# Prices of Raw Materials, Budgetary Earnings and Economic Growth: A Case Study of Côte d'Ivoire

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## ABSTRACT

The objective of this study was to evaluate the impact of the fluctuation of international prices of raw materials on the variability of the gross domestic product (GDP) in Côte d'Ivoire. The study used the vector autoregressive model on an international data set of primary products and export earnings; inflation and GDP were selected variables analysed in relation to this variability. From 1960 to 2005, fluctuations of coffee prices explained about 15% of the variability of the GDP, while export earnings in total explained approximately 20% of this variability. The exchange rate of the dollar and fluctuation of the petroleum price, which are external factors, also had a significant impact on the dynamics of the growth of Côte d'Ivoire. These results confirm the dependence of the Ivorian economy on raw materials. They illustrate the need for the continuation of efforts aimed at diversifying the economy, in particular of the agricultural sector, and encouraging the setting up of an observatory for a better interpretation of the world economic environment, in order to predict and weather the various shocks.

## INTRODUCTION

Côte d'Ivoire contributes to global trade through a limited range of products including cocoa, coffee, timber and oil. According to statistics (National Statistical Institute of Côte d'Ivoire) on Côte d'Ivoire's external trade, these few products have accounted for more than half of the value of exports since the attainment of independence. Like the majority of Sub-Saharan African countries, Côte d'Ivoire is a 'price taker'. For this reason, it does not wield any control over the level of prices of its exports or imports. Furthermore, its exports are quoted in foreign currency and it has no control over the exchange rate, which affects the export earnings quoted in national currency. It therefore seems that Côte d'Ivoire's dependence on raw materials makes the country vulnerable. As an illustration, between 1980 and 2002, annual world prices dropped by 58% in nominal value. In real value (that is, when inflation for the entire period is taken into account), the effect was a gradual decrease in the purchasing power of farmers – the decline in prices observed was 80.8%.

### Issue

Côte d'Ivoire relies on the prices of raw materials, like most other Sub-Saharan African countries, but what is the effect of the instability of these prices on budgetary earnings, and what is the indirect effect on the economic growth of Côte d'Ivoire? Is it

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possible to evaluate the magnitude of the effect? Finally, how can the effects (since we can't do away with them) of this instability on our economies be cushioned?

**Objectives**

*General objective*

The purpose of this study was to demonstrate that there is a high correlation between international prices of raw materials (coffee, cocoa, oil, etc.), the budgetary earnings from entry-point taxation and economic growth.

*Specific objectives*

To analyse Côte d'Ivoire's export structure in order to highlight the importance of raw materials in export earnings; to analyse the coffee–cocoa sector, the oil sector and stakeholders; to evaluate the influence of price fluctuations on revenue from entry-point taxation; to highlight the impact of the variations of this revenue on the economic growth of Côte d'Ivoire.

**Literature Review**

There is a great deal of literature relating to variability (instability) of prices of raw materials. Kose and Reizman (2001) demonstrated that in Sub-Saharan Africa, trade shocks linked to fluctuations of international prices accounted for almost 45% of GDP fluctuations, 87% of investment variations and 80% fluctuation of labour supply. A study carried out by the Central Bank of West African States (BCEAO, 2007) with the Projection Macro-Econométrique et de Simulation (PROMES) model on regional economic prospects, proved that, in general, oil shocks contributed to the worsening of financial stability of the electricity sector in most of the countries of the West African Economic and Monetary Union (WAEMU) in view of the fact that a greater part of the electrical energy being produced is from thermal sources. Harvard economist David Dawe (1996) carried out an econometric audit on the assumption that fluctuation in export earnings leads to instability in household incomes. Chambas (CERDI, nd) notes that, in the 1970s, mismanagement of the rise in international prices of phosphate led to the appearance of the 'Dutch syndrome' in Senegal.[2] However, these studies are general and conceal the specificities particular to each country.

## MATERIALS AND METHOD

To attain the objectives of this study, the following tools were used: documentary research and economic analysis, descriptive statistics and econometric analysis.

- Documentary research helped with a theoretical analysis of the economic repercussions of a shock on the raw materials.
- Graphical analysis and descriptive statistics helped in the presentation and description of the macro-economic magnitudes used in the study.
- Econometric analysis, particularly the vector autoregressive/vector error correction model (VAR/VECM) modelling, helped in analysing the impact of

[2] 'Dutch syndrome' is a paradoxical phenomenon: a boom in a sector that produces a natural resource would spontaneously tend to compromise any effort of industrialisation or diversification of exports, so aggravating the vulnerability of the economy.

an increase in prices of raw materials on Ivorian macro-economic variables. This econometric analysis was subdivided into three parts.

- Causality, which helps in the correct formulation of economic policy and decision-making. In this study, Granger's (1969) notion of causality was used. According to Granger, an effect of *X* magnitude causes a response of *Y* magnitude, if the knowledge of *X* improves the prediction of *Y*. This definition established the anteriority of events.
- The functions of impulse responses, which measure the consequences of a shock on the variables.
- Analysis of the decomposition of the variance of error prediction, the objective of which is to elicit information on the relative importance of innovation in the variations of each of the model variables.

# RESULTS

## Economic Analysis

The effect of international prices on the GDP is not a direct one, but comes by way of intervening variables. One can distinguish between the following channels: taxation, distribution of national revenue, consumption and investment behaviours.

These shocks on the prices of raw materials can trace their source to the supply and demand sides, or result from a variation in the exchange rate (for countries in the CFA franc zone, it will be the difference between euro and dollar). On the supply side, it could be the result of an overproduction crisis, a domestic supply shock (e.g. increase in the cost of inputs); whereas on the demand side, the shocks emanate from a decline in global demand, which is generally external.

A negative price shock of raw materials meant for export would result in a decline in export revenue. This decrease in revenue has an effect on all economic operators. Households, particularly those of farmers, experience a decline in their incomes and therefore also adjust their consumption patterns.

## Graphical Analysis and Descriptive Statistics

*Importance of Raw Materials in Exports*

The engine of growth of Ivorian exports is coffee and cocoa, which contribute greatly in terms of exports. In 1960, exports of these two products accounted for more than 80% of total exports and remained above 55% of total exports until 1979. In 1999, the share of cocoa among the export crops was still 43.8% (Table 1, which gives an idea about the concentration of Ivorian exports on cocoa).

**Table 1** Distribution of major export crops, 1991 and 1999

| No. products exported | | Share of total exports (%) | | | |
|---|---|---|---|---|---|
| 1991 | 1999 | Product most exported (cocoa) | | Three major products exported (cocoa, coffee, oil) | |
| | | 1991 | 1999 | 1991 | 1999 |
| 23 | 20 | 33.1 | 43.8 | 48.5 | 55 |

Source: Gros *et al.* (2002).

*Developments in the Prices of Coffee and Cocoa*

On the whole, the prices of the two products witnessed similar developments from 1960 to 2002. Two periods can be identified in terms of developments in prices of these two products at the world level. The first is from 1960 to 1977, characterised by an upward trend with an all-time record of 1977, corresponding to a positive shock in prices of these two products. In fact, the prices of cocoa and coffee increased from US$56.49/pound and $61.05/pound in 1975 to $17.96/pound and $233.75/pound in 1977. In 3 years, prices tripled for cocoa and quadrupled for coffee. The second period, from 1977 to 2002, was characterised by a very serious downward trend. During that period, a very wide price variability and two negative shocks (in 1982 and 1993) were observed, and prices returned to the 1960 level (International Cocoa Organization, ICCO, www.icco.org; International Coffee Organization, ICO, www.ico.org).

In terms of the comparative developments of entry-point taxation revenue, Ivorian GDP and world coffee prices, it appears that variations in the price of coffee

correspond with variations in revenue and, in a similar vein, with GDP (Fig. 1). One can therefore surmise that there is a close link between instability of prices of raw materials and an increase in GDP.

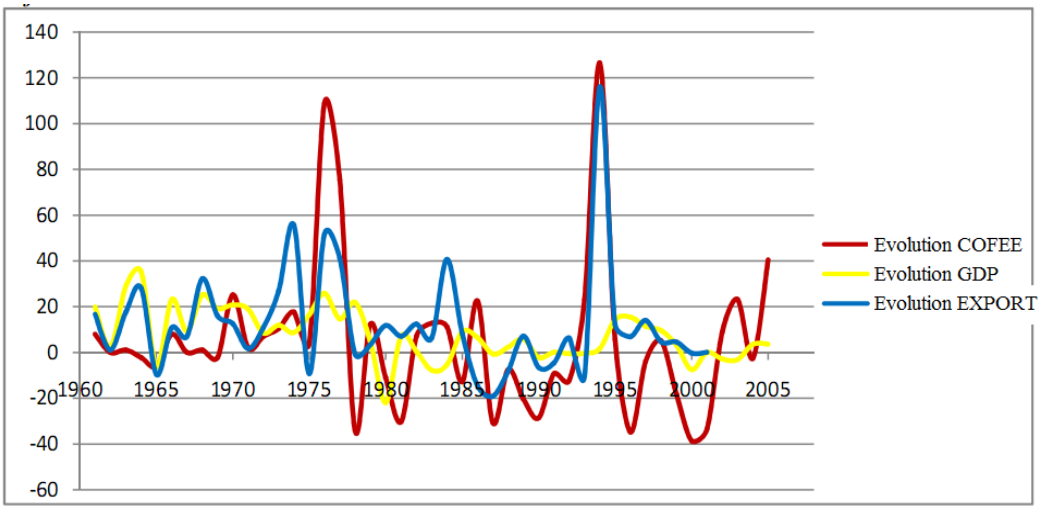


***Figure 1*** *Developments in terms of GDP, exports and coffee price*
*Source: our calculations, with data from the ICO and the macro-economic database (National Statistical Institute of Côte d'Ivoire)*

## Econometric Analysis

*Definition of Variables of the Study*
The variables used in this study are as follows:

- DOLLAR = international price of US dollar;
- COFFEE = international price of coffee (annual average calculated from monthly averages);
- OIL = international price of oil (annual average calculated from monthly averages);
- EXPORT = export earnings (per year);
- INFL1 = rate of inflation (annual average calculated from monthly averages);
- GDP = gross domestic product.

In application of the VAR model, all variables are considered in logarithms. Thus, the 'L' before the rating variables is the logarithm. The logarithmic form can easily derive the elasticity and function of growth rate. The difference in log $Y_t$ and log $Y_{(t-1)}$ corresponds to the growth rate of $Y$. Therefore the first log difference of each function gives an approximation of the growth rate of the function.

One step in the VAR model is the stationarity test. We used the Dickey–Fuller and Phillips–Perron tests. (The use of these two tests is motivated by the fact that the first takes into account the existence of a possible correlation of residuals, while the second takes into account the existence of possible heterocedasticity.) The results of these tests show that only the variable 'inflation' is stationary at a probability level of 5%. So we differentiated all the variables to make them stationary. Differentiated series are denoted by 'DL'.

*Causality*

As the developments in the prices of coffee and cocoa were similar over the period under review, we use only coffee prices in this modelling (to do away with the risk of multi-collinearity). After carrying out the different tests, the VAR model obtained was:

$$Y_t = A_0 + \sum A_j Y_{t-j} + \varepsilon_t$$

where $\varepsilon_t = (\varepsilon_{1t}, \varepsilon_{2t}, \varepsilon_{3t}, \varepsilon_{4t}, \varepsilon_{4t}, \varepsilon_{5t}, \varepsilon_{6t})$ (the vector of stochastic error terms is called impulses or innovations or shocks in the VAR language); $Y_t$ is the stationary process; $A_j$ is the matrix coefficient; and $t$ stands for any given year. The order of our model is 1, and in matrix form, we used the following equation:

$$\begin{pmatrix} DLCDOLLAR_t \\ DLCPETROLE_t \\ DLCCAFE_t \\ DLEXPORT_t \\ LINFL1_t \\ DLPIB_t \end{pmatrix} = \begin{pmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \\ c_5 \\ c_6 \end{pmatrix} + \begin{pmatrix} a_{11} & a_{12} & \dots & a_{16} \\ a_{21} & a_{22} & \dots & a_{26} \\ a_{31} & a_{32} & \dots & a_{36} \\ a_{41} & a_{42} & \dots & a_{46} \\ a_{51} & a_{52} & \dots & a_{56} \\ a_{61} & a_{62} & \dots & a_{66} \end{pmatrix} \begin{pmatrix} DLCDOLLAR_{t-1} \\ DLCPETROLE_{t-1} \\ DLCCAFE_{t-1} \\ DLEXPORT_{t-1} \\ LINFL1_{t-1} \\ DLPIB_{t-1} \end{pmatrix}$$

where:

$$Y_t = \begin{pmatrix} DLDOLLAR_t \\ DLOIL_t \\ DLCOFEE_t \\ DLEXPORT_t \\ LINFL1_t \\ DLGDP_t \end{pmatrix}; \quad A_0 = \begin{pmatrix} a_{01} \\ a_{02} \\ a_{03} \\ a_{04} \\ a_{05} \\ a_{06} \end{pmatrix}; \quad A_j = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{16} \\ a_{21} & a_{22} & \dots & a_{26} \\ a_{31} & a_{32} & \dots & a_{36} \\ a_{41} & a_{42} & \dots & a_{46} \\ a_{51} & a_{52} & \dots & a_{56} \\ a_{61} & a_{62} & \dots & a_{66} \end{pmatrix}; \quad \varepsilon_t = \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \\ \varepsilon_6 \end{pmatrix}$$

Figure 2 provides a summary of the causality between the variables obtained from the estimates of the selected model: the Ivorian GDP growth rate is jointly influenced by the variation in the price of oil, coffee and Côte d'Ivoire's export earnings.

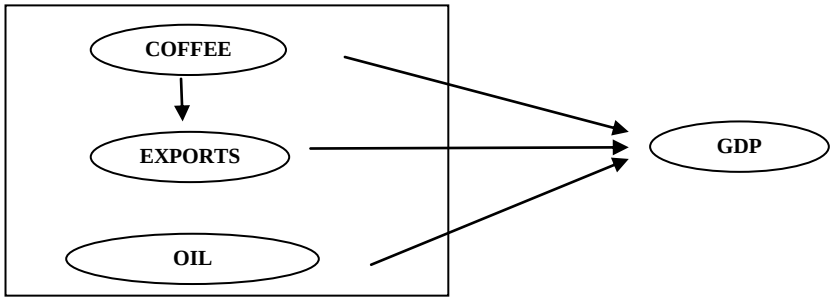


***Figure 2*** *Causality between the variables*

*Impulse Analysis*

The impulsive answer measures the consequence of a shock on variables. The graphs (Fig. 3) present some of the essential impulse functions obtained. We are interested in

the effect of a shock over 10 years. Generally, the shocks are transitional since their effects disappear at the end of ten (10) years.

This horizon represents the necessary maximal timeframe for the variables to regain their long-term level. The shocks were simulated on the basis of coffee prices.

The effect of a positive shock on coffee price translates into an increase in the GDP. Following this shock, the GDP increases in the first year, then decreases from the second year before gradually finding its long-term level after a period of 6 years. These results once again confirm the coffee price and growth dynamics in Côte d'Ivoire. It must also be noted that the effect of coffee price shock on GDP goes beyond 4 years.

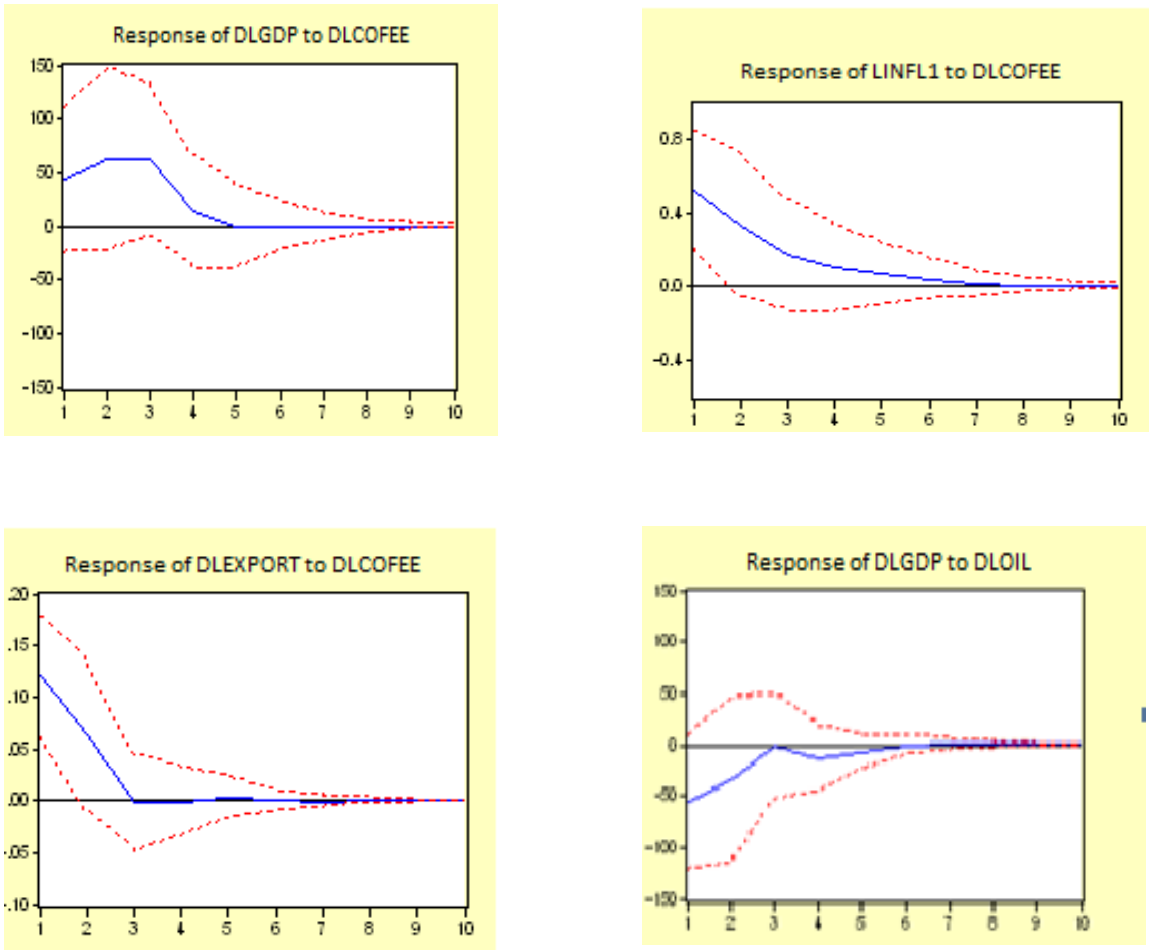


***Figure 3*** *Impulse response*

*Dotted red lines are confidence intervals (±2SE).*

The effect of a positive shock on coffee price is translated instantly into an upward adjustment in export revenue. In the aftermath of this shock, export revenue regains its long-term level at the end of 3 years.

*Variance Decomposition*

The objective is to determine the relative importance of the innovations in the variations of each of the variables of the model. Concretely, we write the variance of the error of forecast on a horizon, *h* (in our case *h* goes from 1 to 5) according to the variance of the error attributed to each of the variables. When an innovation explains a significant proportion of the variance of the forecast error, we deduce that the economy is sensitive to shocks affecting this series. In this section, we analyse the decomposition of the variance of DLGDP and DLEXPORT.

**Table 2** Variance decomposition of GDP

| Period | SE | DLCOFEE | DLOIL (%) | DLEXPORT (%) | DLGDP (%) | DLINFL1 (%) |
|---|---|---|---|---|---|---|
| 1 | 1.016124 | 13.5 | 7.7 | 17.7 | 61.1 | 0 |
| 2 | 1.124223 | 17.1 | 7.5 | 24.0 | 51.3 | 0.1 |
| 3 | 1.145297 | 20.4 | 6.9 | 22.3 | 49.9 | 0.5 |
| 4 | 1.153545 | 20.5 | 7.1 | 22.3 | 49.5 | 0.6 |
| 5 | 1.156771 | 20.5 | 7.2 | 22.3 | 49.4 | 0.6 |

The variance of error prediction of the GDP in the first year is 61% due to its own changes, 13% to coffee price changes, and 17% to export changes. In other words, the variations of the GDP depend (on the horizon of 1 year) by 13% on the dynamics of the coffee prices and by 61% on its own innovations (or variations). It can therefore be said that these variables influence GDP fluctuations in Côte d'Ivoire. These results once again reflect Côte d'Ivoire's dependence on this raw material.

**Table 3** Variance decomposition of export earnings.

| Period | SE | DLCOFEE | DLDOLLAR | DLOIL (%) | DLEXPORT (%) | DLGDP (%) | DLINFL1 (%) |
|---|---|---|---|---|---|---|---|
| 1 | 0.203407 | 33.8 | 36.0 | 4.6 | 25.7 | 0.0 | 0.0 |
| 2 | 0.226766 | 35.8 | 29.1 | 3.8 | 28.6 | 1.2 | 1.5 |
| 3 | 0.234586 | 34.5 | 28.0 | 7.3 | 27.1 | 1.1 | 2.2 |
| 4 | 0.238643 | 33.5 | 27.8 | 7.3 | 26.8 | 1.2 | 3.5 |
| 5 | 0.239793 | 33.2 | 27.5 | 7.7 | 26.9 | 1.2 | 3.5 |

The variance of error prediction of export earnings is attributable by 26% to its own changes, and 10.8% to coffee price changes during the first year. In other words, Table 3 shows that the dynamics of the export earnings in Côte d'Ivoire are due to the variations of the coffee prices (by 34%), variations of the exchange rate of the dollar (33%), and its own variations (26%) on the horizon of 1 year. It therefore seems that the shocks on these variables are dominant in all aspects over the fluctuations in export earnings. It can be concluded that, in Côte d'Ivoire, the coffee price and changes in export revenues have a very great impact on export revenue.

## DISCUSSION AND CONCLUSION

The objective of this study was to evaluate how world prices of raw materials contribute to the explanation of Ivorian GDP growth. In terms of impact of the simulated shock, the study revealed that, following a positive shock of coffee prices, there would be a positive growth reaction of the Ivorian GDP. Furthermore, the GDP would regain its long-term stability within a period of 4 and 5 years for a positive shock of the dollar and coffee, respectively. On the other hand, following a coffee

price shock, GDP and inflation take more time to regain their long-run equilibrium than in the aftermath of any other shock (oil, dollar).

With regard to the contribution of world prices in explaining fluctuations of growth in Côte d'Ivoire, it seems that there, too, export revenue has a role to play in the explanation of the GDP representing over 17.68%. Thereafter, the price of coffee accounts for at least 13.5% in the explanation of GDP fluctuations.

This study helps to confirm the dominant role of coffee and exports in the Ivorian economy, including oil, the development of which is very important to the growth of the country. Diversification of the Ivorian economy appears to be crucial in order to release the country from its dependence on coffee and other export crops such as cocoa by creating processing industries at local level.

Also, as the need for diversification is a long-term policy, in the short term it would be necessary to ensure a prudent budgetary management policy and a good understanding of the international economic environment, for example through the establishment of an observatory.

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## REFERENCES

BCEAO. 2007. *Perspectives économiques des Etats de l'UEMAO en 2007*. Banque Centrale des Etats de l'Afrique de l'Ouest (BCEAO), Dakar, Senegal.

CERDI. nd. 'L'intégration commerciale et financière à l'économie mondiale'. *In* 'Plan de classification des activités de recherche'. [online]. Centre d'Études et de Recherches sur le Développement International, Clermont-Ferrand, France. (www.cerdi.org/l-ouverture-et-le-commerce-international.html).

Dawe, D. 1996. 'A new look at the effects of export instability on investment and growth'. *World Development* 24 (12): 1905–1914.

Granger, C.W.J. [1969]. 'Investigating causal relations by econometric models and cross-spectral methods'. *Econometrica* 37 (3): 424–438.

Gros, J.-B., Letilly, G. and Martinet, S. 2002. *Performances commerciales de l'Afrique subsaharienne : une diversification nécessaire.* DIAL (Développement, Institutions & Analyses de Long terme) Document de travail DT/2002/13. DIAL, Paris, France.

Kose, M.A. and Reizman, R. 2001. 'Trade shocks and macroeconomic fluctuations in Africa'. *J. Development Economics* 65 (1): 55–80.