

# Threshold Effect Between Stock Market and Long-term Economic Growth in Côte d'Ivoire

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## Abstract

This paper provides an empirical assessment of the relationship between stock market development and long-run growth in Côte d'Ivoire over the period 1993-2020. The cointegration results between the variables reveal a long-run relationship between economic growth and its determinants. Furthermore, the results of the quadratic model estimates show a threshold of the level of development that reduces the long-term growth in Côte d'Ivoire. Finally, the results of this study could guide the competent authorities in the elaboration of efficient economic policies to favour the development of the financial market.

**Keywords:** stock market, development, financing, economic growth

**Classification JEL:** E44, G10, O16, O50.

## 1. Introduction

The relationship between finance and economic growth has been controversial in the economic literature for several decades. Bagheot (1873), Schumpeter (1911) and Gurley and Shaw (1955) were the first to conduct theoretical work on this relationship. For some economists, the financial market promotes economic growth by improving the efficiency of financial intermediation in dealing with information asymmetries, risk diversification, and resource allocation on the one hand, and by increasing capital accumulation and/or total factor productivity growth on the other (King & Levine, 1993; Loayza & Beck, 2000). For Greenwood and Smith (1997), the development of the stock market leads to a decrease in the cost of mobilizing savings and, in turn, facilitates productive investment. Levine (1991) and Bencivenga et al. (1969), in their empirical work, have shown that the placement of savings of economic agents in the form of shares or other securities, on the stock market, would lead to the liquidity of the latter. This would have an impact on economic growth. The development of the stock market is a major factor of economic growth, in the world in general and in developing countries in particular (Rousseau & Wachtel, 2000). Authors such as Levine (1997) have proven the robustness of this link.

Other economists reject the idea of a possible relationship between finance and economic growth. For them, the development of the stock market does not guarantee economic growth. Indeed, to finance themselves, companies can have recourse to other sources than the stock market (Robert, 1988; Mayer, 1988). Stiglitz (1985, 1993), going in the same direction, shows that the liquidity of the financial markets has no impact on the behaviour of companies and therefore does not exercise a certain corporate control.

However, the emerging economic literature is undergoing a renewal with respect to the relationship between the stock market and economic growth. In particular, the work of Rioja and Valev (2004), shows the presence of threshold effects in this relationship. Specifically, the relationship between finance and long-term economic growth is either dependent on the level of development of the financial market (Berthelemy & Roudakis, 1996) or on the level of per capita income (Gaytan & Ranciere, 2004).

In view of these contradictory positions, this article is situated in the literature on threshold effects. We attempt to reconcile the different strands of the economic literature on the link between the stock market and long-term economic growth. Thus, the objective of this study is to highlight the relationship between the WAEMU (Note 1) regional financial market (BRVM) and long-term growth in Côte d'Ivoire, and the presence of a possible effect in this link.

This article is organized as follows: the first part presents the estimation technique to be adopted; the second part

is devoted to the presentation and analysis of the results obtained.

## 2. Methodology of the study

To identify the effect of the stock market on economic growth and to test the theoretical and empirical evidence presented in the introduction, we have opted for an approach that consists of determining the optimal level of stock market development through the method that consists of regressing the economic growth rate on all the explanatory variables as well as on the squares of the threshold variables (quadratic model). This method obeys the principle of the curve, which makes it possible to model a U-shaped or inverted-U-shaped relationship between the threshold variable and the dependent variable. The estimation of the quadratic equation model shows whether there is a reversal effect of the proxy variable of stock market development on economic growth.

Thus, the model is written:

$$\gamma_t = \alpha + \beta\tau_t + \delta\tau_t^2 + e_t \quad (1)$$

$\gamma_t$  denotes the logarithm of the Gross Domestic Product per Capita (LGDP) which is used as a proxy for the economic growth rate (Levine, 1997). It is often considered as the best synthetic indicator to measure the economic growth of a country;  $\tau_t$  denotes the stock market capitalization (SMC) that is an indicator of stock market development. This variable was also used by Levine and Zervos (1996). The expected sign is positive;  $\alpha, \beta$  et  $\delta$  denotes the parameters of the model to be estimated and  $e_t$  denotes the specification error term.

In line with the literature review, we will include control variables in our model. We thus retain the investment rate approximated by gross fixed capital formation (GFCF) as a % of GDP. According to economic theory, investment is the engine of economic growth in a country. The expected sign will be positive. In addition, we introduce the openness rate of the economy (ROE). We expect this to be a positive sign, as an economy that is more open to the outside world is more dynamic than one that is autarkic (Keho, 2017). In addition, we inserted dummy variables to capture the effect of the various crises (CRISES) experienced by the ivoirien economy as well as the devaluation (DEV) of the CFA (Note 2) in 1994. The model used in this study is formulated as follows:

$$\gamma_t = \alpha + \beta\tau_t + \delta\tau_t^2 + \theta_1ORE_t + \theta_2GFCF_t + \theta_3CRISES_t + \theta_4DEV_t + e_t \quad (2)$$

With  $\theta_1, \theta_2, \dots, \theta_4$  denoting the parameters of the control variables.

This study aims to determine the level of stock market development that maximizes economic growth. In mathematical terms, it will be a matter of deriving equation 2 with respect to the variable whose threshold we want to determine (Yaya, 2008). We will have the following operation:

$$\frac{d(\gamma_t)}{d(\tau_t)} = 0 \Leftrightarrow \beta + 2\delta\tau = 0$$

The level of market capitalization that maximizes economic growth is obtained by the following relationship:

$$\tau^* = -\frac{\beta}{2\delta} \quad (3)$$

With  $\tau^* \in \mathbb{R}^+ \Leftrightarrow \beta > 0$  et  $\delta < 0$ .

Thus, in this model, the coefficient of the threshold variable and that of its square must be of opposite sign before one can speak of a reversal or the existence of a threshold. Furthermore, the sign of the stock market proxy is positive in order to capture the beneficial effect of investment on the growth rate, while the sign of its square is negative in order to capture the undesirable effects of excess capital in the market.

The data collected for this study come from secondary sources and are quantitative in nature. They were extracted from the World Bank's World Development Indicators (WDI, 2021) database. Indeed, this data source has been used for many scientific works that have been conclusive at national, regional and international levels. Thus, we assume the reliability of the various data sources as a fact. This study covers the period from 1993 to 2020. The periodicity is quarterly.

## 3. Empirical Results

In this section, the results of the estimation of the threshold model will be interpreted: the effect of stock market development on economic growth with a market capitalization as a threshold variable. These results confirm or refute our initial hypotheses.

### 3.1 Preliminary Tests

Before any estimation procedure, it is essential to assess the quality of our data. To do this, we will use descriptive statistics and the correlation matrix of the variables.

### 3.1.1 Descriptive Statistics Variables

The importance of this test is to check for the existence of “outliers”. The results of this test are shown in the table below:

Table 1. Descriptive statistics of variables

	LGDP	SMC	SMC_SQ	GFCF	ORE
Mean	7.0148	17.7302	440.4434	14.3267	7.4916
Median	6.9140	14.2044	201.7657	13.1019	8.4172
Maximum	7.7517	40.7704	1662.233	23.4847	11.5382
Minimum	6.4056	0.2349	0.0551	4.7037	1.9907
Std. Dev.	0.4094	11.2804	431.7061	4.5562	3.0892
Observations	109	109	109	109	109

Source: Authors, using WDI data (2021).

Table 1 shows that the logarithm of the average GDP per capita of the sample over the period under study is 7.01, with a minimum value of 6.40 and a maximum value of 7.75. With regard to the indicator of the development of the WAEMU regional stock market, the average value of the market capitalization was 17.73%. The average level of investment approximated by gross fixed capital formation is 14.32% of GDP. Furthermore, the results of this table reveal that the averages and medians are very close, which implies that the data do not suffer from any “outlier” problem.

### 3.1.2 Variable Correlation Matrix

Table 2. Correlation matrix of variables

Correlation					
Probability	LGDP	SMC	SMC_SQ	GFCF	ORE
LGDP	1.0000				
	-----				
SMC	0.5594 (0.0000)	1.0000			
	-----	-----			
SMC_SQ	0.4571 (0.0000)	0.9644 (0.0000)	1.0000		
	-----	-----	-----		
GFCF	0.7556 (0.0000)	0.2747 (0.0038)	0.2643 (0.0055)	1.0000	
	-----	-----	-----	-----	
ORE	-0.9749 (0.0000)	-0.4473 (0.0000)	-0.3651 (0.0001)	-0.8025 (0.0000)	1.0000
	-----	-----	-----	-----	-----

Source: Authors, using WDI data (2021).

With regard to the correlation between the variables (Table 2), two remarks are worth highlighting. The first remark is based on a positive and significant correlation at the 5% threshold in most cases between the exogenous variables (market capitalization, its square, and gross fixed capital formation) and the logarithm of GDP per capita. The second remark is based on a negative and significant correlation between the openness rate of the economy to economic growth. The correlation coefficients are low for most of the variables selected. All in all, the reading of the correlation matrix proves the existence of a weak correlation between the variables. This leads to the conclusion that there is no problem of multi-collinearity. Consequently, all variables can be taken into account in the model.

The rest of the analysis is devoted to the empirical evaluation of the impact of stock market development on economic growth. For this purpose, an analysis of the stationarity test on the series seems indispensable in order to be objective with regard to the choice of the estimation method.

### 3.2 Stationarity Tests

The analysis of the stationarity of the series is in principle necessary in order to avoid spurious regressions. A stationary series can be defined as a series with constant mean and variance over time and constant autocovariances for each given lag (Barreto & Howland, 2006). In our research, we will opt for the application

of the Augmented Dickey-Fuller (ADF) test based on the Autoregressive model of parameter  $p$   $AR(p)$  and the Phillips-Perron (PP) test. The results of these different tests are shown in the following table:

Table 3. Results of the stationarity tests on the variables

Variable	Model	In level		1 <sup>st</sup> difference		Conclusion
		ADF	PP	ADF	PP	
Logarithm of GDP per capita (LGDP)	Constant	0.8981	0.9883	0.0003	0.0007	I (1)
	T & int	0.2849	0.1984	0.0025	0.0056	
	None	0.9824	0.9912	0.0001	0.0001	
Stock market capitalization (SMC)	Constant	0.2952	0.2913	0.1927	0.0038	I (1)
	T & int	0.9539	0.6192	0.1905	0.0153	
	None	0.3804	0.6562	0.0239	0.0002	
Stock market capitalization squared (SMC_SQ)	Constant	0.1338	0.2357	0.0000	0.0000	I (1)
	T & int	0.3204	0.4029	0.0000	0.0000	
	None	0.0973	0.2280	0.0000	0.0000	
Gross fixed capital formation (GFCF)	Constant	0.4981	0.5626	0.1827	0.0049	I (1)
	T & int	0.2943	0.6127	0.4182	0.0080	
	None	0.6629	0.7655	0.0244	0.0003	
Openness rate of the economy (ROE)	Constant	0.4073	0.2420	0.0767	0.0080	I (1)
	T & int	0.0946	0.3330	0.2845	0.0475	
	None	0.5278	0.2471	0.0097	0.0004	

Note. T & int denotes trend and intercept.

Source: Authors, using WDI data (2021).

According to the results of the ADF and PP tests, all variables are unit order stationary i.e. I (1). Thus, according to Keho (2011), the estimation of series with different integration orders is very complex. At a glance, the ordinary least squares (OLS) method does not seem to be adequate, as there is a presumed long-run relationship between the series. This leads us to determine the cointegration rank of the variables. However, before determining the cointegration rank, it is necessary to know the optimal number of lags.

### 3.3 Optimal Number of Lag And Cointegration Test Of Variable

The analysis of cointegration makes it possible to clearly identify the true relationship between two variables, by looking for the existence of a cointegrating vector and eliminating its effect if necessary. The approach adopted in this study is that of the Johansen (1988) cointegration test, as it provides information on the number of cointegrating relationships between the variables under study. The application of this test requires the prior determination of the optimum number of lags to be considered.

An important step in the framework of dynamic models is the determination of the optimum number of lags to consider. To determine this, different criteria are often used, the most common of which are: Akaike information criterion (AIC) and Schwartz information criterion (SIC). In our study, the determination of the optimal delay reveals satisfactory results. Indeed, all criteria indicate the existence of two delays. Thus, the number of delays 2 is retained. This is summarized in Table 4 below.

Table 4. Determining the optimal delay

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1369.170	NA	160377.1	26.1746	26.3010	26.2258
1	-464.1791	1706.554	0.0084	9.4129	10.1712	9.7202
2	-279.7699	330.1804*	0.0004*	6.3765*	7.7667*	6.9398*
3	-275.8327	6.6745	0.0006	6.7777	8.7998	7.5971
4	-269.3956	10.2993	0.0008	7.1313	9.7853	8.2067

Source: Authors, using WDI data (2021).

Table 5. Johansen's cointegration test

Hypothesized nulle	Eigenvalue	Max-Eigen Stat	Critical Value (5%)	Probability
None *	0.5556	46.2394	46.2214	0.0400
At most 1 *	0.5104	40.7171	40.0775	0.0423
At most 2	0.3868	27.8776	33.8768	0.2192
At most 3	0.3437	24.0051	27.5843	0.1345
At most 4	0.2643	17.5026	21.1316	0.1496
At most 5	0.1449	8.9287	14.2646	0.2921
At most 6	0.0929	3.5605	3.8414	0.0584

Source: Authors, using WDI data (2021).

The results of the trace test for cointegration to investigate the extent to which there is a long-run equilibrium relationship between the series are shown in the table above. Starting from the null hypothesis of no cointegration ( $r = 0$ ) between the five variables LGDP, SMS, SMS\_SQ, GFCF, and ROE the trace test indicates 2 cointegrating vectors ( $r = 2$ ). This suggests that the existence of a long-run equilibrium relationship between the explained and explanatory variables cannot be rejected for Côte d'Ivoire.

The estimation of a long-run relationship involving integrated variables has been the subject of much recent literature (Montalvo, 1995; Keho, 2011). The literature proposes three methods for estimating integrated time series of unit order. The choice of the adequate method depends not only on the presence of cointegrating relationships but especially on the number of these relationships considering all the variables of the model to be estimated (Keho, 2013; Schoeman & Heerden, 2009). This could be presented by the figure below.

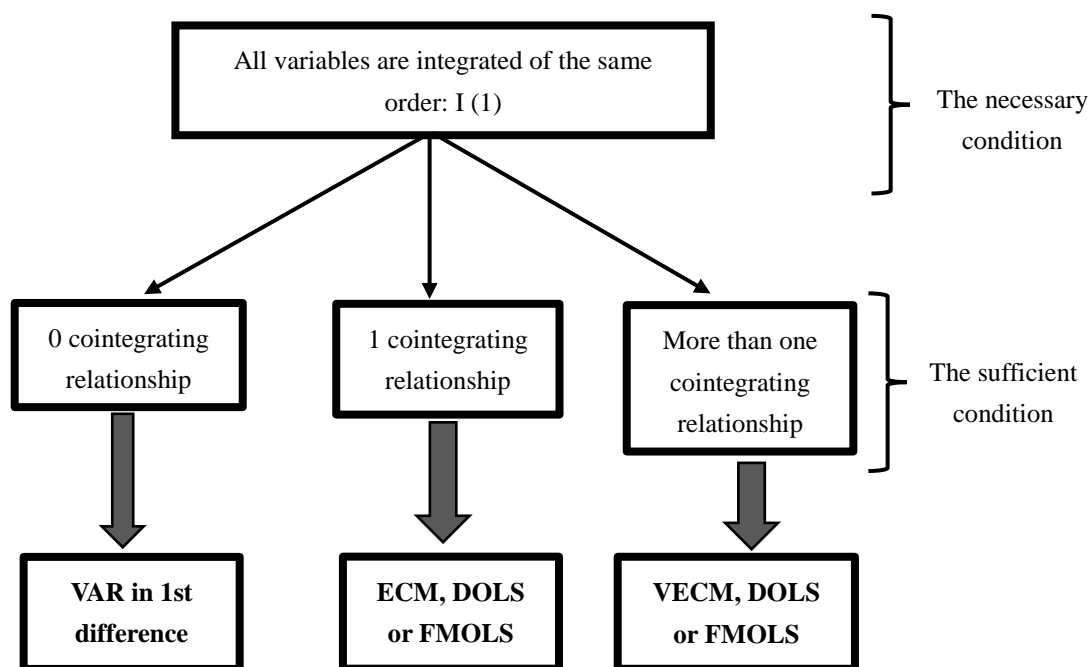


Figure 1. Cointegrated series estimation methods of the same order

Source: Authors.

According to the previous results, the series are all integrated of unit order ( $I(1)$ ), i.e., they are stationary after differentiation. Also, we have demonstrated the presence of a long-run relationship between the series studied. Thus, it is then possible to estimate the error correction model (ECM). This model allows us to analyze the detailed results of the long-term relationship, as well as the dynamics of the variables in the short term. However, the objective of our analysis is to determine the level of stock market development that maximizes growth in Côte d'Ivoire. This optimum can only be determined from the long-term dynamics. To do this, we opt for the FMOLS (Full Modified Ordinary Least Square) technique proposed by Phillips and Hansen (1990) and DOLS (Dynamic Ordinary Least Square) proposed by Stock and Watson (1994) to overcome certain limitations of the

OLS method. Indeed, when the presence of a long-term relationship has been confirmed, the FMOLS or DOLS estimator can then be applied to analyze the long-term relationship between the cointegrated variables.

### 3.4 Long-Term Estimation

As mentioned above, we estimate the equations of the quadratic model by the DOLS, and FMOLS methods. Several specifications have been made. However, the dummy variables that were not significant were ejected from the model. The results are reported in the table below.

Table 6. Results of the long-term estimation

Variable	FMOLS		DOLS	
	Coefficient	P-value	Coefficient	P-value
Stock market capitalization	0.0157***	0.0005	0.0109**	0.0149
Stock market capitalization squared	-0.0002***	0.0090	-0.0001	0.1360
Openness rate of the economy	-0.1244***	0.0000	-0.1361***	0.0000
Gross fixed capital formation	-0.0033	0.4553	-0.0097**	0.0283
Constant	7.8437***	0.0000	8.0594***	0.0000
Explanatory power of the model	$\bar{R}^2 = 98\%$		$\bar{R}^2 = 98.89\%$	
Threshold value: $\tau^* = -\frac{\beta}{2\delta}$	$\tau^* = -\frac{0.0157}{2(-0.0002)} = 39.25\%$		$\tau^* = -\frac{0.0109}{2(-0.0001)} = 54.5\%$	

Note. \*\*\*: P-value <0.01; \*\*: P-value <0.05; \*: P-value <0.1. The values in parentheses are the p-values.

Source: Authors, using WDI data (2021).

Recall that the equation to be estimated amounts to equation 2 without binary variables as they are not significant:

$$\gamma_t = \alpha + \beta\tau_t + \delta\tau_t^2 + \theta_1ORE_t + \theta_2GFCF_t + e_t \quad (4)$$

A remarkable observation of these results is that regardless of the estimation technique (FMOLS or DOLS), the parameters estimate  $\beta > 0$  and  $\delta < 0$ . Therefore, an inverted U-shaped or bell-shaped curve is evident between the development of the BRVM financial market and economic growth in Côte d'Ivoire. However, two observations can be made about the results. Firstly, the DOLS estimation technique gives a higher adjusted R-squared than the FMOLS technique. Secondly, the FMOLS technique gives significant coefficient estimates for the variable of interest and its square. This is not the case with the DOLS technique. Thus, for the purposes of this study, we will retain the results provided by the FMOLS technique.

So, the estimated model is:

$$\gamma_t = 7.8437 + 0.0157\tau_t - 0.0002\tau_t^2 - 0.1244ORE_t - 0.0033GFCF_t + e_t \quad (5)$$

with  $\varepsilon$ , the estimation residual.

Thus, there is a threshold of market capitalization beyond which the development of the BRVM financial market becomes harmful to economic activity in Côte d'Ivoire, and this threshold is established at 39.25% of GDP. This can be explained by the fact that when the market capitalization of the BRVM is less than 39.25%, ivorian companies operating on the BRVM's regional financial market capitalization exceeds that of foreign companies, which has a positive effect on the companies, hence the positive effect on ivorian economic growth. With a threshold below 39.25%, we can see that ivorian companies are the most dynamic in terms of market capitalization on the market. market capitalization on the market. However, when it is higher than 39.25%, the most dynamic companies in the BRVM market are foreign companies. The Ivorian economy relies on the export of goods and services to meet global demand. demand. Moreover, during the study period, the market capitalization only exceeded this threshold in the first quarter of 2007.

## 4. Conclusion

This study is interested in examining the link between stock market development and economic growth in Côte d'Ivoire. The study involved the estimation of a quadratic model. In terms of results, the said estimations reveal the existence of an inverted U-shaped relationship between economic growth and the stock market indicator. Furthermore, the critical threshold of the stock market size is 39.25% of GDP. Thus, it is important to stress that the BRVM stock market is weakly developed. For this reason, it has had little influence on economic growth from 1993 to 2020. The small size, a limited number of tradable securities, low trading volume, and poor

liquidity of stock exchanges as well as the narrowness of the national economies that host them remain the most important handicaps of African stock markets (Atiopou, 2006).

However, the BRVM stock market suffers from a crucial lack of competitiveness in terms of savings mobilization due to the companies that issue the investment choices, which is detrimental to the liquidity of the stock market, as well as the structure of the BRVM stock market that does not encourage ivoirien small and medium enterprises to join. In addition, the repeated socio-political crises in the ivoirien territory make investors lose confidence in companies established in a peaceful territory, as political stability is a key factor for investment.

These results have economic policy implications. Indeed, the stock market reinforces the reputation of companies that are integrated into it. It is necessary to facilitate access to SMEs and start-ups and also to facilitate the procedures for formalizing informal enterprises.

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## Notes

Note 1. West African Economic and Monetary Union.

Note 2. F cfa: (French: franc des Communautés financières africaines; English: Franc of the African Financial Communities).

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