of a time series, it is necessary to ascertain their stationarity, hence the necessity of performing stationarity tests to determine the degree of integration of variables, among the various tests of verification of stationarity that exist. Our study retained the Augmented

Dickey-Fuller Unit Root Test (Dickey and Fuller, 1981) and Phillips-Perron (PP) (Phillips and Perron, 1988).

**Stationarity test (Appendix 1)**

The time series used are often influenced by the time and the econometric results are sometimes biased. This requires verification of their stationarity. A series is stationary if its characteristics (mean, variance and covariance) are independent of time.

According to the tests, the GDP growth rate per capita, the exports growth rate per capita, the public expenditure growth rate per capita are stationary to level, means order 0, on the other hand, the growth rate of capital per capita, as well as the share of credit granted to the private sector, are stationary first-order, that is, integrated first-order series. If there is a long run relationship we use the Johansen cointegration test for possible use of the error correction model (ECM).

**Johansen cointegration test (Appendix 2)**

The advantage of this test lies in the fact that it can be used in all the cases (same order of integration of the different series or integration orders). Unlike that of Johansen, the cointegration test of Engle and Granger requires that all variables be of the same order of integration, hence the choice of the cointegration test of Johansen. In this test, the null hypothesis refers to the absence of cointegration relation. If this null hypothesis is rejected, we test the null hypothesis of the presence of at most one cointegration relation and so on. Once the null hypothesis is accepted, the process stops.

According to the results there are at most three cointegration relationships. This leads us to write the error-correction model. The error-correction model given the possibility of having a cointegration relation, we will use the Hendry error correction model which is written as follows:

$$\begin{aligned} \Delta y_t = & b_0 + b_1 \Delta k_t + b_2 \Delta x_t + b_3 \Delta g_t + b_4 \Delta dev_t + b_5 \Delta pcsp_t + b_6 y_{t-1} + \\ & b_7 k_{t-1} + b_8 x_{t-1} + b_9 g_{t-1} + b_{10} dev_{t-1} + b_{11} pcsp_{t-1} + \mu_t \end{aligned} \tag{9}$$

D: represents the first difference operator defined by:  
 $D(X_t) = X_t - X_{t-1}$

The coefficients  $b_1, b_2, b_3, b_4, b_5$  represent the short run dynamics and the coefficients  $b_7, b_8, b_9, b_{10}, b_{11}$  characterize the long run equilibrium. The coefficient  $b_6$  is the correction coefficient of error, it must be less than unity and negative and above all significant. The error correction coefficient indicates the rate of adjustment of the endogenous variable  $y_t$  to return to the long run equilibrium following a shock. The coefficient  $b_0$  represents the constant of the model.

$y_{t-1}$ : represents the growth rate of GDP per head delayed by a period  
 $b_1, b_2, b_3, b_4, b_5$ : represent the short-run elasticities.  
 $-b_7/b_6, -b_8/b_6, -b_9/b_6, -b_{10}/b_6, -b_{11}/b_6$ : represent long-run elasticities.

The estimate of the error correction model (9) gives the Table in Appendix 3, the results of which will be used to analyze the global significance of the model, the autocorrelation of the errors, and then the economic interpretation of the coefficients.

**RESULTS AND INTERPRETATION**

According to the results, the value of  $R^2$  is 0.968220, which

means that the GDP per capita growth rate is more than 96% explained by the model. Fisher's statistic has a zero probability which means that the model is globally significant. The Durbin's h-test is less than 1.65 ( $|h| < 1.65$ ), hence a lack of autocorrelation of errors. As for the White test (Appendix 4), the probability values being greater than 5%, we accept  $H_0$ , that is, the homoscedasticity of the errors. Moreover, for the stability tests of Cusum and Cusum squared, the graphs (Appendix 5) are not removed from the corridor, so the coefficients are stable over time. For the Ramsey test (Appendix 6), the probability values being greater than 5%, the model is globally well specified.

The restoring force is negative and significant, which justifies the use of the error correction model. It measures the rate of adjustment of the per capita GDP growth rate to return to long run equilibrium following a shock.

In the short term, the change in the growth rate of exports per capita and the growth rate of public expenditure per capita have positive and significant coefficients at the 5% threshold, but the change in the capital growth per capita rate has a coefficient negative but not significant. On the other hand, in the short term, the effect of devaluation has a negative but not significant coefficient, also the change in the shared of credit granted to the private sector has a negative and significant coefficient at the 5% threshold. It can therefore be deduced that in the short term an increase in exports and public expenditure positively affects Togolese economic growth. An increase in exports of 1%, for example, would lead to an increase in the economic growth rate of 0.20%. And an increase in public expenditure of 1% would lead to an economic growth rate of 0.58%. In the long run, the coefficients of the growth rate of exports per capita, of the growth rate of public expenditure per capita, are positive and significant at the 5% threshold compared with the growth rate of capital per capita, the devaluation are positive but not significant. On the other hand, the coefficient of the shared of credit granted to the private sector is negative but not significant. In the long run, an increase in exports of 1% would lead to an increase in economic growth of 0.09% ( $b_8/b_6 = 0.110653/1.135342$ ). As a result of this empirical evaluation, the findings show a positive and significant impact of exports on Togolese economic growth in the short and long run, otherwise exports have a significant impact on economic growth in the short and long run. Those results mentioned support the results obtained by Kpemoua (2016) which indicate that the impact of exports on economic growth in the long-run is positive and significant at 1% level for the Togolese economy and exports cause economic growth according to Toda and Yamamoto. Conversely, the question that arises is what will be the impact of economic growth on exports? to attempt to answer this question, we will estimate a new model for error correction of exports as a function of GDP since there is a cointegration relation. According to the results, the value of  $R^2$  is 0.942245, which

means that the growth rate of GDP per capita is explained at more than 94% by the model. Fisher's statistic has a zero probability which means that the model is globally significant. The Durbin-Watson statistic is substantially equal to two (2.32), hence a lack of autocorrelation of the errors.

The return force is less than unity, negative and significant, which justifies the use of the error correction model. It measures the rate of adjustment of the growth rate of exports per capita to return to the long run equilibrium following a shock.

In the short run, changes in the GDP growth rate per capita, capital growth rate per capita, the effect of devaluation, and the shared of credit granted to the private sector have positive and significant coefficients at the threshold of 5%. On the other hand, the coefficient of variation in the growth rate of public expenditure per capita is negative and significant at the 5% threshold.

It can therefore be deduced that, in the short run, an increase in the rate of economic growth, capital, and the shared of credit granted to the private sector affects the country's exports positively. An increase in the rate of economic growth of 1%, for example, would lead to an increase in the growth rate of exports of 3.49%. A capital increase of 1% would lead to an export growth rate of 2.05%.

In the long run, the coefficients of the GDP growth rate per capita, the capital growth rate per capita, and the devaluation effect are positive, but note that the growth rate of GDP per capita is significant at the threshold By 5%, while those of the capital growth rate per capita and the effect and devaluation are insignificant. Also the coefficients of the public expenditure per capita and the shared of credit granted to the private sector are negative, but that of the growth rate of public expenditure is significant at the 5% threshold while that of the shared of credit granted to the private sector is not significant.

In the long run, an increase of the rate of economic growth of 1% leads an increase of the rate of exports growth per capita of 5.37% ( $b_8/b_6 = 4.347909/0.808839$ ).

As the result of this empirical assessment, the findings point to a positive and significant impact of exports on Togolese economic growth in the short and long run. Also short run and long run economic growth has a positive and significant impact on export growth.

## Conclusion

In view of the results obtained, it appears that in the short and long run, exports have a positive and significant impact on the Togolese economic growth, in the same way in the short run and in the long run economic growth has a positive and significant impact on export growth.

The main objective of this study is to determine the impact of exports on the growth of the Togolese economy. As a consequence of this objective, it is important to

propose ways and means to increase and improve the action of exports on the growth of the Togolese economy. Thus three solutions can be advanced namely:

First, let us note that in the first case, in the short run, the devaluation had a non-significant and long run negative effect a non-significant positive effect and in the second case in the short run, the devaluation had a positive and significant and long run effect. The devaluation had a non-significant positive effect. This policy did not produce expected effects to cause unfulfilled conditions, notably the deficit worsening in a first due to the price effect, subsequently the country's condition must be improved by the quantity effect, That is to say the supply but unfortunately this did not follow. Also note the unavailability of resources on the spot for production which aggravates the situation of the country because of its imports.

Second, sustained economic growth requires not only an increase in exports, but also the existence of close links between it and investment so that imported equipment, raw materials and inputs are used effectively and contribute to a constant improvement in the productivity of labor in the economy as a whole. For Togo, this condition is particularly important in order to be able to devote a little more financial resources to investment, and to focus on local entrepreneurship which is not very developed.

Thirdly, there is a need to increase the processing capacity of primary commodities and diversify exports from primary to manufactured products in order to achieve sustainable growth. The diversification of exports can then help stabilize export earnings and long run economic growth.

Let us note, however, that our study has limits both in terms of substance and space: in substance, because it deals only with exports in their globalities, to say that they can be split into primary and manufactured products or more far on each primary and manufactured product especially the main exported. And in space, because it concerns only one country, Togo, while the results would have been more interesting if the study had been conducted on the WAEMU zone, or all the countries of the franc zone, notably WAEMU and CEMAC. All these stated limits constitute avenues for further research on the same subject.

## CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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## APPENDICES

## Appendix 1. Stationarity test of Dickey Fuller.

Series	Dickey Fuller's test				Phillips Perron's test			
	Level			First Difference	Level			First Difference
	TS	DS avec dérive	DS sans dérive		TS	DS avec dérive	DS sans dérive	
Pib	-5.682934 (-3.5066)	-5.388407 (-2.9241)	-4.004525 (-1.9478)		-7.905063 (-3.5045)	-7.687081 (-2.9228)	-6.431183 (-1.9476)	
K	-2.835810 (-3.5162)	-2.617715 (-2.9303)	-1.731096 (-1.9486)	-4.569656 (-1.9488)	-2.581384 (-3.5136)	-2.411950 (-2.9286)	-1.578810 (-1.9483)	-5.557719 (-1.9486)
Ex	-5.823456 (-3.5112)	-5.700649 (-2.9271)	-4.967502 (-1.9481)		-9.263234 (-3.5088)	-9.106491 (-2.9256)	-8.176861 (-1.9480)	
G	-3.956653 (-3.5162)	-3.850553 (-2.9303)	-2.991706 (-1.9486)		-7.936014 (-3.5136)	-7.857134 (-2.9286)	-6.676402 (-1.9483)	
Pcsp	-1.412416 (-3.5088)	-1.510517 (-2.9256)	0.116179 (-1.9480)	-4.516150 (-1.9481)	-1.719377 (-3.5066)	-1.731791 (-2.9241)	0.038184 (-1.9478)	-8.203292 (-1.9480)

( ): Critical values at the 5% threshold

## Appendix 2. Result of the cointegration test on model 8.

Eigen value	Ratio	Critical Values		Number of E.C Assumed
		5%	1%	
0.781868	171.5448	82.49	90.45	None **
0.715606	107.5933	59.46	66.52	At most 1 **
0.418549	54.78264	39.89	45.58	At most 2 **
0.398438	32.00905	24.31	29.75	At most 3 **
0.222849	10.66357	12.53	16.31	At most 4
0.001773	0.074526	3.84	6.51	At most 5

\* Denotes the existence at most one cointegration relation (1%)

**Appendix 3.** Estimation of the Hendry Error Correction Model.

<b>Variables</b>	<b>Coefficients</b>	<b>t-student</b>	<b>Probability</b>
DK	-0.378444	-1.606600	0.1183
DEX	0.206050	8.926415	0.0000
DG	0.581300	7.215103	0.0000
DDEV	-0.113928	-1.661229	0.1067
DPCSP	-1.384470	-4.622827	0.0001
PIB (-1)	-1.135342	-9.293899	0.0000
K (-1)	0.146331	0.954547	0.3472
EX (-1)	0.110653	2.047261	0.0492
G(-1)	0.609868	5.721352	0.0000
DEV (-1)	0.055200	0.676771	0.5036
PCSP(-1)	-0.084790	-0.766175	0.4494
C	0.022954	1.121453	0.2707

$R^2 = 0.968220$

$R^2\text{-Ajusté} = 0.956943$

F-statistic = 85.85979

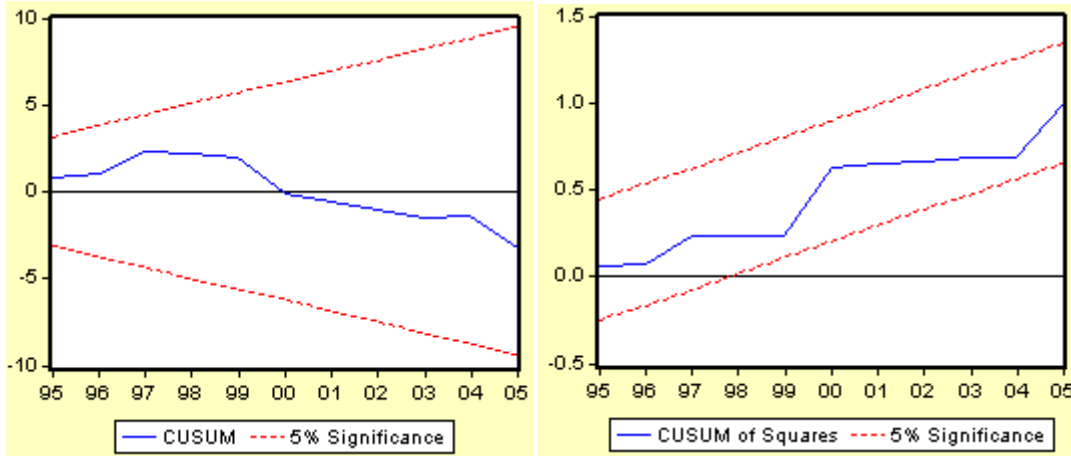
Prob (F-statistic) = 0.000000

DW = 2.150882

**Appendix 4.** White Test.

<b>White Heteroskedasticity Test:</b>			
<b>F-statistic</b>	1.065855	Probability	0.439877
<b>Obs*R-squared</b>	21.16105	Probability	0.387708

**Appendix 5. Cusum and squared Cusum Test.**



**Appendix 6. Ramsey Test.**

**Ramsey RESET Test:**

<b>F-statistic</b>	0.321044	Probability	0.574402
<b>Log likelihood ratio</b>	0.380136	Probability	0.537531

**Appendix 7. Estimation of the Hendry Error Correction Model (exports relative to GDP).**

<b>Variables</b>	<b>Coefficients</b>	<b>t-student</b>	<b>Probability</b>
DK	2.050890	2.181911	0.0368
DPIB	3.493880	8.926415	0.0000
DG	-2.244903	-6.171231	0.0000
DDEV	0.671799	2.498584	0.0180
DPCSP	3.451545	2.335013	0.0262
EX (-1)	-0.808839	-4.315484	0.0002
K (-1)	0.294306	0.461091	0.6480
PIB (-1)	4.347909	7.367383	0.0000
G (-1)	-2.466853	-5.518688	0.0000
DEV (-1)	0.181116	0.537807	0.5946
PCSP(-1)	-0.143630	-0.312733	0.7566
C	-0.016525	-0.192319	0.8487

$R^2 = 0.942245$   
 $R^2\text{-Ajusté} = 0.921751$   
 F-statistic = 45.97729  
 Prob (F-statistic) = 0.000000  
 DW = 2.328861