Full Length Research Paper

Effect of Chinese outward foreign direct investment on international trade of Africa

Wang Aihu* and Adolphe Bertrand Chedjou

Department of Logistics and Supply Chain Management, School of Business Administration, South China University of Technology, China.

This article aimed at analyzing the relationship between foreign direct investments from China and the international trade of African countries. International trade was found to be affected by the degree of openness of the economy, the level of exports and the level of imports. The findings were brought out by using a Vector Error Correction Model in a cylindrical panel of 52 African countries on a period going from 2000 to 2015. The three main findings were: There was a two-way relationship between foreign direct investment and international trade; foreign direct investment had a strong positive influence on international trade; trade exerted a weak and negative influence on foreign direct investment. Thanks to this study, it was indicated to recommend that alternation be sought by African heads of states through transparent elections to guarantee political stability necessary to attract foreign direct investment.

Key words: Foreign direct investment, outward Chinese foreign direct investments, international trade, exports, Imports, Africa.

INTRODUCTION

In 1955 at the Bandung conference in Indonesia, the first diplomatic contact between China and Africa was made. Relations have since become tighter and China has become the largest trading partner for Africa. At this time, Outward Foreign Direct Investment (OFDI) of China was supported by central governments (UNCTAD, 2007). China has continued since this period to support African countries. Chinese investment in Africa has increased dramatically in the last 15 years (MOFCOM, 2017). This increase of investment in Africa is part of a growing social, economic and political cooperation between China

and Africa; indeed, the relationship is embodied in the Forum on China-Africa Cooperation (FOCAC).

Since the year 2003, cooperation between China and Africa has been growing considerably. China's total OFDI to Africa stood at $4,875.41 million in 2015 (MOFCOM, UNCTAD and Author's imputation data, 2017). In 2008, the Statistical Bulletin of China's OFDI showed that China invested in 45 of 54 African countries during the period 2003 to 2008. Africa came third behind Latin America, accounting for 6.9 per cent of China's total OFDI.

In 2012, the Chinese department of trade published an

*Corresponding author. E-mail: bmawang@scut.edu.cn.

agreement in which China was, under the direct investment, investing in different ways in Africa, allowing the African continent to take off in the fight against poverty and in the improvement of its economic growth; all benefits that aligned with the Millennium Development Goal set by the international community. Chinese direct investment is well oriented in various sectors such as the extractive industries, trade, construction of road infrastructure and railway. A large share of FDI inflows to Africa goes to the primary and tertiary sector.

In 2013 the share of world OFDI had overcharged three times more from 2.8% in 2008 to 3.2%. Africa had 2.7% (UNCTAD, 2014) of world OFDI and 23% of FDI coming from China ministry of commerce, which made china not only a donor, but also a backer, investor and contractor. In 2017, global foreign investment inflows increased by 38%in 2015 to $1,762 billion, up from $1,277 billion in 2014. The past decade witnessed a dramatic increase in FDI flows to developing countries except the year 2015. FDI flows to developing economies decreased to 9.5 percent in 2015 dipping to $765 billion; however, there is a high probability of growth over the next 10 years. This is welcome news, especially for some developing countries that do not have access to international capital markets. The African continent has received inflows of foreign investment for $ 54,079 million in 2015. The rapid growth of Chinese OFDI is likely to continue, particularly in services and in infrastructure industries.

Relationships between FDI and trade are studied by several researchers. Some of them have found that there is a substitution effect between FDI and trade. Others have concluded on complementarity between the two variables. Positive relationship between these variables has emerged in the literature in the recent years. Also we note that negative relationship has stand out. Certain authors have found that there is short run causality between FDI and trade and others have found a long run relationship between these variables.

In addition to financial support through its FDI in Africa, China has kept tight commercial relations with the African market. The share of African market considered as sizeable, although not representing a high level on the international market. The place of Africa in the global economy accurately reflects its economic weaknesses. The share of Africa in world trade and foreign investment has never exceeded 4% between 1990 and 2016.

The increase in the volume of trade is accompanied by rapid inflow of FDI in Africa. It is interesting to note that the main investors are also the major trading partners of Africa. The relationship between China and Africa has intensified since the beginning of the year 2001, with expansion of bilateral trade. We noted an increase of 16.5 percent in the Chinese exports in Africa from 2013-2015 and a decrease of 25.5 percent of African export to china from 2011 to 2015.

LITERATURE REVIEW

FDI and trade

The empirical literature that studies the impacts of FDI and trade is very large. The results of these studies vary considerably from country to country and from industry to industry. Mundell (2010) in his study on International Trade and International Capital Flows mentioned the substitutability of trade and capital flows in different ways: An increase in trade impediments stimulates factor movements, and an increase in impediments to factors stimulates trade. Mundell (2010) has taken an example to illustrate the assumption (Mundell, 2010). This example concludes that a change in the structure of trade, in this case led by an exogenous increase in tariffs, created incentives for capital to move across borders. In conclusion, FDI and international trade have substitution effect.

Bruce and Blonigen (1999) in the study in research of substitution between foreign production and exports, used dataset of product-level for the period 1972 to 1996 to find substantial evidence for both a substitution and a complementarity effect between affiliate production and exports with Japanese automobile parts for the US market. Authors have used methods such as Zellner's iterative SUR technique; regression analysis and AR1 correction to show that substitution of foreign production for exports are often large one-time shifts, not gradual changes over time. However, it is also apparent that there is no complete replacement of exports by local production. Thus, firms may often choose to have some combination of both to serve a market.

Simionescu (2014) studied the relationship between trade and FDI. The author used several methods such as Granger causality tests, unit root test and ADF test for panel data for the period 2002 to 2013 for G7 country. The result showed that there is only short run causality between FDI and exports and FDI and imports. There were unidirectional causal relationships on long run between FDI and trade. Moreover, short run causality in both senses was observed for FDI and trade in G7 countries on the considered horizon.

Liu et al. (2002) analyzed the causal relation between FDI and trade (exports and imports) in China. The authors used a panel of bilateral data for China and 19 regions on the horizon from 1984 to 1998. The panel data methods were used to test unit roots and causality. The results showed a potential development for China: the increase in imports determined the increase in FDI from regions to China and an increase in exports from China to regions or home country. An increase in exports determined the increase in imports.

Markusen and Maskus (2002) argued that vertical FDI where multinational enterprises geographically split

stages of production is likely to stimulate trade; On the other hand, horizontal FDI where multinational enterprises (MNCs) produce identical goods at multiple locations is likely to substitute for trade. Causal links between trade liberalization and FDI was highlighted by Iqbal et al. (2015). They carried out studies by taking evidence in Pakistan. For this purpose, they used secondary data from year 1990 to 2005. By applying in gretl test data and using dependent variable (FDI, Taxes, and Taxes on income) and independent variables (trade liberalization), the results were estimated through the economic tool known as Autoregressive model (AR1) and computes feasible Generalize Least Square (GLS) to estimate the model in which error term will assume to follow first-order autoregressive process. The model interpreted that there were positive relationship between dependent and independent variables which is shown by P value.

The value of P was also greater than 0.5 which indicated that this study results were significant. The null-hypothesis were rejected and accepted alternatives (H1,H2,H3 and H4) which means that reducing custom and other duties, taxes, taxes on income and capital gain and profit, and interest payment will cause FDI to increase. Relationship between FDI and export trade was also made by Wang and Qiang (2016) in Shaanxi province in China; they used co-integration analysis for the data from 1996 to 2015 to explore long-term equilibrium relationship between FDI and export trade. The research found that FDI and export trade were co-integrated. The coefficient estimation value of log (FDI) of 0.8979 indicated that there were promoting relationship between FDI and export. It is important for the policy formulation to give priority to large Multinational companies and make full use of the technology spillover effect to expand to Shaanxi the scale and improve the quality of actual use of foreign investment.

Popovici and Calin (2017) conducted an empirical analysis to evaluate whether FDI is involved in the promotion of Exports and Imports in eight of the newest European Union member states. Using a dynamic method for the panel data from 1999-2013, the result showed that there were a complementarity relation between FDI and both exports and imports. Mainly, the capacity to attract foreign investment would provide higher amounts of exports in the next year, indicating that foreign companies located in the host countries were developing export activities.

Tham et al. (2017) employed a more advanced dynamic panel econometric technique known as System Generalized Moments (System GMM) to sort up relationship between bilateral-export, OFDI and IFDI using sectorial data from Malaysia 2005 to 2013 to 78 countries. The findings revealed that both inwards and outwards FDI were complementary to bilateral export

trade in services, mining and manufacturing.

African's research perspective

Africa has seen a decrease of his exchange rate with the low international market, despite the relatively large number of countries within it. The contribution of foreign trade of African countries is relatively low (less than 5% of world trade, the World Trade Statistical Review, 2016). The bulk of African exports consist mainly of raw materials for factories in developed countries. Most African Imports are manufactured goods. The virtual absence and the lack of involvement of African countries in international trade is an obstacle to continuous development. Several studies have examined the relationship between FDI and trade in host countries. N'guessan and Yaoxing (2010) examined the long-run impact of FDI and trade openness on economic growth in Cote d'Ivoire.

The study used the more recent data analysis technique-the bounds testing cointegration approach and the VAR Granger causality/Block Exogeneity Wald tests. The data span for the study was from year 1980-2007. The Result showed that there were a long run relationship between the FDI, trade openness and output; and the VAR Granger causality/Block Exogeneity Wald tests revealed unidirectional causal relationship running from FDI, trade openness to output and from output, FDI to trade openness. Both FDI and trade openness are significant in explaining output growth in Cote d'Ivoire. This study concluded by recommending: Cote d'Ivoire by the opportunities offered by world markets has to manage a good combination with a domestic investment and institution-building strategy to attract more inflows of FDI for output growth dynamics.

Frimpong (2012) studied the relationship between trade and FDI between China and Ghana. Research results showed that FDI and Trade were an integral part of an open and effective international economic system and a major catalyst to development; National policies and the international investment architecture matter for attracting FDI to a larger number of developing countries and for reaping the full benefits of FDI for development; The challenges primarily address host countries, which need to establish a transparent, broad and effective enabling policy environment for investment and to build the human and institutional capacities to implement them. The result indicated that, China is the second highest country in terms of trade and FDI in Ghana.

Belloumi (2014) studied the dynamic causal relationships from the series of economic growth, FDI, and trade openness, labor and capital investment in Tunisia. This paper examined this issue for Tunisia by applying the bounds testing (ARDL) approach to co-

integration for the period from 1970 to 2008. The bounds tests suggested that the variables of interest were bound together in the long run when FDI is the dependent variable. The associated equilibrium correction was also significant, confirming the existence of a long-run relationship. The results shown that there was co-integration among the variables specified in the model when FDI is the dependent variable. Trade openness and economic growth promoted FDI in Tunisia in the long run. The results indicated that there was no significant Granger causality from FDI to economic growth or from economic growth to FDI in the short run. Turning to the Granger causality test results for economic growth and trade openness, there was also no significant Granger causality from trade to economic growth or from economic growth to trade in the short run.

Kipeja (2015) analyzed the various key determinants of China's outward FDI for a sample of selected African economies and a panel data analysis was used in the study. The time frame for analysis was a 7-year period, 2005 to 2011 and 43 African countries were involved in this study, based on data availability. The Hausman test specification, recommended the using of fixed effects model. An empirical analysis revealed that China's OFDI to Africa responded positively to openness, resource seeking and market opportunities ties.

Akame et al. (2016) examined the impact of the business climate on FDI in the Economic and Monetary Union of Central African States (CEMAC) region from 2007 to 2014 using panel data with the adoption of the Feasible Generalized Least Squares (FGLS) technique of estimation. The study found that the doing business index, the corruption perception index and the Ibrahim Index of African Governance positively and significantly affect FDI in the CEMAC region.

Thus, the study found that some components of the Doing Business Index positively and significantly affected FDI in the CEMAC region. However, economic freedom index and other components that constitute the Doing Business Index though with positive coefficients did not significantly affect FDI. The study recommended that policymakers of the CEMAC region put in place laws, measures and structures that improve the business climate of the region to attract more FDI. It is therefore imperative that the various economic agents of the CEMAC region ensure a favourable business environment or investment climate for this will go a long way in attracting FDI thereby leading to economic growth and development through the multiplier effect.

Dupasquier and Osakwe (2003) examined the performance, promotion, and prospects for FDI in Africa. Several factors such as weak infrastructure, political and macroeconomic instability were identified as being responsible for the poor FDI record of the region. The authors stressed the need for more trade and investment relations between Africa and Asia. They also argued that countries in the region should pay more attention to the improvement of relations with existing investors and offer them incentives to assist in marketing domestic investment opportunities to potential foreign investors. The result also indicated that the current wave of globalization sweeping through the world has intensified the competition for FDI among developing countries.

Overview of Chinese OFDI to Africa and Africa trade

Many prior studies have examined the determinants of inward (FDI) with respect to China. Comparatively less, however, has been written in regard to the Chinese economy. In many ways, the trajectory of growth in terms of China's OFDI has appeared to be highly counter cyclical and opportunistic. In the period following the global economic crisis in 2008 and as recessionary conditions took hold and asset values decreased, Chinese firms seemed to be acquiring distressed firms at bargain prices on every continent, particularly in the technology and natural resource sectors.

Chinese OFDI to Africa

The growing interest of China in Africa has sparked intense debate. In recent years, China was the new partner for most of African countries. FDI in Africa grew on average by 46% per year during the last decade. In 2015, African countries received inward FDI flows for $ 54.079 million (UNCTAD, 2016) (UNCTAD Handbook of Statistics, Foreign Direct Investment Inflows, P 192), amounting for 3% of total world inwards FDI; Figure below (Appendix 1) shows the evolution of OFDI from China to Africa by region and country. The remarkable thing about Chinese OFDI stems not from its aggregate size but rather the trajectory of its recent growth, not to mention its staggering long-term potential (Belloumi, 2014).

In absolute terms, China is a minor player when it comes to OFDI. Total worldwide OFDI stocks only totaled around $1280974.6 million in 2016 (World Investment Report, 2017), far below its inward FDI stock of $1354404.0 million. In other words, while the inward-to-outward gap seems to be shrinking, China remains very much a net importer of FDI. Generally speaking, Chinese OFDI in Africa involves various business areas including trade, turnkey projects, resources exploration and extraction, processing, manufacturing, transport and communications, finance, etc. (Kipeja, 2015).

China's average annual OFDI grew from less than $50 billion in 2008 to upwards of $101 billion in 2016, which amounts to a compound annual growth rate of 102%.

Some studies estimate Chinese OFDI could increase to reach as high as $2 trillion by 2020 (Rosen and Thilo, 2011). Although Chinese OFDI to Africa is still low, the rate of growth over the last years has been impressive. Available data on approved investments per country of destination shows that the pattern of Chinese investment in Africa has been historically low. The top 5 African destination of Chinese FDI in 2014 were Algeria, Zambia, Kenya, Republic of Congo, and Nigeria. Algeria accounted for more than 20% of all Chinese OFDI to Africa in 2014.

China-Africa bilateral trade

Currently, as international situation undergoes profound and intricate changes, newly emerging and developing economies have become the major force pushing forward the world's economic development. China has become Africa's largest trade partner, and Africa is now China's major import source, second largest overseas construction projects contract market and fourth largest investment destination. China-Africa bilateral trade has been steadily increasing for the past 15 year, punctuated by a slight slump and quick recovery from the 2009 financial crisis (Chinese worked in Africa, China Africa Research Initiative 2017; http://www.sais-cari.org/). In 2016, the largest exporter to China from Africa was South Africa, followed by Angola and Sudan. South Africa is the largest buyer of Chines goods, followed by Nigeria and Egypt. Trade volume between China and African countries surged 16.8% year on year in the first quarter of 2017 to $38.8 billion (Said by the commerce ministry, Mofcom, May 11 2017; http://english.gov.cn/). This was the first quarterly rebound in bilateral trade between China and Africa since 2015, with Chinese imports from Africa up 46% to $18.4 billion (Press Conference by Sun Jiwen, spokesperson for the Ministry of Commerce, 2017). Chinese exports to Africa declined 1% year on year to $20.5 billion in the first three months of 2017, compared with an 18 percent drop in the same period in 2016. In the first quarterly 2017, Chinese enterprises made more than $750 million of non-financial DFI to African countries, up 64% year on year. Bilateral trade between China and Africa stood at $149.1 billion in 2016. Total China-Africa trade volume, China's export volume to Africa and China's import volume from Africa all reached new highs.

FDI and trade nexus

With specific regards to the recent rise of multinational enterprises from emerging economies, it is believed that their investments are 'triggered by trade-related variables, which facilitate and necessitate OFDI (Banga,

2008). In China, Cheung and Qian (2008) add that the complementarity between FDI and exports has increased after the launch of the 'Going Out' strategy and that it is stronger for investments directed towards developing countries. Therefore, looking at the impact of trade on FDI, it is possible to assume that more exports on the one hand may require an improvement in trade supporting services and, on the other hand, providing knowledge on external markets may also reduce transaction costs of the investments and encouraging FDI. Imports, providing an indication of the importance of the products (mostly natural resources) transferred and may spur firms to internalize these strategic flows by means of OFDI.

METHODOLOGY

This article investigates whether Chinese OFDI and international trade of Africa have causal relationship. This research is quantitative based and data is quantified by using Vector Error Correction Model (VECM). A model is designed to access the variables like trade, exports, imports, institution, gross domestic product, human capital and labor force. Secondary data is used for this research with the econometric methodology of cross country studies such as Wang and Qiang (2016), Gul and Naseem (2015) and Iqbal et al. (2015) to bring out the causal relationship among variables.

Data and variables

We have time series data of 16 years ranging from 2000 to 2015 taken from secondary source. All the data were collected from the database of United Nations (UN), World Bank, international monetary fund (IMF), Comtrade and MOFCOM 2016 and 2017. The 52 samples (Table 1) used in this study consist of African countries across six different regions that have consistent and available data of the period of investigation.

Dependent variable

Trade (sum of export and import), export and import are the dependent variable.

Independent Variable

Independent variables for this research study are outwards Chinese foreign direct investment (OCFDIA), institution (INST-P.S), institution (INST-C.C), gross domestic product (GDP), human capital (H), labor force (L), SouAfr, CenAfr, NorAfr, WestAfr, Indianocean and EastAfr written on right side of equation.

Theoretical framework

This theoretical framework shows the relationship between dependent variables (TRADE: EXP+IMP/GDP, EXP, IMP) and independent variables (L, H, INST-P.S, INST-C.C, OCFDI, SOUAFR, NORAFR, CENAFR, WESTAFR, INDOCEAN and GDP).

Table 1. Countries list.

List of 52 countries in the study
Southern Africa: 10 countries
Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia, Zimbabwe.
Central Africa: 10 countries
Burundi, Cameroon, Central African Republic, Chad, Congo. Dem. Rep. Congo, Equatorial Guinea, Gabon Rwanda, Sao Tome and Principe.
Eastern Africa: 7 countries
Djibouti, Eritrea, Ethiopia, Kenya, Sudan, Tanzania, Uganda.
Western Africa: 16 countries
Benin, Burkina Faso, Cabo Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra-Leone, Togo.
Northern Africa: 5 countries
Algeria, Egypt, Libya, Morocco, Tunisia.
Indian Ocean: 4 countries
Comoros, Madagascar, Mauritius, Seychelles

Trade (export-import)

Trade relates to the openness of the economy to the rest of world. Nonetheless, due to time shortage, series data for the measure of openness, the sum of import and export as a ratio of GDP is used as proxy trade. This is justified by arguing that the more a country is open to globalization, the more attractive it is to FDI. *A* priori, it's expected that trade will be positively related to FDI.

Gross domestic product (GDP)

GDP is actually the measure of overall economy's expenditures and output. GDP in real terms is a national income contributing towards economic growth by viewing the number of domestic products produces from domestic resources.

Institution (INST)

The institution variable is the political stability and absence of violence and control of corruption index from the World Institute Governance Indicators. It measures the extents which agents have confidence and abide by the rules of society, and in particular the quality of contract enforcement, property right, the police, and the courts, as well as the likelihood of crime and violence. The index runs from -2.5 to 2.5, with higher numbers signifying better institutions. This index broadly reflects the preceding theoretical arguments on the role of institutions in attracting Chinese OFDI which also regulate trade policy.

Labor force (L)

Labor force is the supply of labor services for the production of

goods during a stipulated time period. It includes both employed and unemployed labor. When all labor force is fully employed the output ratio increase with appropriate allocation of resources. Labor force is the sum of two components, that is, population growth rate and employment opportunities.

Human capital (H)

Human capital is used as a proxy of level of education among different countries. Countries that have more educated people attract more FDI, and have more knowledge on doing business.

Outward Chinese foreign direct investment to Africa (OCFDI)

Foreign capital is the amount of Chinese OFDI to Africa. It represents market shares by foreign investors. Foreign investors buy local assets and domestic residents also. Foreign capital shows the balance of payment recording positive balance on capital account. Present study is intended to investigate the OCFDIA contribution on trade boosting from 2000 to onward.

Hypotheses development

H1: An increase of Chinese OFDI leads to an increase of the degree of economy's openness.
H2: An increase of Chinese OFDI leads to an increase of exports.
H3: An increase of Chinese OFDI leads to an increase of imports.

Data analysis (econometrics techniques)

The hypotheses are sought out after many review of literature that

are related to the topic, the model is specified and data is fitted into software known as Eview 9.0 for identifying whether OCFDI and Trade (Exports and Imports) are correlated positively. The model used is Vector Error Correction Model (VECM). The details of the model are outlined below:

Equation for model

The three main equations are :

Model 1

$$\Delta ltrade_{it} = \alpha_1 + \delta_{11}\Delta lgdp_{it} + \delta_{21}\Delta llabor_{it} + \delta_{31}\Delta lh_{it} + \delta_{41}\Delta linstps_{it} + \delta_{51}\Delta linstcc_{it}$$
$$+\tau_{11}SOUAFR_{it} + \tau_{21}CENAFR_{it} + \tau_{31}NORAFR_{it} + \tau_{41}WESTAFR_{it} + \tau_{51}INDOCEAN_{it} + \sum_{k=1}^{4}\theta_{1k}\Delta ltrade_{i,t-k} +$$
$$\sum_{k=1}^{4}\lambda_{1k}\Delta locfdi_{i,t-k} + \gamma_1\hat{\varepsilon}_{i,t-1} + v_{1,it} \quad (1)$$

$$\Delta locfdi_{it} = \alpha_2 + \delta_{12}\Delta lgdp_{it} + \delta_{22}\Delta llabor_{it} + \delta_{32}\Delta lh_{it} + \delta_{42}\Delta linstps_{it} + \delta_{52}\Delta linstcc_{it}$$
$$+\tau_{12}SOUAFR_{it} + \tau_{22}CENAFR_{it} + \tau_{32}NORAFR_{it} + \tau_{42}WESTAFR_{it} + \tau_{52}INDOCEAN_{it} + \sum_{k=1}^{4}\theta_{2k}\Delta ltrade_{i,t-k} +$$
$$\sum_{k=1}^{4}\lambda_{2k}\Delta locfdi_{it-k} + \gamma_2\hat{\varepsilon}_{i,t-1} + v_{2,it} \quad (2)$$

Model 2

$$\Delta lexp_{it} = \alpha_1 + \delta_{11}\Delta lgdp_{it} + \delta_{21}\Delta llabor_{it} + \delta_{31}\Delta lh_{it} + \delta_{41}\Delta linstps_{it} + \delta_{51}\Delta linstcc_{it}$$
$$+\tau_{11}SOUAFR_{it} + \tau_{21}CENAFR_{it} + \tau_{31}NORAFR_{it} + \tau_{41}WESTAFR_{it} + \tau_{51}INDOCEAN_{it} + \sum_{k=1}^{4}\theta_{1k}\Delta lexp_{i,t-k} +$$
$$\sum_{k=1}^{4}\lambda_{1k}\Delta locfdi_{i,t-k} + \gamma_1\hat{\varepsilon}_{i,t-1} + v_{1,it} \quad (1)$$

$$\Delta locfdi_{it} = \alpha_2 + \delta_{12}\Delta lgdp_{it} + \delta_{22}\Delta llabor_{it} + \delta_{32}\Delta lh_{it} + \delta_{42}\Delta linstps_{it} + \delta_{52}\Delta linstcc_{it}$$
$$+\tau_{12}SOUAFR_{it} + \tau_{22}CENAFR_{it} + \tau_{32}NORAFR_{it} + \tau_{42}WESTAFR_{it} + \tau_{52}INDOCEAN_{it} + \sum_{k=1}^{4}\theta_{2k}\Delta lexp_{i,t-k} +$$
$$\sum_{k=1}^{4}\lambda_{2k}\Delta locfdi_{i,t-k} + \gamma_2\hat{\varepsilon}_{i,t-1} + v_{2,it} \quad (2)$$

Model 3

$$\Delta limp_{it} = \alpha_1 + \delta_{11}\Delta lgdp_{it} + \delta_{21}\Delta llabor_{it} + \delta_{31}\Delta lh_{it} + \delta_{41}\Delta linstps_{it} + \delta_{51}\Delta linstcc_{it}$$
$$+\tau_{11}SOUAFR_{it} + \tau_{21}CENAFR_{it} + \tau_{31}NORAFR_{it} + \tau_{41}WESTAFR_{it} + \tau_{51}INDOCEAN_{it} + \sum_{k=1}^{5}\theta_{1k}\Delta limp_{i,t-k} +$$
$$\sum_{k=1}^{5}\lambda_{1k}\Delta locfdi_{i,t-k} + \gamma_1\hat{\varepsilon}_{i,t-1} + v_{1,it} \quad (1)$$

$$\Delta locfdi_{it} = \alpha_2 + \delta_{12}\Delta lgdp_{it} + \delta_{22}\Delta llabor_{it} + \delta_{32}\Delta lh_{it} + \delta_{42}\Delta linstps_{it} + \delta_{52}\Delta linstcc_{it}$$
$$+\tau_{12}SOUAFR_{it} + \tau_{22}CENAFR_{it} + \tau_{32}NORAFR_{it} + \tau_{42}WESTAFR_{it} + \tau_{52}INDOCEAN_{it} + \sum_{k=1}^{5}\theta_{2k}\Delta limp_{i,t-k} +$$
$$\sum_{k=1}^{5}\lambda_{2k}\Delta locfdi_{i,t-k} + \gamma_2\hat{\varepsilon}_{i,t-1} + v_{2,it} \quad (2) \quad avec \; \gamma_2 = 0$$

Where,

Trade = trade openness;
OCFDI = Outwards Chinese Foreign Direct Investment;
GDP = Gross Domestic Product;
H = Human Capital;
L = Labor force;
IMP = Imports goods and service (% of GDP);
EXP = Export goods and service (% of GDP);

INST-P.S = Political Stability and Absence of Violence;
INST-C.C = Control of Corruption;
SOUAFR = Southern Africa;
NORAFR = Northern Africa;
CENAFR = Central Africa;
WESTAFR = Western Africa;
INDOCEAN = Indian Ocean;
SOUAFR, NORAFR, CENAFR, WESTAFR, INDOCEAN are dummy variables that take the value 1 if a country belongs to the

Table 2. Variables of study by subregion.

Africa region	Southern Africa	Central Africa	Eastern Africa	Western Africa	Northern Africa	Indian Ocean	Africa
LTRADE	4.374	4.147	3.853	4.235	4.277	4.574	4.233
LEXP	3.548	3.231	2.762	3.294	3,597	3,669	3.331
LIMP	3.772	3.546	3.400	3.709	3,535	4,063	3.665
LOCFDI	6.720	6.731	6.741	6.727	6,743	6.742	6.731
LGDP	22.551	23.227	22.353	22.320	23.973	22.516	22.721
LLABOR	15.087	14.422	15.943	14.848	15.836	13.727	14.953
LH	4.624	6.827	5.102	6.219	6.123	5.310	5.791
LINSTPS	0.941	0.448	0.257	0.646	0.662	1.053	0.657
LINSTCC	0.328	-0,072	0.058	0,124	0.263	0.562	0.168

Source : Author's calculation.

Table 3. Descriptive statistics of study for whole Africa during the period 2000-2015.

Variable	Obs.	Mean	Std.Dev	Coeff. of variation	Min	Max
LTRADE	832	4.233	0.461	0.109	2.950	5.861
LEXP	832	3.331	0.622	0.187	1.488	5.200
LIMP	832	3.665	0.450	0.123	2.351	5.465
LOCFDI	832	6.731	0.334	0.050	-2.408	8.635
LGDP	832	22.721	1.732	0.076	17.183	26.864
LLABOR	832	14.953	1.615	0.108	10.689	23.915
LH	832	5.791	3.294	0.569	4.605	18.169
LINSTPS	832	0.657	0.598	0.910	-4.362	1.358
LINSTCC	832	0.168	0.493	2.927	-2.757	1.112

given sub-region and 0 otherwise.

RESULTS AND DISCUSSION

Descriptive analysis

For all 832 observations (52 countries x 16 years), the most dispersed distributions are those related to the governance variables, which have the highest coefficients of variation (CV), 2,927 for the control of corruption, and 0.910 for political stability (Table 3). The panel is therefore sufficiently heterogeneous with regard to governance. Regarding the control of corruption, the Indian Ocean is on average the least corrupt zone (0.562) and Central Africa is the most corrupt (-0.072). For political stability, the Indian Ocean remains better (1.053) and East Africa is the most unstable (0.257) (Table 2). For international trade, the most homogeneous indicator is LTRADE with a coefficient of variation of 0.109, followed by LIMP (0.123) and LEXP, the most heterogeneous (0.187). Import behavior would be more similar than exports. Regarding FDI inflows from China,

LOCFDI represents the most homogeneous distribution with a CV of 0.050. Its highest average sub-regional value is north Africa with 6,743 and the lowest is Southern Africa with 6,720 (Table 16 and Appendix 2). This shows a fairly low average gap (0.017) compared to the governance variables. The influx of FDI from China would therefore not be very different from one subregion to another.

Trends of international trade and FDI flows from China

Figure 1 highlights the change in the average values of the three variables informing international trade and FDI flows from China for the whole African continent. In terms of trend, we can say that LTRADE variable has globally evolved upwards, with a slight stagnation for the last three years. Thus, there is a significant shock in 2009 that materializes by a V-shaped trough. However, starting in 2012, there is a gradual decline. The level of LTRADE in 2015 is indeed similar to its 2005 value. The evolution of LEXP is similar to LTRADE. The LIMP trend is almost
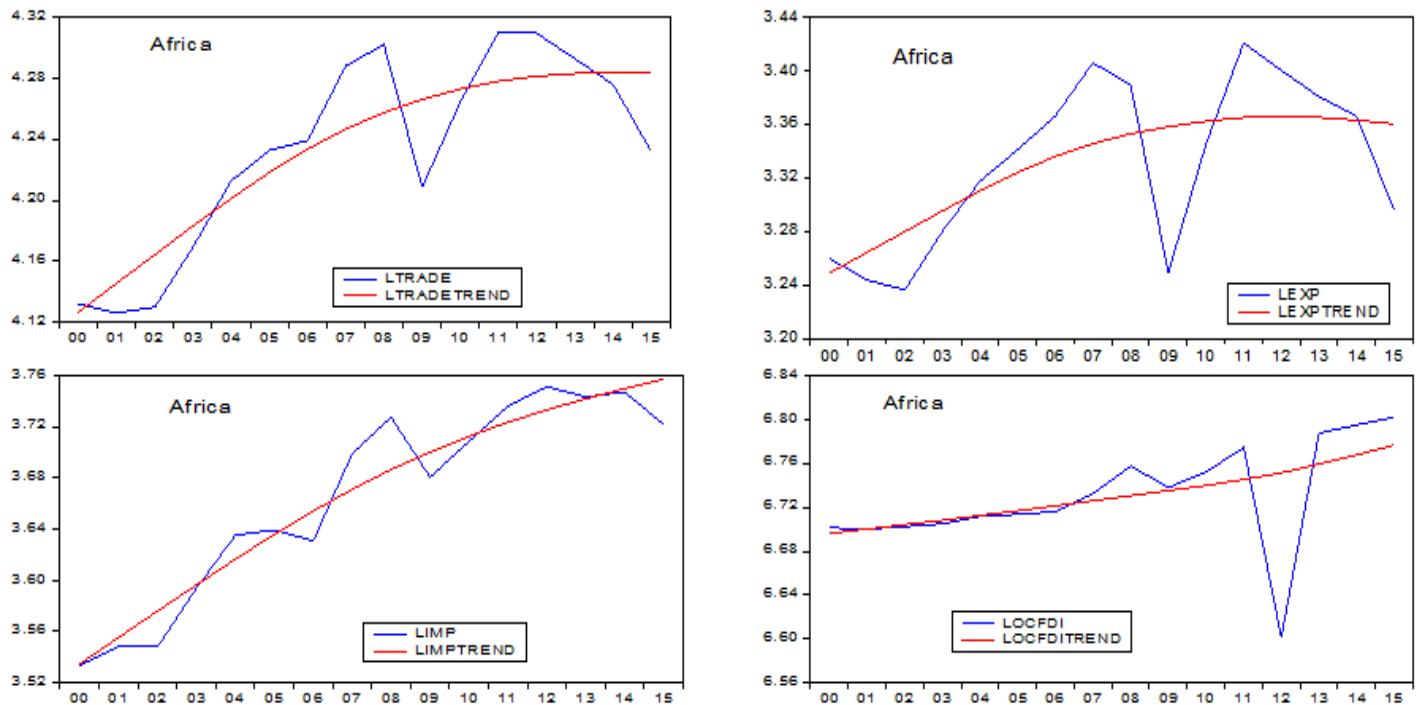
Figure 1. Evolution of International Trade and FDI Inflows from China.

Table 4. Growth rate (%) of international trade and FDI in Africa.

Period	LTRADE (%)	LEXP (%)	LIMP (%)	LOCFDI (%)
2000-2008	0.51	0.49	0.67	0.10
2009-2015	-0.23	-0.37	-0.02	0.10
2000-2015	0.16	0.09	0.35	0.10

linear and increasing with a slight length cyclicity of 3 years. With regard to LOCFDI, the evolution is slightly linear and stagnant, with a vertiginous fall in 2012. This accidental variation is also observed in South Africa during the same year (Appendix 1). The trends of the four variables that define their long-term movements are obtained by applying the Hodrick-Prescott filter. Table 4 summarizes the evolution of these four variables. It can be seen that LOCFDI has almost stable evolution. Its growth rate is 0.10% for the two sub-periods 2000-2008 and 2009-2015. The international trade through its three indicators increased range from 2000 to 2015, 0.16% for LTRADE, 0.09% for LEXP and 0.35% for LIMP. However, they are decreasing during the period 2009 to 2015, for respective values of -0.23%, -0.37% and -0.02%. This implies that the commercial performance of the African continent fell overall between 2009 and 2015. This result

is the most dependent on the fall in exports (-0.37% <- 0.02%).

Comparison of average levels of international trade and FDI indicators by sub-regions of the African continent

For the inter-regional comparison, looking at Figure 2, three sub-regions show practically better levels for LOCFDI. These include North Africa (6,743), the Indian Ocean (6,742) and East Africa (6,741). Southern African countries receive on average the least FDI, in this case (6,720), this is mainly attributable to South Africa, which has the lowest average (6,372) of the 52 countries in the study. For the three variables of international trade, the Indian Ocean has the highest values, 4,574 for LTRADE, 3,669 for LEXP and 4,063 for LIMP. East Africa has the
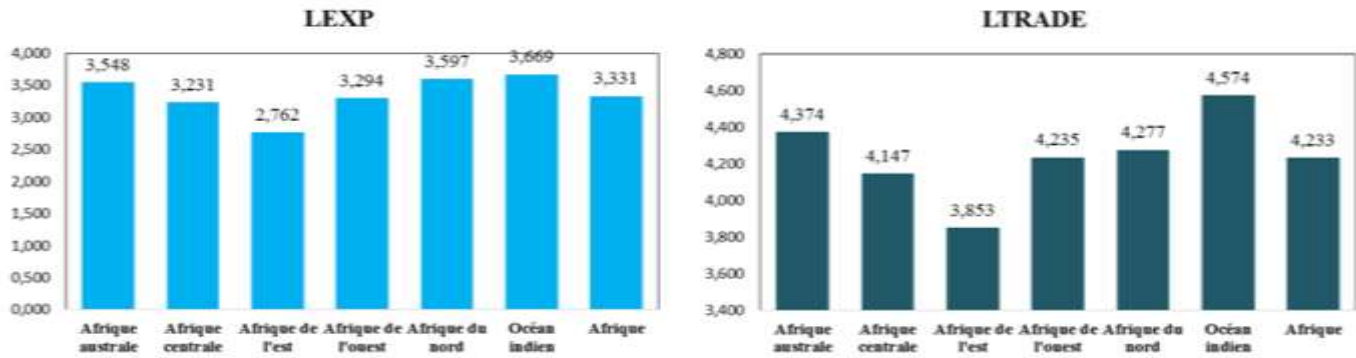
Figure 2. Average variables of international trade and FDI from China by sub-regions of the African continent.
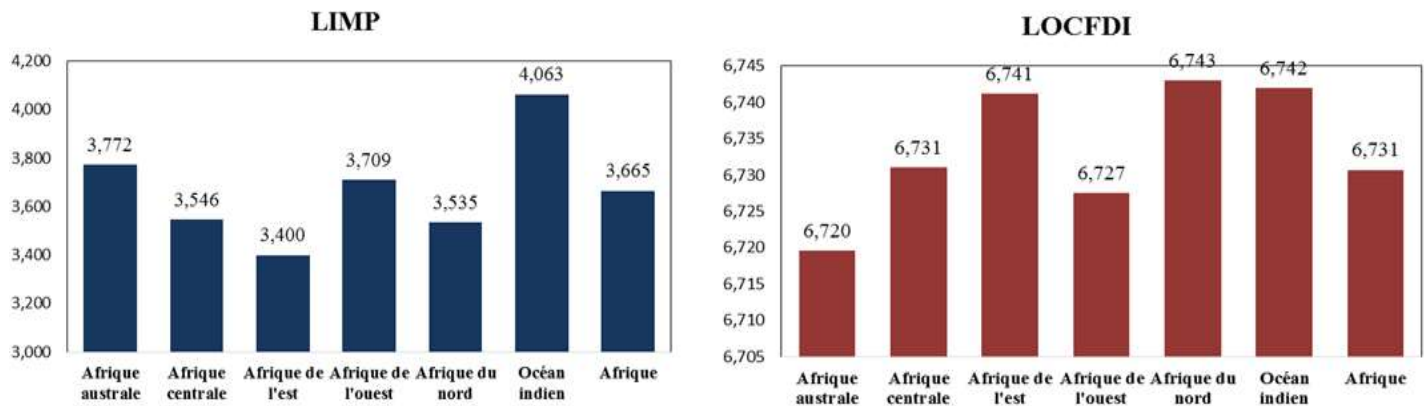

Figure 3. Average of variables of International Trade and FDI from China by African countries.

lowest values (3,853, 2,762 and 3,400 respectively). These results would push us to say that at the sub-regional level, international trade is moving in the same direction as FDI.

Comparison of average levels of international trade and FDI indicators at the level of the countries of the African continent

Looking at the average values over the entire period (2000 to 2015) country by country (Figure 3), the first five and the last five are as follows (Appendix 3). In terms of country analysis, the strong regional correlation between international trade and FDI from China is not fully confirmed. We are even faced with a contradiction, particularly the case of Sudan, which is among the first for FDI and last for LTRADE and LIMP. We would therefore be tempted to say that imports vary in the opposite direction to China's FDI. This implied that at the

country level, other factors than FDI would influence the level of international trade.

Linear correlations between variables of study

Considering all of the 832 observations, we notice a weakly linear relationship between China's FDI and African international trade. The Table 5 reveals a linear correlation coefficient of -0.004 between LTRADE and LOCFDI, 0.005 between LEXP and LOCFDI and -0.011 between LIMP and LOCFDI. These results, however, reflect a positive association between FDI and exports, and negative with imports. Correlations are also strong between the three indicators of international trade. However if we take this analysis back to the period, the sub-regional level or the country level, the results are undoubtedly different. For example, for Burkina-Faso, these three correlations are significant at the 5% threshold and are 0.974 between LTRADE and LOCFDI,

Table 5. Pearson linear correlations of variables of study in Africa (2000-2015).

Variable	LTRADE	LEXP	LIMP	LOCFDI	LGDP	LLABOR	LH	LINSTPS	LINSTCC
LTRADE	1.000	0.881	0.895	-0.004	-0.047	-0.402	0.039	0.334	0.027
LEXP	0.881	1.000	0.604	0.005	0.027	-0.272	0.100	0.273	-0.040
LIMP	0.895	0.604	1.000	-0.011	-0.120	-0.428	-0.044	0.338	0.120
LOCFDI	-0.004	0.005	-0.011	1.000	0.047	0.032	0.010	-0.057	-0.053
LGDP	-0.047	0.027	-0.120	0.047	1.000	0.306	0.016	-0.103	-0.067
LLABOR	-0.402	-0.272	-0.428	0.032	0.306	1.000	-0.128	-0.329	-0.095
LH	0.039	0.100	-0.044	0.010	0.016	-0.128	1.000	-0.148	-0.323
LINSTPS	0.334	0.273	0.338	-0.057	-0.103	-0.329	-0.148	1.000	0.517
LINSTCC	0.027	-0.040	0.120	-0.053	-0.067	-0.095	-0.323	0.517	1.000
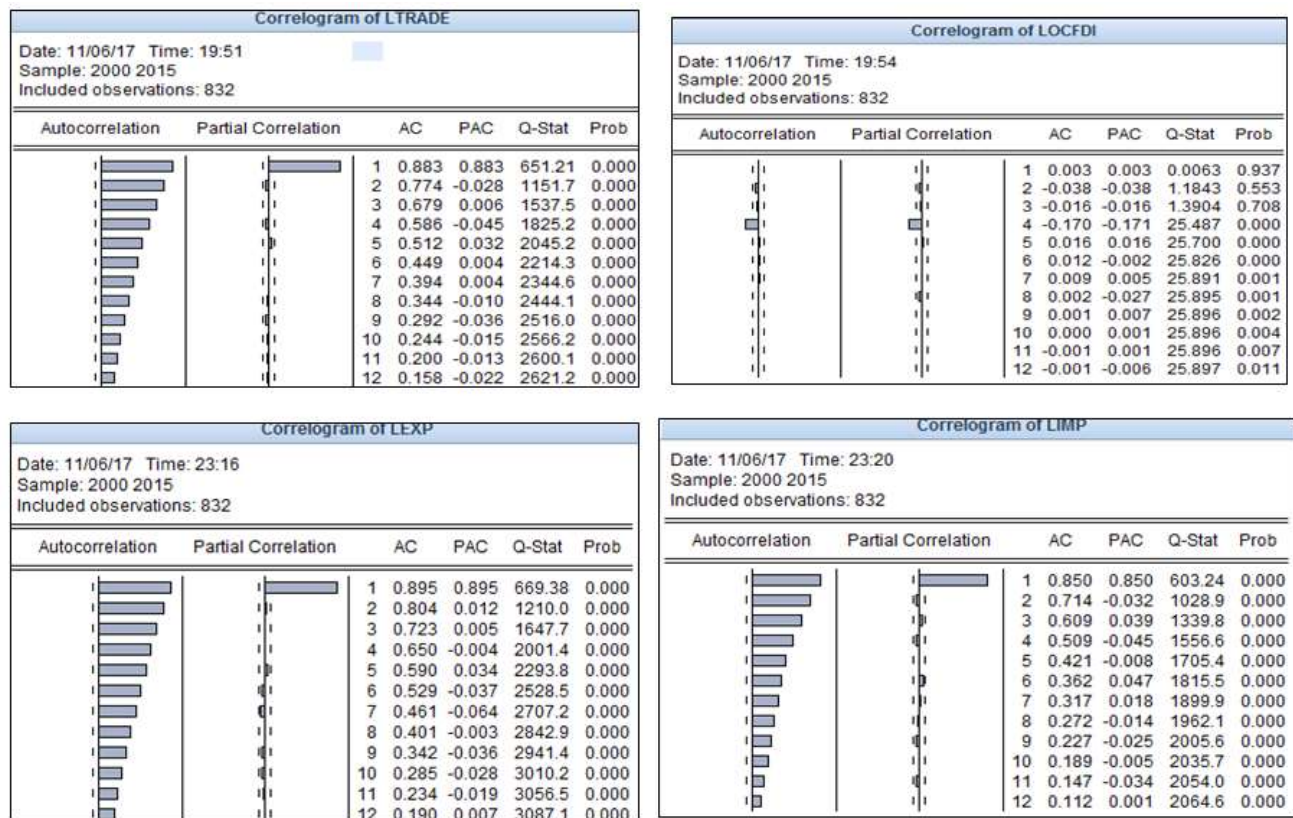
Figure 4. Simple and partial autocorrelations of variables LTRADE, LEXP, LIMP and LOCFDI.

0.983 between LEXP and LOCFDI, and 0.942 between LIMP and LOCFDI. By examining simple autocorrelations (Figure 4), we found that there is a significant correlation between current LTRADE and its lagged values. The decrease is always exponential, that means the influence of past values decreases as one moves away from the present, but remains positive. This is almost the same for LEXP and LIMP. On the other hand, for LOCFDI, the relation between the current value and the delayed values becomes significant only from the fourth shift. The simple autocorrelation coefficient of order 4 has a negative sign and the others are almost null, it is the same for the partial autocorrelation coefficients.

Unit root test

In the analysis of the common and individual unit root

Table 6. Panel unit root test.

Variable	Common unit root test			Individual Unit Root Test						Ccl.
	Levin. Lin et Chu * t-stat			Im. Peasaran et Shin *W-stat			ADF-Fisher *Chi2-stat			
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	
$ltrade$	0.5678	0.0000	0.0000	-	0.0000	0.0000	0.9999	0.0291	0.0234	I (1)
$\Delta ltrade$	0.0000	0.0000	0.0000	-	0.0000	0.0000	0.0000	0.0000	0.0000	
$lexp$	0.0745	1.0000	1.0000	-	0.0017	0.0625	0.9906	0.0017	0.0496	I (1)
$\Delta lexp$	0.0000	0.0000	0.0000	-	0.0000	0.0000	0.0000	0.0000	0.0000	
$limp$	0.4269	1.0000	1.0000	-	0.0094	0.0019	1.0000	0.0090	0.0017	I (1)
$\Delta limp$	0.0000	0.0000	0.0000	-	0.0000	0.0000	0.0000	0.0000	0.0000	
$locfdi$	1.0000	0.0041	0.0000	-	0.7693	0.0000	1.0000	0.1669	0.0000	I (1)
$\Delta locfdi$	0.0000	0.0000	0.0000	-	0.0000	0.0000	0.0000	0.0000	0.0000	
$lgdp$	1.0000	0.6365	0.0000	-	1.0000	0.1385	1.0000	0.9913	0.0042	I (1)
$\Delta lgdp$	0.0000	0.0000	0.0000	-	0.0000	0.0000	0.0000	0.0000	0.0000	
$llabor$	1.0000	0.2025	0.0000	-	1.0000	0.0000	1.0000	0.5422	0.1814	I (1)
$\Delta llabor$	0.0000	0.0000	0.0000	-	0.0000	0.0000	0.0000	0.0000	0.0000	
lh	1.0000	1.0000	1.0000	-	1.0000	1.0000	1.0000	0.2088	0.0000	I (1)
Δlh	0.0000	0.0000	0.0000	-	0.0000	0.0000	0.0000	0.0000	0.0000	
$linstps$	0.0007	0.0000	0.0000	-	0.0000	0.0000	0.0334	0.0000	0.0000	I (1)
$\Delta linstps$	0.0000	0.0000	0.0000	-	0.0000	0.0000	0.0000	0.0000	0.0000	
$linstcc$	0.0168	0.0002	0.0000	-	0.0250	0.0990	0.0214	0.0018	0.0060	I (1)
$\Delta linstcc$	0.0000	0.0000	0.0000	-	0.0000	0.0000	0.0000	0.0000	0.0000	

The hypothesis Ho for all these tests provide that there is a presence of unit root but alternative hypothesis are different. The first line represente the variable at level and the second ligne is the first difference. The v alues in the cell are the P-value. The intercept points up the individual effect and trend, individual trend. (1) : without intercept and trend   (2) : with intercept (3) : with intercept and trend.

Table 7. Kao cointegration test.

Model	Pool of variable	Elements of test
Model 1	LTRADE LOCFDI LGDP LLABOR LH LINSTPS LINSTCC	Pr (ADF) = 0.0012
Model 2	LEXP LOCFDI LGDP LLABOR LH LINSTPS LINSTCC	Pr (ADF) = 0.0003
Model 3	LIMP LOCFDI LGDP LLABOR LH LINSTPS LINSTCC	Pr(ADF) = 0.0000

The Kao test has four hypothesis Ho, no cointegration. ADF is the augmented Dickey-Fuller.

tests (Table 6), which have the same basic hypothesis H0, but different alternative hypotheses, it can be said without ambiguity that all series associated with the variables retained are integrated for order 1. We also note, a significant presence of individual effects and temporal effects, this is the case, for example, with LTRADE.

Tests de cointégration

This study has three variables for capturing international trade, which leads to three models. The cointegration test of Kao denotes cointegrated variables in all three models (Table 7). This cointegration is precisely of rank 1.

Tests de causalité en panel

The examination of the linear correlation of coefficients gave us rather mixed results according to the level of analysis (Africa, subregion, period, country). From one period to another, the correlation between international trade and FDI is generally significant, but for the same

Table 8. Granger causality test between LTRADE –OCFDI.

Number of delays	Granger test (common coefficient)	Dumitrescu-Hurlin of test (individual coefficient)
K=1	0.1837	0.8786
	0.9962	0.0000
K=2	0.3404	0.7355
	0.8127	0.0000
K=3	0.4611	0.7717
	0.9194	0.0008
K=4	0.4277	NA
	0.0310	
K=5	0.0011	NA
	0.2526	
K=6	0.0031	NA
	0.6222	

(1)*HO: No Granger Causality between LOCFDI and LTRADE (2)*HO : No Granger ; Causality between LTRADE and LOCFDI. The first line representes the associate P-value for the Case(1) and the second for the case (2).

period the heterogeneity between countries mitigates this association. Therefore, it is necessary to perform panel causality tests.

Model 1 : LTRADE and LOCFDI

Examination of Table 8 shows that for the first three offsets, the common test is not significant for both directions of causality. On the other hand, the non-admissible Dumitrescu-Hurlin coefficient test from the fourth shift reveals that LTRADE causes LOCFDI for the first three delays (p-value takes the values 0.0000, 0.0000 and 0.0008, respectively), but not the other way around (p-value = 0.8786, 0.7355, 0.7717 respectively). For the fourth delay, LOCFDI does not cause LTRADE (p-value = 0.4277> 0.05), but LTRADE causes LOCFDI (p-value = 0.0310 <0.05) according to the Granger test. From the fifth delay, LOCFDI causes LTRADE (p-value = 0.0010 for L = 5 and 0.0031 for L = 6). But LTRADE does not cause LOCFDI (p-value = 0.2526 and 0.6222 respectively). These results lead us to glimpse a double causality with staggered delays between LOCFDI and LTRADE.

Model2 LEXP and LOCFDI

Table 9 reveals similar conclusions to those found in

Table 8. However, the Dumitrescu test is only valid for the first two discrepancies. The results with LEXP go in the same direction as those of LTRADE.

Model3 LIMP and LOCFDI

For the Granger test (Table 10), the conclusions are the same as those obtained for model1 (Table 8). The Dumitrescu test has a special feature. In fact, for the second delay, there is double causality. For delays L = 1 and L = 3, the decisions are the same as in the case of LTRADE.

Estimation choice of methods for the three models

The results of the panel causality tests lead us to glimpse the use of a dual causality model. The VAR model appears to be indicated between international trade variables and China's FDI. However, to ensure the correct VAR or VECM (Vector Error Correction Model) specification, the econometric procedure is as follows:

Step 1: Determining the number of p delays of the model according to the AIC or SC criteria.
Step 2: Johansen test determines the number of cointegration relationships.
Step 3: Identification of cointegration relationships, that

Table 9. Granger causality test (LEXP and LOCFDI).

Number of delays	Granger test (common coefficient)	Dumitrescu-Hurlin of test (individual coefficient)
K=1	0.2272 0.8176	0.8893 0.0000
K=2	0.3680 0.8319	0.1103 0.0000
K=3	0.4973 0.8681	NA
K=4	0.4033 0.0638	NA
K=5	0.0013 0.2870	NA
K=6	0.0030 0.5467	NA

(1)*HO: No Granger Causality between LOCFDI and LEXP (2)*HO: No granger causality between LEXP and LOCFDI. The first line represents the associate P-value for the Case(1) and the second for the case (2).

Table 10. Granger causality test (LIMP and LOCFDI).

Number of delays	Test de Granger (coefficients communs)	Test de Dumitrescu-Hurlin (coefficients individuels)
K=1	0.3159 0.8069	0.5126 0.0000
K=2	0.5771 0.8404	0.0054 0.0016
K=3	0.7264 0.9424	0.7086 0.0002
K=4	0.6708 0.0060	NA
K=5	0.0216 0.1505	NA
K=6	0.0322 0.4444	NA

(1)*HO : No Granger Causality between LOCFDI and LIMP (2)*HO : No granger causality between LIMP and LOCFDI. The first line represents the associate P-value for the Case(1) and the second for the case (2).

is, long-term relationships between variables.

Step 4: Estimation by the maximum likelihood method of the vector model with error correction and validation using the usual tests: coefficient significance and verification that the residues are white noises, low exogeneity tests.

Determination of the optimal number of delays

The number of delays (Table 11) to be retained in these models according to the panel causality tests (Tables 8 to 10) would be at least 5. Thus, we will retain the number of delays that minimize the Akaike information

Table 11. Determination of the optimal number of delays.

Number of delays	Model1	Model 2	Model 3
L=1	AIC=0.248 SIC=0.286	AIC=0.606 SIC=0.644	AIC=0.620 SIC=0.658
L=2	AIC=0.152 SIC=0.219	AIC=0.565 SIC=0.632	AIC=0.527 SIC=0.594
L=3	AIC=0.200 SIC=0.299	AIC=0.596 SIC=0.696	AIC=0.564 SIC=0.664
L=4	AIC= -1.087 SIC= -0.950	AIC= -0.564 SIC= -0.427	AIC= -0.762 SIC= -0.625
L=5	AIC= -1.050 SIC= -0.870	AIC= -0.467 SIC= -0.287	AIC= -0.808 SIC= -0.628
L=6	AIC= -0.915 SIC= -0.685	AIC= -0.326 SIC= -0.096	AIC= -0.706 SIC= -0.475
L=7	AIC= -1.001 SIC= -0.710	AIC= -0.240 SIC= 0.050	AIC= -0.763 SIC= -0.472
Decision	Hold h=4	Hold h=4	Hold h=5

Table 12. Determination of the number of cointegration relationships.

Hypothesized No. of CE(s)	Model1 LTRADE-LOCFDI		Model2 LEXP-LOCFDI		Model3 LIMP-LOCFDI	
	Trace test	Max Eigen-value test	Trace test	Max Eigen-value test	Trace test	Max Eigen-value test
None	576.4 (0.0000)	262.4 (0.0000)	472.7 (0.0000)	210.4 (0.0000)	588.5 (0.0000)	286.3 (0.0000)
At most 1	113.0 (0.2576)	113.0 (0.2576)	95.11 (0.7219)	95.11 (0.7219)	114.6 (0.2246)	114.6 (0.2246)

Decision For the 3 models, there is exactly one cointegration relation; Values in parentheses represent p-value.

criteria (AIC) and Schwarz (SIC), based on the gradual estimation (delays ranging from 1 to 6) of VAR models with international trade variables and FDI as first differences.

Test de Johansen-Fisher

The number of cointegration relationships (Table 12) is determined by the Johansen test. Indeed, it is based on the test of the trace and the test of the maximum eigenvalue of the variance-covariance matrix of the errors, starting from five specifications. As some unit root tests for the LOCFDI series reveal (see Table 7) the presence of a deterministic trend, we will retain the specification N ° 4 (Bourbonnais, 9th edition - 2015, pp 312-313) which is based on the presence of a linear trend.

Low exogeneity test

The weak exogeneity test (Table 13) consists in verifying if the variables are indeed endogenous. This test relates

Table 13. Low exogeneity test.

Variable	Model1		Model2		Model 3	
	Eq.LTRADE	Eq.LOCFDI	Eq.LEXP	Eq.LOCFDI	Eq.LIMP	Eq.LOCFDI
Terme correcteur d'erreur	-0.078*** (0.011)	-0.059*** (0.021)	-0.047*** (0.008)	-0.028** (0.011)	-0.086*** (0.018)	-0.053* (0.030)

Decision for the first 2 models, both variables is endogenous. However, in model 3, LOCFDI is weakly exogenous; Values in parentheses represent p-value.

to the coefficient γ of the restoring force towards equilibrium (as there is only one cointegration relation). Performing a test on γ amounts to checking if the cointegration relation is present in all equations of the model. In the end, model 3 will have to be estimated with a constraint stipulating a nullity of the correction term for the LOCFDI equation.

Estimations results and interpretation

Model 1 LTRADE

The estimation of model1 reveals mainly the following results (Table 14):

Validity of the model

Regarding the validity of the model, the two variables LTRADE and LOCFDI are endogenous variables, based on the low exogeneity test (Table 13). Indeed, the corrective term is significant at 1% in both equations and has the expected negative sign. There is a reminder to balance. The model has residuals that are uncorrelated according to the Ljung-Box test (p-value = 0.1758> 0.05), so they have the behavior of a white noise. These elements indicate that model 1 is indeed valid.

Coefficient of endogenous variables

On the other hand, all 4 variables delayed by LOCFDI are positively associated with LTRADE at the threshold of 1%. This means that when LOCFDI increases by 10% today, LTRADE increases 5.22% 4 years later, 5.21% 3 years later, 5.44% 2 years later and 5.48% the following year. These results show a positive and almost stable influence of FDI from China on the trade openness of African countries. With regard to the decomposition of the conjectured variance at the 10th delay, LOCFDI explains 55% of the variation of LTRADE. This result is confirmed by the p-value of the Wald statistic of the Granger test,

which has a value of 0.0000. It is thus concluded that LOCFDI actually causes LTRADE.

Coefficients of exogenous variables

Only sub-regional dummies in Africa are significant at 1, 2 and 3%. Souafr, Cenafr, Norafr, Westafr and Indocean are dummy variables indicating the country's membership in a given sub-region, with Eastafr being the reference variable omitted for reasons of multicollinearity. The coefficients of these variables measure the gap of the LTRADE mean for a given subregion with respect to East Africa. They are all positive, but their values do not reach 10%. In addition, the LLABOR variable with a negative sign is significant at 10%. This would mean that when the labor force increases by 10%, the trade opening decreases by 0.23%.

Equation 2

Coefficient of endogenous variables

With regard to LOCFDI, only LTRADE variables delayed by one period and LOCFDI lagged by 4 periods are significant at 5% and 1% respectively. Thus, 10% of increase of LTRADE value at time t results an decrease of 1.19% of LOCFDI in t + 1. An opening up of the economy in the present, would therefore reduce an influx of FDI in the near future. For an increase of 10% of LOCFDI in t, it is expected to observe a decline of LOCFDI 4 years later of the order of 32.16%. With regard to the decomposition of the conjectured variance at the 10th delay, LTRADE only explains 0.85% of the LOCFDI variation. The Granger test reveals that LTRADE does not cause LOCFDI (p-value = 0.5075). It is concluded that LTRADE does not formally cause LOCFDI.

Coefficients of exogenous variables

As for the LOCFDI equation, no exogenous variable is

Table 14. Estimations results for the 3 models by the VECM.

	Model 1: $ltrade$		Model 2: $lexp$			Model 3: $limp$		
Variable	$\Delta ltrade_t$	$\Delta locfdi_t$	Variable	$\Delta lexp_t$	$\Delta locfdi_t$	Variable	$\Delta limp_t$	$\Delta locfdi_t$
Delayed endogenous variables and error correction term								
Terme correcteur	-0.078*** (0.011)	-0.059*** (0.021)	Terme correcteur	-0.047*** (0.008)	-0.028** (0.011)	Terme correcteur	-0.032*** (0.006)	0.000^{NA} (0.000)
$\Delta ltrade_{t-1}$	-0.001 (0.037)	-0.119** (0.070)	$\Delta lexp_{t-1}$	-0.091** (0.041)	-0.059 (0.060)	$\Delta limp_{t-1}$	-0.052* (0.041)	-0.119** (0.069)
$\Delta ltrade_{t-2}$	-0.074** (0.036)	-0.037 (0.069)	$\Delta lexp_{t-2}$	-0.078** (0.040)	-0.083* (0.058)	$\Delta limp_{t-2}$	-0.063** (0.036)	0.019 (0.062)
$\Delta ltrade_{t-3}$	0.043 (0.034)	0.0004 (0.065)	$\Delta lexp_{t-3}$	-0.065* (0.039)	-0.033 (0.057)	$\Delta limp_{t-3}$	0.017 (0.035)	0.006 (0.059)
$\Delta ltrade_{t-4}$	-0.041(0.034)	-0.029 (0.066)	$\Delta lexp_{t-4}$	-0.067** (0.040)	-0.078* (0.058)	$\Delta limp_{t-4}$	0.003 (0.034)	0.016 (0.057)
-	-	-	-	-	-	$\Delta limp_{t-5}$	-0.100*** (0.033)	-0.019 (0.057)
$\Delta locfdi_{t-1}$	0.548*** (0.081)	0.142 (0.155)	$\Delta locfdi_{t-1}$	0.679*** (0.118)	0.125 (0.171)	$\Delta locfdi_{t-1}$	0.455*** (0.114)	-0.235 (0.195)
$\Delta locfdi_{t-2}$	0.544*** (0.081)	0.032 (0.155)	$\Delta locfdi_{t-2}$	0.670*** (0.117)	0.016 (0.170)	$\Delta locfdi_{t-2}$	0.467*** (0.100)	-0.099 (0.170)
$\Delta locfdi_{t-3}$	0.521*** (0.079)	0.180 (0.151)	$\Delta locfdi_{t-3}$	0.638*** (0.113)	0.163 (0.165)	$\Delta locfdi_{t-3}$	0.449*** (0.099)	0.011 (0.169)
$\Delta locfdi_{t-4}$	0.522*** (0.086)	-3.216*** (0.163)	$\Delta locfdi_{t-4}$	0.635** (0.121)	-3.225*** (0.177)	$\Delta locfdi_{t-4}$	0.446*** (0.111)	-3.521*** (0.188)
-	-	-	-	-	-	$\Delta locfdi_{t-5}$	-0.056 (0.171)	-1.335*** (0.291)
Endogenous variables								
C	-0.055*** (0.017)	0.040 (0.033)	C	-0.035* (0.023)	0.052* (0.033)	C	-0.059*** (0.021)	0.066** (0.036)
$\Delta lgdp_t$	0.058 (0.080)	-0.045 (0.153)	$\Delta lgdp_t$	0.138* (0.105)	-0.056 (0.153)	$\Delta lgdp_t$	0.016 (0.093)	-0.012 (0.160)
$\Delta llabor_t$	-0.023* (0.014)	-0.006 (0.027)	$\Delta llabor_t$	-0.059*** (0.019)	-0.003 (0.029)	$\Delta llabor_t$	-0.003 (0.016)	-0.011 (0.028)
Δlh_t	-0.0005 (0.003)	-0.002 (0.006)	Δlh_t	0.002 (0.004)	-0.002 (0.006)	Δlh_t	-0.002 (0.003)	-0.001 (0.006)
$\Delta linstps_t$	-0.021 (0.018)	0.045* (0.035)	$\Delta linstps_t$	-0.008 (0.024)	0.042 (0.034)	$\Delta linstps_t$	-0.037** (0.022)	0.048* (0.037)
$\Delta linstcc_t$	-0.001 (0.040)	0.053 (0.076)	$\Delta linstcc_t$	-0.0007 (0.052)	0.042 (0.076)	$\Delta linstcc_t$	0.011 (0.047)	0.062 (0.081)
-	-	-	-	-	-	-	-	-
Southern Afr.	0.072*** (0.021)	0.017 (0.040)	*Southern Afr.*	0.042* (0.027)	0.003 (0.040)	*Southern Afr.*	0.090*** (0.025)	0.005 (0.043)
Central Afr.	0.039* (0.021)	-0.032 (0.039)	*Central Afr.*	0.008 (0.027)	-0.03 (0.039)	*Central Afr.*	0.061*** (0.024)	-0.050 (0.042)
Northern Afr.	0.052** (0.024)	0.005 (0.047)	*Northern Afr.*	0.021 (0.032)	-0.003 (0.047)	*Northern Afr.*	0.069*** (0.029)	-0.017 (0.049)

Table 14. Contd.

Western Afr.	0.048** (0.019)	-0.020 (0.037)	*Western Afr.*	0.022 (0.025)	-0.033 (0.037)	*Western Afr.*	0.056*** (0.023)	-0.036 (0.040)
Indian ocean	0.083*** (0.027)	0.040 (0.051)	*Indian ocean*	0.059** (0.034)	0.014 (0.049)	*Indian ocean*	0.111*** (0.033)	0.032 (0.059)
Eastern Afr.	Réf.	Réf.	*Eastern Afr.*	Réf.	Réf.	*Eastern Afr.*	Réf.	Réf.
Obs.	572	572	Obs.	572	572	Obs.	520	520
R^2	0.109	0.816	R^2	0.105	0.815	R^2	0.112	0.827
Ajusted R^2	0.079	0.810	Ajusted R^2	0.075	0.809	Ajusted R^2	0.075	0.820
F-statistic	3.553	129.18	F-statistic	3.422	128.67	F-statistic	2.993	113.26
-	-	-	-	-	-	LR test Res. (A(2,1)=0)	p-value=0.0761	
Pr Wald causality test	0.0000	0.5075	Pr Wald causality test	0.0000	0.3856	Pr Wald causality test	0.0000	0.6884
%variance LTRADE h=10 retards	45.00%	55.00%	%variance LEXP h=10 retards	49.48%	50.52%	%variance LIMP h=10 retards	51.23%	48.77%
%variance LOCFDI h=10 retards	0.85%	99.15%	%variance LOCFDI h=10 retards	0.46%	99.54%	%variance LOCFDI h=10 retards	0.24%	99.76%
Test Ljung-Box	P=0.1758	-	Test Ljung-Box	P=0.1240	-	Test Ljung-Box	P=0.0923	-

significant at 5%. Only linstps explains LOCFDI at 10%. One could say that when the stability score increases by 10%, the volume of FDI increases by 0.45%.

Model 2 LEXPORT

The estimation of model 2 reveals mainly the following results (Table 14).

Validity of the model

Regarding the validity of the model, the two variables LEXPORT and LOCFDI are endogenous variables, based on the weak exogeneity test (Table 14). Indeed, the corrective term is significant at 1 and 5% in both equations, and has the expected negative sign. There is a reminder to balance. The model has residuals that are uncorrelated according to the Ljung-Box test (p-value = 0.1240> 0.05), so they have the behavior of a white noise. These elements indicate that model 2 is indeed valid.

Equation 1

Coefficients of endogenous variables

For delayed endogenous exports, the coefficients from the first to the fourth offsets are significant at 5%. This means that when LTRADE increases by 10% during the year considered, it is expected that it decreases by 0.91% the following year, 0.78% two years later, 0.65% three years later, 0.67 four years later. On the other hand, all 4 delayed LOCFDI variables are positively associated with the 1% threshold export. This means that when LOCFDI increases by 10% today, the export increases 6.35% 4 years later, 6.38% 3 years later, 6.7% 2 years later and 6.79% the following year. These results show a positive and almost stable influence of foreign direct investment from China on the level of exports of African countries. With regard to the decomposition of the conjectured variance at the 10th delay, LOCFDI explains 50.52% of L EXPORT variation. This result is confirmed by the

p-value of the Wald statistic of Granger test, which has a value of 0.0000. It thus concludes that LOCFDI actually causes LEXPORT.

Coefficients of exogenous variables

Only the dummies of the Souther Afr, Indian Ocean sub-regions are significant at 10%and 5%. Souafr, Cenafr, Norafr, Westafr and Indocean are dummy variables indicating the country's membership in a given sub-region, with Eastafr being the reference variable omitted for reasons of multicollinearity. The coefficients of these variables measure the difference in the average of exports for a given sub-region with respect to East Africa. They are all positive, for the significances of 5% and 10% for only two sub-regions. In addition, the LLABOR variable with a negative sign is significant at 1%. This would mean that when the labor force increases by 10%, the trade opening decreases by 0.59%.

Equation 2

Coefficients of endogenous variables

With regard to LOCFDI, only the variables lexport delayed by two periods and four periods and LOCFDI offset by 4 periods are significant at 10%, 10% and 1% respectively. Thus, 10% of increase in the value of the export at time t results a decrease of LOCFDI of 0.83% in t + 2 and 0.78% in t + 4. Increasing exports in the present, would therefore reduce an influx of OCFDI in the near future. For an increase of 10% of LOCFDI in t, it is expected to observe a decline of LOCFDI 4 years later of the order of 32.25%. As for the decomposition of the conjectured variance at 10th delay, LEXPORT explains only 0.46% of the variation of LOCFDI. The Granger test reveals that the export does not cause LOCFDI (p-value = 0.3856). It is concluded that LEXPORT does not formally cause LOCFDI.

Coefficients of exogenous variables

Regarding the LOCFDI equation, no exogenous variables are significant.

Model 3 LIMPORT

The estimation of model 3 reveals mainly the following results (Table 14).

Validity of the model

Regarding the validity of the model, only IMPORT is an

endogenous variables, based on the weak exogeneity test (Table 13). Indeed, the correction term is significant at 1% and 10% in both equations and has the expected negative sign. There is a reminder to balance. The model has residuals that are uncorrelated according to the Ljung-Box test (p-value = 0.0923> 0.05), so they have the behavior of a white noise. These elements indicate that model3 is indeed valid.

Equation 1

Coefficients of endogenous variables

For endogenous retarded of limport, only the coefficient of the first, second and third shifts are significant at 10, 5 and 1%, respectively. This means that when the import increases by 10% during the year, it is expected to decrease by 0.52% the following year and by 0.63% two years later. On the other hand, all 4 delayed LOCFDI variables are positively associated with the 1% threshold. This means that when LOCFDI increases by 10% today, limport increases by 4.46% 4 years later, by 4.49% after 3 years, by 54.67% 2 years later and by 4.55% the following year. These results show a positive and almost stable influence of foreign direct investment from China on the level of imports of African countries.

With regard to the decomposition of the conjectured variance at 10th delay, LOCFDI explains 48.77% of LIMPORT's variation. This result is confirmed by the p-value of the Wald statistic of the Granger test, which has a value of 0.0000. It thus concludes that LOCFDI actually causes LIMPORT.

Coefficients of exogenous variables

Only the dummies in the sub-regions of Africa are significant at 1%. Souafr, Cenafr, Norafr, Westafr and Indocean are dummy variables indicating the country's membership in given sub-region, with Eastafr being the reference variable omitted for reasons of multicollinearity. The coefficients of these variables measure the difference in the average of limport for a given subregion with respect to East Africa. They are all positive, but their values do not reach 10%. In addition, the linstps variable with a negative sign is significant at 5%. This would mean that when the level of political stablity increases by 10%, the level of imports decreases by 0.37%.

Equation2

Coefficients of endogenous variables

As far as LOCFDI is concerned, only the lagged variables

of a period, the fourth period and LOCFDI lagged by 5 periods are significant at 5, 1 and 1% respectively. Thus, an increase of 10% of limport at time t results a decrease of 1.19% of LOCFDI in t + 1, 35.21% in t + 4 and 13.35% in t + 5. An increase of imports in the present, would therefore reduce an influx of FDI in the near future. For a LOCFDI increase of 10% in t, it is expected to observe a decrease of LOCFDI 4 and 5 years later of the order of 35.21% and 13.35%. Regarding the decomposition of the conjectured variance at 10th delay, LIMPORT explains only 0.24% of the variation of LOCFDI. The Granger test reveals that limport does not cause LOCFDI (p-value = 0.6884). It is concluded that LIMPORT does not formally cause LOCFDI.

Coefficients of exogenous variables

As for LOCFDI equation, no exogenous variable is significant at 5%. Only linstps explains LOCFDI at 10%. One could say that when the stability score increases by 10%, the volume of FDI increases by 0.48%.

Conclusion

This study examines the effect or impact of Chinese OFDI on international trade in Africa during the period 2000 to 2015. To bring out this result, we have firstly posed three hypotheses that must be tested to confirm several literature review and assumption. Data was collected through several sources as World Bank Indicator, International Monetary Fund, MOFCOM, UNCTAD. The error corrector model has been chosen to show the long-run relationship between trade and OCFDI. Secondly we applied Levin, Lin and Chu; Im, Pesaran and Shin; ADF-Fisher to see if our variables have unit root or not. The results reveal that hypothesis H0 (has unit root) is rejected; the variables are integrated I (I), (Table 6).

After tested the stationary of the variables, the cointegration test needs to be done; results in Table 7 show that all the variables are cointegrated. Thus the ECM is applied to have the long run equilibrium relationship between Chinese OFDI and international trade. As we see, the trade has positive and significant long-run relationship with OCFDI (Table 14). In the short term, there are bidirectional causality between LTRADE, LEXP, LIMP and OCFDI (Tables 8 to 10). Export and import have a positive and significant relationship with OCFDI; OCFDI cause both Export and Import.

African government should create the mechanism to attract more world FDI and particularly Chinese OFDI. By example, the reduction of time of administrative procedures that are too long; the fight against corruption must be put in the forefront by the African leaders, which should allow investors to invest in Africa and also allow international organizations to provide development assistance on the continent.

Furthermore, to increase also the share of African international market, African leaders must ensure political stability through alternation in power in real time and through transparent elections of the head of states; to give a better image of the continent to the global investors.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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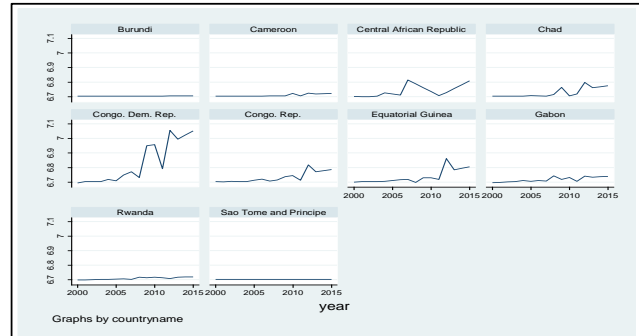World Investment Report. (2017). http://unctad.org/en/PublicationsLibrary/wir2017_en.pdf

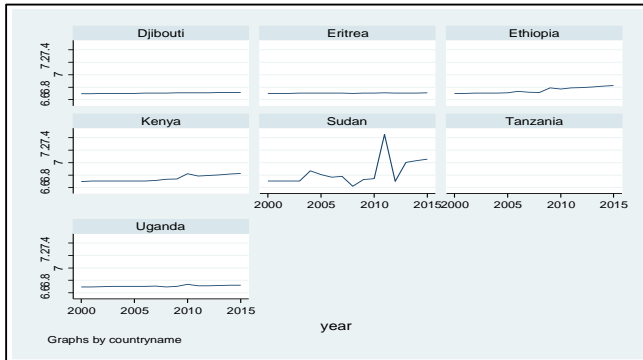# APPENDICES

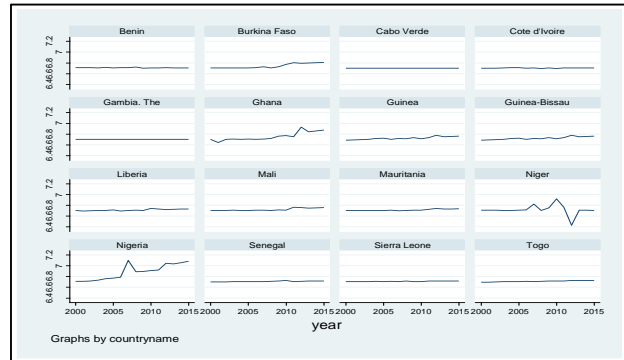**Appendix 1.** Evolution of LOCFDI by country.

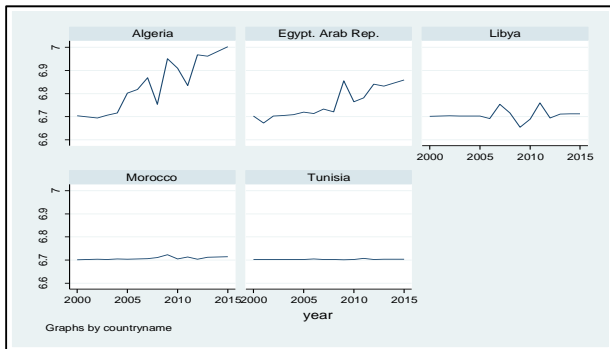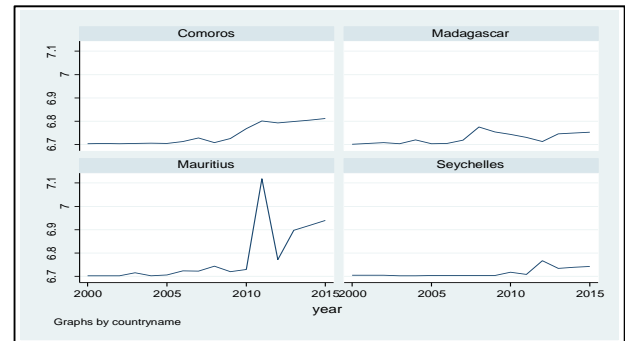Southern Africa
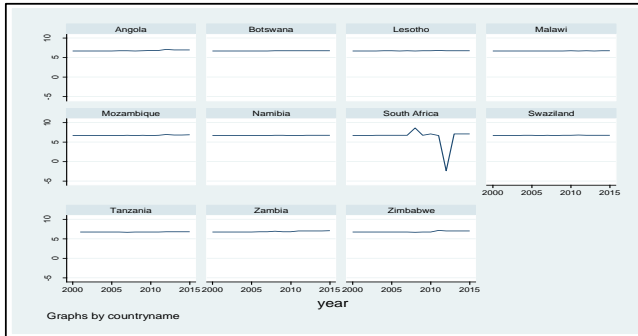
Central Africa

Eastern Africa

Western Africa

Northern Africa

Indian Ocean

Appendix 2. Average of OCFDI and international trade by country.

Country Name	LTRADE	LEXP	LIMP	LOCFDI
Africa	**4,233**	**3,331**	**3,665**	**6,731**
Southern Africa	**4,374**	**3,548**	**3,772**	**6,720**
Angola	4,741	**4,179**	3,886	6,792
Botswana	4,568	3,913	3,821	6,721
Lesotho	4,468	3,352	4,066	6,731
Malawi	4,067	3,138	3,558	6,706
Mozambique	4,381	3,329	3,938	6,748
Namibia	4,597	3,802	3,991	6,710
South Africa	4,070	3,382	3,370	6,372
Swaziland	**4,824**	4,051	**4,204**	6,731
Tanzania	3,825	2,928	3,297	6,743
Zambia	4,219	3,475	3,564	**6,848**
Zimbabwe	4,320	3,443	3,772	6,815

	LTRADE	LEXP	LIMP	LOCFDI
Central Africa	**4,147**	**3,231**	**3,546**	**6,731**
Burundi	3,613	1,971	3,392	6,703
Cameroon	3,794	3,017	3,171	6,709
Central African	3,633	2,622	3,165	6,740
Chad	4,386	3,462	3,815	6,727
Congo, Dem, Rep,	4,045	3,264	3,430	**6,832**
Congo, Rep,	4,930	4,370	4,069	6,732
Equatorial Guinea	**5,069**	**4,477**	**4,200**	6,736
Gabon	4,450	4,031	3,373	6,717
Rwanda	3,670	2,426	3,325	6,710
Sao Tome and Principe	3,875	2,667	3,520	6,703

	LTRADE	LEXP	LIMP	LOCFDI
Eastern Africa	**3,853**	**2,762**	**3,400**	**6,741**
Djibouti	**4,564**	**3,720**	**4,001**	6,705
Eritrea	3,776	2,018	3,561	6,704
Ethiopia	3,575	2,342	3,229	6,749
Kenya	4,006	3,093	3,489	6,747
Sudan	3,460	2,675	2,838	**6,835**
Tanzania	3,511	2,593	3,002	6,703
Uganda	3,757	2,736	3,307	6,709

	LTRADE	LEXP	LIMP	LOCFDI
Western Africa	**4,235**	**3,294**	**3,709**	**6,727**
Benin	4,030	3,103	3,525	6,710
Burkina Faso	3,760	2,646	3,352	6,743
Cabo Verde	**4,594**	3,563	4,148	6,703
Cote d'Ivoire	4,430	**3,824**	3,639	6,705
Gambia, The	4,136	3,124	3,665	6,703
Ghana	4,467	3,571	3,941	6,755
Guinea	4,210	3,365	3,634	6,725
Guinea-Bissau	3,906	2,985	3,394	6,725
Liberia	4,902	3,561	**4,540**	6,712

Appendix 2. Contd.

Mali	4,041	3,200	3,474	6,721
Mauritania	4,591	3,635	4,092	6,714
Niger	3,959	2,915	3,521	6,716
Nigeria	3,938	3,411	3,024	**6,880**
Senegal	4,254	3,296	3,768	6,708
Sierra Leone	3,973	2,816	3,583	6,709
Togo	4,569	3,683	4,037	6,711

	LTRADE	LEXP	LIMP	LOCFDI
Northern Africa	**4,277**	**3,597**	**3,535**	**6,743**
Algeria	4,192	3,642	3,303	**6,836**
Egypt	3,871	3,054	3,285	6,760
Libya	4,490	**4,023**	3,483	6,707
Morocco	4,267	3,447	3,685	6,708
Tunisia	**4,564**	3,818	**3,920**	6,704

	LTRADE	LEXP	LIMP	LOCFDI
Indian Ocean	**4,574**	**3,669**	**4,063**	**6,742**
Comoros	4,074	2,801	3,729	6,743
Madagascar	4,242	3,311	3,734	6,727
Mauritius	4,761	4,004	4,125	**6,783**
Seychelles	**5,220**	**4,561**	**4,662**	6,716

Appendix 3. Looking at the average values over the entire period (2000-2015) country by country (Figure 3), the first five and the last five are as follows:

Rank	LTRADE	LEXP	LIMP	LOCFDI
1[er]	Seychelles	Seychelles	Seychelles	Nigeria
2[e]	Equatorial Guinea	Equatorial Guinea	Swaziland	Zambia
3[e]	Congo	Congo	Liberia	Algeria
4[e]	Swaziland	Angola	Equatorial Guinea	Sudan
5[e]	Mauritius	Swaziland	Cabo verde	Congo democratic
48[e]	Rwanda	Burkina-Faso	Ethiopia	Burundi
49[e]	Central African Rep.	Central African Rep.	Cameroon	Cabo verde
50[e]	Burundi	Ethiopia	Central African Rep.	Gambia
51[e]	Ethiopia	Eritrea	Nigeria	Sao tome
52[e]	Sudan	Burundi	Sudan	South Africa