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Effect of Trade Openness on Productivity in Cote d'Ivoire

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Abstract

The implementation of the African Continental Free Trade Zone offers important trade opportunities to African countries, including Côte d'Ivoire. The economic literature has shown that trade openness affects productivity. Therefore, this paper aims tocompare the effect of trade between Côte d'Ivoire and other African countries on productivity and the effect of trade between Côte d'Ivoire and the rest of the world (outside Africa) on productivity. To achieve this objective, the Dynamic Least Squares (DOLS) and Cointegration Canonical Regression (CCR) methods of Park (1992) were used to analyze the relationship between productivity and trade openness in Côte d'Ivoire over the period 1980-2019. We use Total Factor Productivity as measure of productivity in this study. The results show that the effect of trade between Côte d'Ivoire and African countries on productivity differs from the effect of trade between Côte d'Ivoire and the rest of the world (outside Africa) on productivity. Indeed, exports from Côte d'Ivoire to Africa have a positive and significant effect on productivity. while Côte d'Ivoire's imports from Africa have a negative and significant effect. Côte d'Ivoire's imports from the rest of the world (outside Africa) positively and significantly affect productivity. On the other hand, exports from Côte d'Ivoire to the rest of the world (outside Africa) have a negative and significant effect on productivity.

Keywords: Productivity, total factor productivity, innovation, trade openness, AfCFTA

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1. Introduction

Through the elaboration and implementation of National Development Plans, Côte d'Ivoire has demonstrated its ambition to achieve the structural transformation of its economy to support sustainable growth. Productivity gains at both the global and sectoral levels remain an important aspect of the structural transformation of economies. The impact of technological diffusion and innovation on economic growth has been studied in relation to the role of international trade as a channel for the transmission of technological knowledge (Coe and Helpman, 1995; Coe, et al., 1997). Technological diffusion and innovation appear to be important factors that several countries have relied on to achieve their structural transformation.

Export expansion contributes to economic growth by facilitating factor mobilization and capital accumulation in a quantitative sense. It also contributes to promoting productivity growth through the emulation of advanced foreign technology and through competition in foreign markets. In *The East Asian Miracle*, the World Bank (1993) suggested that exports and export promoting policies had been instrumental in East Asia's adoption of frontier technologies, which enhanced the productivity of exporting firms and economies in general, thus accelerating economic growth.

Innovation is at the heart of technical progress and economic growth. Indeed, the creation of new products and production processes are essential elements to achieve technical progress. It is considered a true source of the country's technical progress that improves the overall productivity of the factors of production (labor and capital). According to the Global Innovation Index of the World Intellectual Property Organization (WIPO), Côte d'Ivoire ranks 112th with a score of 21.24. Côte d'Ivoire is among the lower middle-income countries, whose score is below expectations for their level of development (Cornell University et al., 2020).

In addition,many studies focuses on technological change or technological catch-up and on the economic policies that can facilitate such change. A central question for developing countries in such a context has been that of the trade policy to be adopted, a question that is part of the general debate on the possible gains from trade openness. To compensate for low levels of domestic innovation, developing countries resort to imports and foreign direct investment to acquire modern foreign inventions. Opening to the outside world plays an important role in the innovation process of developing countries.

Côte d'Ivoire ratified the agreement establishing the Continental Free Trade Area (AfCFTA) on November 23, 2018. At a time when the entry into force of the AfCFTA is seen as a real opportunity for Africa through the increase of intra Africa trade, it seems interesting to analyze the effects of trade openness on the Ivorian economy. This study answers the following

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question: does trade openness between african countries have the same effect on productivity as trade openness between african countries and the rest of the world ? This study attempts to answer this question for the case of Cote d'Ivoire. The rest of the paper is organized as follows. Section 2 presents the literature review. Section 3 explains the methodology. The section 4 presents the empirical results while section 5 concludes the study.

2. Literature review

Relationship between trade and productivity

In this section, we review the existing literature on trade and productivity. Many studies have been devoted to identifying the role of TFP in growth dynamics to explain the large variation in economic growth across countries. In theory, there is a two-way causal relationship between trade and productivity but advocates of export-led growth generally contend that exports enhance productivity growth (Baldwin ,2003)). Trade openness is an important determinant of economic growth through channels of technology transfer and productivity improvement (Grossman and Helpman (1991), Edwards (1993), etc.,). An increase in international trade promotes the diffusion of new technologies embodied in industrial goods (Barro and Sala-i-Martin, 1997; Baldwin et al, 2005; Almeida and Fernandez, 2008).

Bloom et al. (2016) examine the impact of Chinese import competition on broad measures of technical change—patenting, IT, and TFP—using new panel data across twelve European countries from 1996 to 2007.They find that competition due to Chinese imports increased technical change (around 14% of European technology upgrading 2000–7). Ding et al. (2016) present a similar result for Chinese manufacturing industries, where competition pressure from imports led to rapid technological upgrading that accelerated in firms and industries close to the world frontier. Examining the relationship between openness and productivity in Swiss, Follmi et al. (2018) show that for some branches in the Swiss manufacturing sector, increases in international trade are associated with higher productivity in the long run.

Empirically, Coe and Helpman (1995) are among the first authors to provide empirical evidence of the importance of trade in the international diffusion of technology. In a study of a sample of 22 industrialized and 77 developing countries, they identified a positive relationship between productivity and trade openness. The estimates showed that for the G7 countries , the level of total factor productivity is determined primarily by domestic R&D efforts, while for the smaller countries, international technological externalities embodied in traded goods and services play a much more important role than those of domestic origin, with higher effects for the most trade-open countries. Countries participating in international trade benefit from the research and development of other countries through imports.

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International trade is an important tool in the transmission of technology between countries. Total factor productivity is influenced by domestic research and development activities as well as imported goods.

Dua and Garg (2017) used panel cointegration and group-mean fully modified ordinary least squares estimation to analyse the determinants of labour productivity in developed and developing countries. The study further finds that while both trade openness and foreign direct investment affect productivity of developing economies positively, only trade openness has a positive and significant impact on the productivity of developed economies.
Rodrik (1999) finds similar results to Coe and Helpman's (1995). He highlights the fundamental role of imports in the transmission of technology from developed to developing countries. He suggests that imports can act as positive externalities because they contain know-how and technology not necessarily mastered by developing countries thanks to technology transfers from the North to the South.

Cortes and Jean (2001) note the interdependence of technical progress and trade openness. Indeed, technical progress influences the country's openness by creating international externalities and the qualification of workers. It also influences the transmission of knowledge and technology from one country to another.

Trade openness could be harmful to an economy if it specializes in sectors with dynamic disadvantages in terms of potential productivity growth (Redding (1999), Young (1991) and Lucas (1988). .

To take full advantage of the productivity effects of openness, countries need to have the right human capital. Investment in human capital accumulation in research and development sectors plays an important role in improving productivity (Dahani et al 2020). Theoretical models have also emphasized the role of learning-by-doing (Arrow, 1962 and Alwyn, 1991). Das and Upadhyay (2019) investigated the growth model in 15 Asian countries from the early 1970s to 2014. The empirical indicates significant influence of human capital either directly on output growth or on growth through total factor productivity.

However, Kim et al. (2007) empirical results indicate that exports do not significantly affect TFP growth. Furthermore, their results show a negative relationship between TFP and trade. These results fail to support the export-led growth hypothesis with respect to TFP growth in Korea. Teresiński (2019) finds a similar result. He analyses how the terms of trade (the ratio of export prices to import prices) affect total factor productivity (TFP). He provides empirical macroeconomic evidence for the European Union countries based on the times series SVAR analysis and microeconomic evidence. They find that the terms of trade improvements are associated with a slowdown in the total factor productivity growth. The shift of resources from knowledge

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development towards physical exportable goods has a negative impact on the TFP growth.

Haider et al. (2020) analyze productivity dynamics using a panel of 12 manufacturing industries in 12 industrialized countries for 1990 to 2006. They find no indication for a direct impact of import shares on TFP growth. Nevertheless, the decomposed measures show evidence of a (at least minor) role for technology transfer.

It appears from the literature that studies on the relationship between trade openness and productivity are generally based on the transfer of technology from Northern to Southern countries. Is the mechanism of technology transfer from Northern to Southern countries the same as that of a Southern country to another Southern country?

In view of the almost similar level of development in the majority of sub-Saharan African countries and with the forthcoming implementation of the AfCFTA, this study analyses the effect of the South - South trade on productivity. This study analyzes the effect of trade between Côte d'Ivoire and other African countries on productivity in Côte d'Ivoire. It also examines the effect of trade between Côte d'Ivoire and the rest of the world on productivity in Côte d'Ivoire.

Productivity measures

Productivity is, in general, a measure of output divided by a measure of inputs. Broadly speaking, a distinction is made between unifactor (relating a measure of output to a single factor) and multifactor (relating a measure of output to several factors) productivity measures. In another distinction, productivity measures relate gross output to one or more factors. In these cases output is approximated by value added. Table 1 lists the main productivity measures.

Table 1: Overview of the main productivity measures

Type of output measure	***Type of input measure***			
	Labour	***Capital***	***Capital and labour***	***Capital, labour and intermediate inputs (energy, materials, services)***
Gross output	Labour productivity (based on gross output)	Capital productivity (based on gross output)	Capital-labour MFP (based on gross output)	KLEMS multifactor productivity
Value added	Labour productivity (based on value added)	Capital productivity (based on value added)	Capital-labour MFP (based on value added)	-
	Single factor productivity measures		***Multifactor productivity (MFP) measures***	

Source : OCDE (2001)

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Another measure of productivity refers to Total Factor Productivity. The three essential components for calculating TFP are real GDP per worker, physical capital per worker and human capital per worker. GDP is the measure of output, with capital and labor as inputs. This definition implies that there is no unit for productivity; it derives its meaning from a comparison across countries or over time.

Different approaches have been used to calculate TFP. The first application will be development accounting, following Hall and Jones (1999) and Caselli (2005). The second application will be on growth accounting, as in Jorgenson and Vu (2010). Klenow and Rodriguez-Clare (2005) use real GDP, employment, real physical capital stock, real human capital stock and the share of physical capital in output or the capital elasticity of output. It calculates TFP according to the following formula: $\ln TFP = \ln(Y / L) - \alpha \ln(K / L) - (1- a)\ln(H / L)$.

The Penn World Table (PWT) has developed its approach to calculating TFP. To provide an overview of the differences and similarities between PWT8.0 and existing approaches, Table 2 summarizes the main methods used and compares them to the "standard" approach of Caselli (2005).

Table 2: Input and productivity measurement methods according to PWT8.0 and Caselli (2005)

Area	**PWT8.0**	**Caselli (2005)**
Capital		
- Investment	By asset	Only total
- Depreciation rate	Varies across countries and time	Common across countries and time
PPP	Capital PPP	Investment PPP
Initial capital stock	Based on initial capital/output ratio	Based on steady-state assumption
Capital measure	Stock de capital	Stock de capital
Labor share	Varies across countries and time	Common across countriesand time
Labor input		
Employment	Number of persons engaged	
Human capital	Average years of schooling and assumed rate of return	

Soucre : Inklaar et Timmer (2013)

In this study we analyse productivity at the national level. We use Total Factor Productivity as measure of productivity in this study. The PWT calculation of TFP which takes into account countries specificities is used as productivity measure in this study.

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3. Methodology

3.1. Model specification

The economic literature provides several methods for analyzing the effects of technological diffusion on total factor productivity. The first analytical models proposed by Coe and Helpman (1995) focus on the neoclassical Solow growth model with a Cobb-Douglas production function where returns to scale are constant and technical progress is exogenous in the Hicks sense. $Y=AK^{\alpha}L^{1-\alpha}$ with A representing Total Factor Productivity (TFP), K and L representing capital and labor factors respectively, Y the Gross Domestic Product and α a parameter representing the share of capital in factor remuneration. This function makes it possible to obtain an estimate of TFP using the accounting decomposition of the sources of growth or by econometric regression.

$$\text{TFP} = \frac{Y}{K^{\alpha}L^{1-\alpha}}. \quad (1)$$

The model used by Coe et al (1997) is based on a linear specification that relates total factor productivity to the stock of foreign R&D capital, the degree of openness to trade with industrialized countries, and the level of education. Based on this study, the model used in this work is as follows:

$$\text{logTFP}_t = \alpha_0 + \alpha_1 logH_t + \alpha_2 logEMP_t + \alpha_3 logOUV_t + \varepsilon_t \quad (2)$$

Where :

logTFP_t is the logarithm of total factor productivity at date t ;

logEMP_t is the population employed at date t;

logH_t is the logarithm of human capital at date t. Benhabib and Spiegel (1994) postulate that human capital can directly influence productivity by determining a nation's ability to innovate. The human capital index is calculated from the number of years of schooling and the returns to education (see Human Capital in PWT9);

logOUV_t is the logarithm of trade openness at date t. Imports of machinery and equipment help improve productivity. Trade openness is measured by the share of imports and exports in GDP.

In several studies, trade openness is measured by the sum of exports and imports relative to GDP. Since the transmission channels for the productivity effects of exports differ from those for the productivity effects of imports, the trade openness variable is disaggregated between imports and exports in this study. We test if the effect of trade between Côte d'Ivoire and other African countries on productivity differs from that of trade between Côte d'Ivoire and the rest of the world (outside Africa). The model used to analyze the impact of trade between Côte d'Ivoire and other African countries on productivity is as follows:

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$$\log TFP_t = \alpha_0 + \alpha_1 logH_t + \alpha_2 logEMP_t + \alpha_3 logX\_CI\_AFR_t + \alpha_4 logM\_CI\_AFR_t + \varepsilon_t \quad (3)$$

Where:

$logX\_CI\_AFR_t$ is the logarithm of Côte d'Ivoire's exports to other African countries ;

$logX\_CI\_AFR_t$ represents the logarithm of Côte d'Ivoire's imports from other African countries.

The model used to examine the effect of trade between Côte d'Ivoire and the rest of the world on productivity is:

$$\log TFP_t = \alpha_0 + \alpha_1 logH_t + \alpha_2 logEMP_t + \alpha_3 logX\_CI\_ROW_t + \alpha_4 logM\_CI\_ROW_t + \varepsilon_t \quad (4)$$

$logX\_CI\_ROW_t$ is the logarithm of exports from Côte d'Ivoire to the rest of the world (outside Africa).

$logM\_CI\_ROW_t$ represents the logarithm of imports of Côte d'Ivoire from the rest of the world (outside Africa).

3.2. Data and descriptive statistics

The data used are mainly sourced from the West African Countries Central Bank (BCEAO) database and the Penn World Table (PWT) version 10.0. Data on TFP, human capital (H), and the employed population come from the PWT. Trade data (imports and exports) are from the BCEAO database. The analysis covers the period 1980-2019. Missing data for the import and export variables were calculated using the interpolation method.

Figure 1 shows the trends in Total factor productivity in Côte d'Ivoire. It declined between 1982 and 1994. It began to rise again in 1995 after the devaluation of its currency (XOF). It began to fall in 2005 after the onset of the 2002 political and military crisis. This decline continued until 2011. TFP has been on the rise since 2012. It seems to be sensitive to different shocks (economic and political). Exports and imports (% of GDP) have followed the same trend since 1985. They alternate between increases and decreases. They have followed a downward trend since 2012. Total factor productivity, exports, and imports follow broadly the same trend in their evolution. This suggests a likely link between these variables (figure 1).

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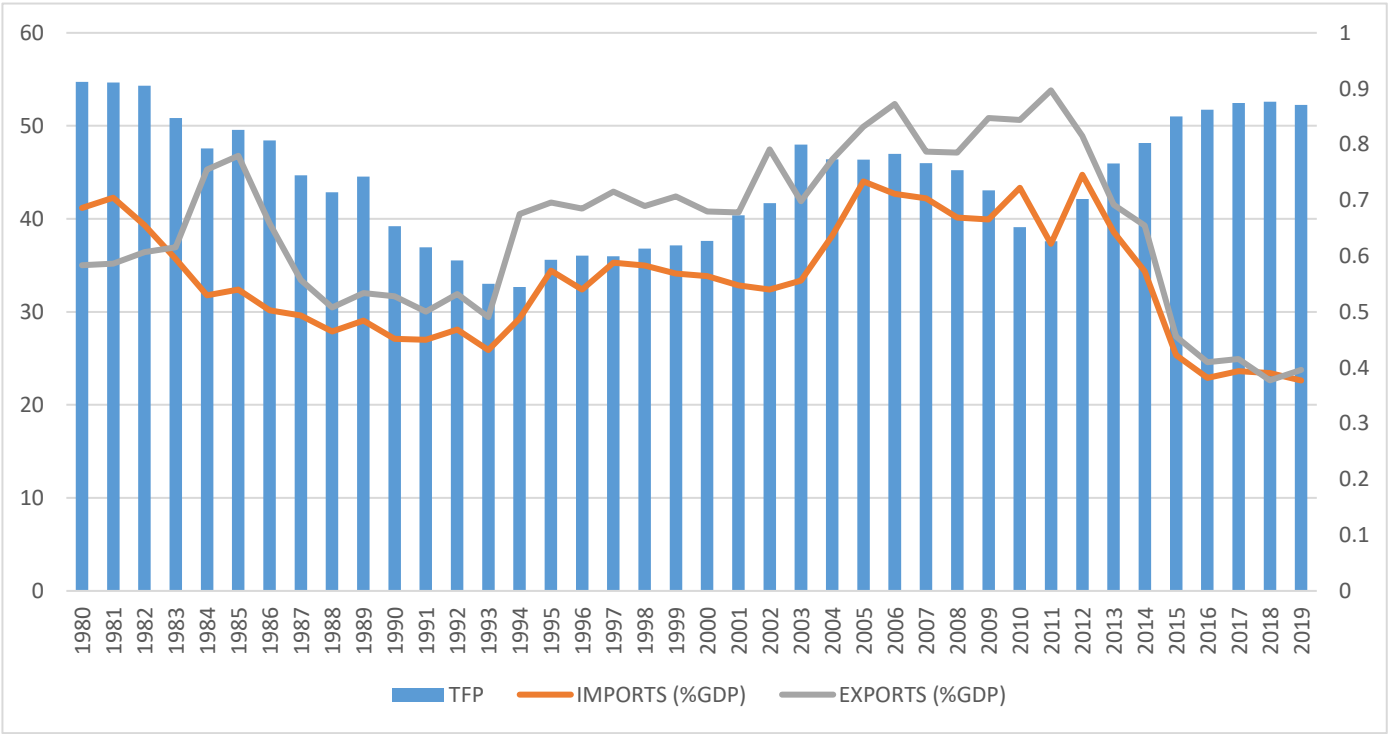
Figure 1: Evolution of Total Factor Productivity (TFP), imports (%GDP) and exports (%GDP) in Côte d'Ivoire



Source: Author's calculations based on PWT and BCEAO data.

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Tables 3 and 4 present the descriptive statistics and the results of the Pearson correlation test, respectively.

Table 3: Descriptive statistics

Variables	Number of observations	Mean	Standard Deviation	Minimum	Maximum
LogTFP	40	-.2283327	.1144331	-.3535398	.0170737
LogH	40	1.40189	.1676758	1.104961	1.695542
logEMP	40	6.683472	.1243419	6.435993	6.875653
logX_CI_AF	40	1.43147	.1427223	1.114929	1.661066
logM_CI_AF	40	1.199691	.398104	.1173582	1.618902
logX_CI_ROW	40	1.852462	.0500223	1.73383	1.939372
logM_CI_ROW	40	1.894574	.0608026	1.766549	1.994272

Source: Author's calculation

3.3. Estimation method

The empirical analysis of the long-run relationship between trade openness and productivity begins with unit root tests. The Augmented Dickey-Fuller and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests were used.

The estimation of a long-term relationship involving cointegrated variables has been the subject of much literature (Montalvo, 1995). Three methods have been proposed to estimate the cointegrating vector: Fully Modified Ordinary Least Squares (FMOLS) (Phillips and Hansen, 1990), Canonical Cointegration Regression (CCR) (Park, 1992), and Dynamic Ordinary Least Squares (DOLS) (Stock and Watson, 1993).

The FMOLS estimator is considered asymptotically unbiased. The FMOLS estimator employs preliminary estimates of the symmetric and one sided long-run covariance matrices of the residuals. The canonical cointegrating regression (Park, 1992) is closely related to FMOLS, but instead employs stationary transformations of the data to obtain least squares estimates to remove the long-run dependence between the cointegrating equation and stochastic regressor innovations.

The CCR transformations asymptotically eliminate the endogeneity caused by the long-run correlation of the cointegrating equation errors and the stochastic regressor innovations, and simultaneously correct for asymptotic bias resulting from the contemporaneous correlation between the regression and stochastic regressor errors (Park, 1992).

Montalvo (1995) finds interesting results and concludes that the CCR estimator shows smaller biases than the OLS and FMOLS estimators while the DOLS estimator consistently performs better than the CCR estimator. On the other hand, the DOLS results are more relevant when there is only one cointegrating relationship (Keho, 2012).

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4. Empirical results

4.1. Results of the unit root and cointegration tests

There are several well-known tests for this purpose based on individual time series. The Augmented Dickey-Fuller and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root tests were used to test the stationarity of the series. The results of both tests indicate that all the variables are stationary at first difference (I(1)). The results of these two stationarity tests are summarized in the table below.

Table 3: Unit root tests results

	Augmented Dickey-Fuller test				**KPSS test**			**Conclusion**
	Level			1st difference	**Level**		1st difference	
	Intercept	Trend and Intercept	None		Intercept	Trend and Intercept		
logTFP	-1.2541 (0.6406)	-2.19690 (0.4773)	0.13560 (0.7195)	-3.797*** (0.0004)	0.327257*** [0.739000]	0.183693*** [0.216000]	0.401002*** [0.739000]	I(1)
logH	0.551362 (0.9864)	-2.64934 (0.2622)	1.487395 (0.9638)	0.041046 (0.6898)	0.781564 [0.73900]	0.127373*** [0.21600]	0.152927*** [0.73900]	I(1)
logEMP	0.438611 (0.9821)	-3.9085** (0.0229)	2.041197 (0.9887)	-0.014148 (0.6716)	0.758740 [0.739000]	0.175320 [0.146000]	0.311580**** [0.739000]	I(1)
LogEXPORT_AF	-2.195532 (0.2111)	-2.73019 (0.2308)	0.002201 (0.6773)	-6.5642*** (0.0000)	0529176 [0.463000]	0.110187** [0.146000]	0.077564** [0.463000]	I(1)
logIMPORT_AF	-2.071946 (0.2566)	-2.0864 (0.5370)	-0.96612 (0.2928)	-6.3055*** (0.0000)	0.253639** [0.463000]	0.174040 [0.146000]	0.286341** [0.463000]	I(1)
logEXPORT_ROW	-2.195532 (0.2111)	-2.73019 (0.2308)	-0.84907 (0.3417)	-6.5642*** (0.0000)	0.567696 [0.463000]	0.085575** [0.146000]	0.084096** [0.463000]	I(1)
logIMPORT_ROW	-2.195532 (0.2111)	-2.73019 (0.2308)	-0.84907 (0.3417)	-6.5642*** (0.0000)	0.155618** [0.463000]	01555441 [0.146000]	0.252786** [0.463000]	I(1)

Probability values for rejection of the null hypothesis are employed at the 5% significance level (**, p-value < 0.05 and***, p-value < 0.01).
Values in ( ) are the p-value (Augmented Dickey-Fuller test) and values in the [ ] are the critical values (KPSS test).
Source: Author's calculation

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The cointegration test was performed to ensure the existence of a long-term relationship between variables. The table below summarizes the results of the cointegration tests. In this study the Johansen cointegration test was used. The results indicate that there are at least two cointegrating relationships for each of the equations. Thus, there is a long-run relationship between the variables.

Table 4: Results of Johansen cointegration test
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.685644	131.3138	95.75366	0.0000
At most 1 *	0.639731	88.49635	69.81889	0.0008
At most 2 *	0.489194	50.72287	47.85613	0.0262
At most 3	0.323251	25.86755	29.79707	0.1327
At most 4	0.244223	11.42072	15.49471	0.1869
At most 5	0.028252	1.060369	3.841466	0.3031

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Source: Author's calculation

4.2. Results and discussion

The Johansen cointegration test indicates the existence of at least two cointegrating relationships. Dynamique ordinary least squares (DOLS) and Canonical Cointegration Regression (CCR) are used to estimate the long-run relationship. Table 5 reports the results of cointegrating regression analysis using CCR and DOLS.

In order to identify the effect of trade between Côte d'Ivoire and African countries on productivity, we estimated the model by considering exports and imports between these two entities. The results reveal that exports from Côte d'Ivoire to Africa have a positive and statistically significant effect on productivity. Firms tend to learn advanced technologies through exports and must adopt them to compete in the foreign markets. Ivorian firms use the innovations contained in the imported goods from developed countries to produce manufactured goods for African countries. The implementation of the AfCFTA, which offers export opportunities to Côte d'Ivoire, should improve the country's productivity.

On the other hand, imports from Africa to Côte d'Ivoire have a negative and statistically significant effect on productivity. Côte d'Ivoire's imports from other African countries are dominated by raw materials whereas its exports to other African countries are mainly manufactured goods. Imports of Côte d'Ivoire from African countries therefore don't contribute to productivity.

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Table 5: Results of estimations

	Productivity and trade between Côte d'Ivoire and Africa		**Productivity and trade between Côte d'Ivoire and the ROW (outside Africa)**	
Variables	**DOLS**	**CCR**	**DOLS**	**CCR**
logH	0.989736 [1.343545] (0.1941)	1.516421*** [3.797795] (0.0006)	1.583592*** [2.889118] (0,0091)	1.538954*** [4.636529] (0,0001)
logEMP	-1.218116 [-1.465981] (0.1582)	-2.041748*** [-4.058729] (0.0003)	-1.901803*** [-3.102657] (0,0056)	-2.103933*** [-5.216531] (0,0000)
LogEXPORT_AF	0.202998 [0.803977] (0.4309)	0.237460** [2.072198] (0.0459)		
LogIMPORT_AF	-0.174219** [-2.411967] (0.0256)	-0.207768*** [-6.749102] (0.0000)		
logEXPORT_ROW			-0.977102 [-1.307605] (0.2058)	-1.399156*** [-4.510308] (0,0001)
logIMPORT_ROW			1.108269** [2.545128] (0,0193)	1.485371*** [7.861155] (0,0000)
C	6.288177 [1.380317] (0.1827)	11.20153*** [3.991259] (0.0003)	9.853810** [2.619886] (0,0164)	11.45388*** [4.973367] (0,0000)
R squared	0.943788	0.850877	0.948492	0.878604
Adjusted R squared	0.898818	0.833333	0.907286	0.864322

The numeric values in [ ] are t-statistic and the numeric values in ( ) are p-values. (**, p-value < 0.05 and ***, p-value < 0.01).
Source: Author's calculation

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Estimation of the effect of trade between Côte d'Ivoire and the rest of the world (outside Africa) shows that Côte d'Ivoire's imports from the rest of the world positively affect productivity. This result is consistent with Rodrik (1999) and Coe and Helpman (1995). Imports of capital goods and intermediate goods which cannot be produced domestically enable domestic firms to diversify and specialize, further enhancing their productivity. The imports of Côte d'Ivoire from developed countries support the diffusion of the new technologies in imported industrial goods. This contributes to improving technical progress which in turn increases productivity in Côte d'Ivoire.

In contrast, Côte d'Ivoire's exports to the rest of the world have a negative and statistically significant effect on productivity. This may be explained by the fact that exports from Côte d'Ivoire to countries outside Africa are dominated by raw materials, especially agricultural.

Human capital plays an important role in the diffusion of innovation. The results show that human capital has a positive and statistically significant effect on productivity in Côte d'Ivoire. The know-how of workers is essential for improving productivity. They are led to succeed in their missions by exploiting their knowledge, training and technology. This result is in line with Traoré (2017) who showed that human capital influences the structural transformation of ECOWAS countries.

On the other hand, the number of people in employment has a negative effect on productivity. A World Bank report[1] showed that labor productivity in Côte d'Ivoire is low. In addition, the promotion of labor-intensive activities to reduce unemployment contributes to explain the negative sign.

Conclusion

Côte d'Ivoire has ratified the agreement establishing the African Continental Free Trade Area (AfCFTA). The implementation of this continental free trade zone offers important commercial opportunities to Côte d'Ivoire. The objective of this paper was to analyze the effect of trade openness on productivity in Côte d'Ivoire. The results showed that the effect of trade between Côte d'Ivoire and African countries on productivity differs from the effect of trade between Côte d'Ivoire and the rest of the world (outside Africa) on productivity.

Côte d'Ivoire's exports to Africa have a positive effect on productivity. On the other hand, Côte d'Ivoire's imports from Africa have a negative effect on productivity.

We also find that Côte d'Ivoire's imports from the rest of the world have a positive effect on productivity. On the other hand, exports from Côte

[1] Banque mondiale (2017). *Rapport sur la situation économique en Côte d'Ivoire : Et si l'Emergence était une femme.* volume 5, juillet 2017. Groupe de la Banque Mondiale.

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d'Ivoire to the rest of the world (outside Africa) have a negative effect on productivity. In addition, human capital has a positive effect on productivity.

In light of these results, the implementation of the AfCFTA represents a real opportunity for Côte d'Ivoire to improve productivity. The government must build its productivity improvement strategy by promoting manufacturing exports to African countries and outside Africa. Efforts should also be made to improve the quality of human capital.

Finally, we discuss the limitations of our study, which are primarily associated with data limitations. In particular, due to unavailability of the relevant data on import and export of manufactured goods, we use total imports and exports. These limitations offer significant opportunities for future research on this important topic. Perhaps, future research focuses more specifically on the relationship between productivity and trade at firm level and in different sectors.

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