Exports diversification and knowledge sharing from south-south and south-north economic cooperation: evidence from the Central and West Africa

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Abstract

In this paper, we address the issue of knowledge sharing from FDI inflows and imports from the north and south on exports diversification of selected African economies. Applying Generalized Method of Moments (GMM) and Random-Effects Probit with control of endogeneity, we find that FDI inflows and imports from the north and the south affect differently horizontal and vertical exports diversification. Indeed, FDI inflows have the strongest effect on vertical diversification whereas imports impact strongly horizontal export diversification. Moreover, imports from the south have the strongest impact on horizontal exports diversification whereas only FDI from the north significantly affect exports diversification irrespective of its nature. In addition, we find no evidence of knowledge sharing through education, meaning that lack of education significantly reduces the marginal effects of FDI inflows and imports on exports diversification. However, taking knowledge separately, we find that higher education is required to vertically diversify an economy. As policy recommendation, further human capital investment and set up of incentive mechanisms to attract FDI are needed to truly diversify economies of selected countries.

Keywords: exports diversification, knowledge, FDI, imports, endogeneity.

JEL Classification: F14, I25, O55, C23, C26

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Introduction

Over the last decade, Africa has achieved an impressive economic growth which has not allowed countries to significantly reduce poverty and create jobs[2]. As a continent of huge natural resources reserve, many countries in the continent, particularly oil producers have benefited from the rising global demand of energy coming from fast growing emerging economies like China and India. However, lack of structural transformation has impeded the region to significantly reap the fruit of the globalization. For instance, Collier (2006) has identified four traps that impede Africa development. Commodity trap, which is one of the four traps, simply mean that many countries in the continent lack diversification of their exports basket. Preliminary conditions such as infrastructure, education and macroeconomic stability are necessary for the exports diversification to create sustainable economic development. Indeed, Africa's export basket is mainly dominated by primary products to non-African developing countries and developed countries with a total share of 90% of total exports to non-African developing countries, around 92% for US and 76% for the EU in 2008 (UNCTAD, 2010). Only exports within the region are relatively balanced between primary and manufactured products. Exports diversification[3] is therefore a necessity for the continent.

Links between economic development and exports diversification have been addressed in the literature (Naudé and Roussow, 2011; Naudé et al. 2010; HERZER and NOWAK-LEHMANN, 2005; Hammouda et al., 2006; Cadot, 2011; Sannasse et al., 2014; Parteka and Tamberi, 2013). The key finding is that exports diversification is positively related to growth and economic development. By reducing export revenues volatility, diversification would allow efficient use of export revenue to productive investment which in turn could foster economic growth. Although the role of exports diversification on growth and economic development is undeniable, clear

[2] Growth in Africa over the past decade is particularly related to rise of oil prices and growing demand of fuel consumption from emerging economies. For Johnson et al. (2007), this economic growth is not sustainable in the sense that it cannot help Africa escape from poverty trap. They conclude that Africa needs a stronger and more dynamic manufacturing export sector to make growth sustainable and possibly escape poverty trap.

[3] For Mayer (1996, P. 2), "diversification refers to the expansion of a range of goods made and sold in order to avoid or minimize commercial risk that would occur in relying on one or few products".

identification of drivers behind diversification is important to understand obstacles affecting economic growth through trade in general and exports in particular.

Main drivers of exports diversification are widely discussed in the literature. By exports diversification, we understand horizontal and vertical exports diversification from the literature[4]. Horizontal exports diversification simply means an increase of the number of export sectors or products while vertical exports diversification is a shift from the exports of primary products to the exports of manufacturing products (Herzer and NOWAK-LEHMANN, 2005; Iwamato and Nabeshima, 2012). Few studies have separately addressed the drivers of these two concepts (Alemu, 2008; Herzer and NOWAK-LEHMANN, 2005). However, more have been said about exports diversification in general, meaning horizontal exports diversification. Such assumption is not really sufficient to address the issue of exports diversification in Africa. Indeed, discovery of new natural resources is counted as new exports sectors or products. The most important issue is the shift from primary export products to manufacturing products. Basic prerequisite such as technological skills is needed for this structural transformation to occur. Instead of thinking about new technologies, which require huge investment, one way could be to acquire and adapt existing technologies through spillover effects from international cooperation. It could be a basic way towards innovation.

The problem to be addressed in this paper is the role that plays education in the potential knowledge transfer from south-south and south-north cooperation in exports diversification of some selected African countries. Education and technological transfer through FDI flows and imports from developing and developed countries have already been found as significant determinant of exports diversification. However, things are happening if by simply attracting FDI from the south or the north, domestic companies will acquire knowledge and foster diversification of their exports products. Although basic conditions such as macroeconomic stability, good infrastructures (roads, telecommunication and energy), and good legal framework among others are required for the attractiveness of FDI, workers with good skills or education are needed for the success of knowledge transfer from FDI to local industries.

[4] Diversification at the extensive and intensive margins has also been discussed in the literature (Cadot et al., 2009). Diversification at the extensive margin simply means the rise of the number of product lines while diversification at intensive margin occurs when exports values at the existing lines become more equal.

The question of education on knowledge transfer is relevant in the sense that poor education is considered as an obstacle to economic growth (Johnson et al., 2007). According to Mayer (1996), technological gap and limited capabilities to acquire knowledge are the reasons of a weak diversification in developing countries.

The main hypothesis to be tested in this paper is that education enhances exports diversification through knowledge sharing from south-south and south-north cooperation. Two specific hypotheses are derived from the main hypothesis. The first specific hypothesis to be tested is that secondary education is more relevant for knowledge sharing from the south-south cooperation to exports diversification whereas tertiary education is more relevant for knowledge sharing from south-north cooperation to diversification. The second hypothesis to be tested is that, although education is key for knowledge sharing to horizontal and vertical exports diversification, the latter requires higher education.

The rest of the paper is structured as follow: the first section introduces literature review, the second section presents the data and estimation techniques, the third section presents empirical analysis and the last section gives some concluding remarks and policy recommendations.

Literature review

Poverty and income inequality could be reduced through knowledge spillover from the south-south cooperation (Das, 2012). Applying computable general equilibrium (CGE) model, the author finds that technology shock from the north to the south through trade channel leads to productivity growth which could help to reduce poverty and income inequality. This technology spillover is facilitated by human capital capability, better governance and institution. Moreover, Omgba (2014) has stressed the importance of institutions on export diversification for oil-producing countries in particular. He finds that export diversification is positively related with the distance between the oil production and the political independence starting dates. However, Parteka and Tamberi (2013) using several measures of diversification indices with respect to the world structure of trade (relative Theil index, relative Gini index and Dissimilarity index) find that the level of income is positively related to trade diversification (exports and imports). Even though diversification indices are computed with respect to the world trade structure, diversification definition remains valid only the reference matter (world trade structure, country trade structure or sectoral trade structure). However, this positive link between trade (export)

diversification and income level has been questioned by Klinger and Lederman (2013) who find that diversification increases with income up to a certain high level then reversed to favor specialization.

Other factors such the size, location and trade barriers of an economy are major obstacle for export diversification (Parteka and Tamberi, 2011). Taylor (2007) using trade data of Latin American and Caribbean countries finds that economic size and social capabilities are major obstacles for export diversification in the region to United States. Mayer (1996) has also pointed out the technological gap and limited capabilities to acquire knowledge as obstacles of export diversification for developing countries. These two points are the most important for vertical export diversification. Romer (1993) has labeled these obstacles as object gaps and ideas gaps. Institutional reforms and infrastructural development could not significantly boost exports of manufacturing products if basics skills or quality education are not available. Good education, particularly in science and mathematics, are key ingredients to close technological gap. Easy way for technology acquisition is through trade and investment with technologically advanced countries. However, technology acquisition is not an easy task in competitive environment. Thus, linkages between companies and within industries are conducive to knowledge sharing. FDI and imports of manufacturing products from technologically advanced countries have been identified in the literature as a significant channel for knowledge sharing in developing countries.

Links between FDI and export diversification have been explored in the literature (Iwamoto and Nabeshima, 2012; Javorcik and Spatareanu, 2009; Javorcik, 2008; Harding and Javorcik, 2012; Amighini and Sanfilippo, 2014; Banga, 2006; Alemu, 2008). Some of these studies have addressed the effects of both exports diversification and sophistication. There is no doubt that FDI is positively linked to export diversification. But, the main concern is under what condition such link is possible.

Methodology

- **Data and descriptive statistics**

The data considered in this study come from various sources such as (United Nations Conference on Trade and Development) UNCTAD, World Development Indicators (WDI), United Nations Commodities and Trade Database (UNCOMTRADE), World Economic Outlook (WEO),

International Financial Statistics (IFS). Since table 1 below summarizes all the variables with expected sign, this section presents technical calculation of dependent and independent variables.

These data are collected for a panel of 14 west and central Africa countries. The countries are members of the two regional organizations, CEMAC region in the Central Africa (Cameroon, Central Africa, Chad, Congo, Equatorial Guinea and Gabon) and ECOWAS in the West Africa (Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali, Niger, Nigeria, Senegal and Togo). Analysis is carried out over the period 2001-2012 for data collected on annual basis. We have two categories of data: variables of interest and control variables.

- **Variables of interest**

The first variable of interest is the exports diversification index. Following literature on diversification indices, we construct horizontal diversification index. Vertical diversification index is constructed a binary variable that takes two values: 1 if horizontal diversification for manufactured products is greater than horizontal diversification for primary products. Many export diversification indices have been proposed in the literature, Gini, Herfindahl and Theil indices. In this paper, we consider the equivalent number (EN) which is an inverse of the Herfindahl index for export diversification index. Following works on export diversification (), horizontal export diversification index constructed at the product level is given as follow:

$$HED_{j,t} = \left(1 - H_{j,t}\right) \times 100 \tag{1}$$

Where $HED_{j,t}$ is horizontal export diversification for country j at time t and $H_{j,t}$ is the corresponding Herfindahl index or export concentration index specified as follow:

$$H_{j,t} = \sum_{i=1}^{n} \left(\frac{X_{j,i,t}}{X_{j,t}} \right)^2 \tag{2}$$

Where $X_{j,i,t}$ is country's j exports for products i limited at 2-digit level of the Standard International Trade Classification (SITC) revision 3, $X_{j,t}$ is the total exports of country j at time t and n is the total number of groups of products at 2-digit level of aggregation in the SITC revision 3 coming from United

Nations Commodity trade Database[5] (UNCOMTRADE). The diversification index is comprised between 0 (meaning weak diversification) and 1 (high level of diversification).

Construction of vertical export diversification starts with the calculation of horizontal export diversification for primary products and manufacturing products following the previous specification. Let $HED_{j,t}^{P}$ the horizontal export diversification index for primary products and $HED_{j,t}^{M}$ horizontal export diversification index for manufacturing products, the vertical export diversification index is defined as follow:

$$VED_{j,t} = 1 \text{ if } \quad HED_{j,t}^{M} \geq HED_{j,t}^{P} \qquad (3)$$

$$VED_{j,t} = 0 \qquad \text{otherwise}$$

Where $VED_{j,t}$ is the vertical export diversification of country j at time t. Thus, the country has vertical diversified if the index takes the value 1. Horizontal export diversification for each sector is given as follow:

$$HED_{j,t}^{x} = \left(1 - H_{j,t}^{x}\right) \qquad (4)$$

Where $HED_{j,t}^{x}$ is horizontal export diversification for sector $x = M, P$ and $H_{j,t}^{x}$ is export concentration index or Herfindahl index for each sector of country j at time t.

Other variables of interest are imports value (IMP) and foreign direct investment stock (FDI) from the south and the north. France and United States represent the north while China is the south. According to UNCTAD (2013), France is the first investor in Africa followed by United States with respectively 17.9% and 17.5% of inward FDI stock. China is the 6th investor in Africa with only 4% of inward FDI stock. France is a former colonial power with significant tie with all francophone countries selected in this study and China is a rising emerging power with growing trade and investment in the continent. Imports and FDI are taking as a percentage of GDP. Following Romer (1993) who addresses the closure of object gaps by imports of machinery and equipment, data on imports of manufactured products are split by nature (chemical products, machinery and transport equipment and other manufactured goods) to fully

[5] The database is accessed through the following website : www.trademap.org

capture the effects of each component on export diversification. Data on imports value come from UNCOMTRADE while FDI are collected from UNCTAD's bilateral FDI statistics[6] and GDP from WDI. Knowledge (know) variable, which interacts with imports and FDI from the north and south, is proxy by primary, secondary and tertiary education enrollment ratio. Data on FDI are collected from UNCTAD website.

- **Control variables**

The following variables are used as control variables: GDP per capita (GDP_PC) collected from WDI, inflation (INF) capture macroeconomic stability. Data on inflation calculated as percentage change of consumer price index of end period collected WDI. The use of exchange rate and terms of trade in the same model as explanatory variables as Amighini and Sanfilippo (2014) did is not interesting since the two variables might be correlated causing an econometric problem of multicollinearity. In this study, we only consider terms of trade instead of exchange rate. Other control variables are investment as percentage of GDP (INV_GDP) collected from the WDI and geographic position of a country (LANDLK). This latter variable takes value 1 if country is landlocked and 0 otherwise. Population (POP) is introduced in the model to take the effects of market size in export diversification[7]. Population variable comes from the UNCTAD database. Since the countries on our sample are in majority oil producers, another key variable to be introduced in the regression is the share of natural resources in total exports of goods. Two groups of products fuels and ores, metals, precious stones and non monetary gold are considered to proxy exports of natural[8] resources. Both data of natural resources proxy and total exports of goods come from UNCTAD.

- **Model specification**

Horizontal export diversification

Following exports diversification literature (Osakwe, 2007; Iwamoto and Nabeshima 2012; Amighini and Sanfilippo, 2014), models considered for analysis in this study

[6] These data are primarily collected from the partner's source. We only refer to host country source when data are not available from the partner's source. This was the case for Chad, Central African Republic, Benin, Burkina Faso, Ghana, Niger and Togo.

[7] Larger countries tend to produce more goods varieties, thus they have ability to diversify (Parteka and Tamberi, 2011). This assertion has a theoretical foundation (see Helpman and Krugman, 1985; Dixit and Norman, 1980, quoted by Parteka and Tamberi (2011)).

[8] See table 1 in annex 1 for the group of products in the natural resources.

$$HED_{i,t} = \beta_1 HED_{i,t-1} + \beta_2 FDI_{i,t-1} + \beta_3 know_{i,t-1} \times FDI_{i,t-1} + \beta_4 know_{i,t-1} + \beta_5^{'} X_{i,t-1} + \nu_i + \kappa_t + \varepsilon_{i,t} \quad (9)$$

$$HED_{i,t} = \alpha_1 HED_{i,t-1} + \alpha_2 IMP_{i,t-1} + \alpha_3 know_{i,t-1} \times IMP_{i,t-1} + \alpha_4 know_{i,t-1} + \alpha_5^{'} X_{i,t-1} + \nu_i + \kappa_t + \varepsilon_{i,t} \quad (10)$$

These models pose an econometric problem since an inclusion of lagged value of the dependant variable among regressors may yield a biased estimator. Iwamoto and Nabeshima (2012) have pointed out that such models suffer from three econometric problems: the first is the issue of endogeneity due to the presence of foreign flows, the second problem is the issue of multicollinearity between time invariant fixed effects and explanatory variables and the third problem is related to the issue of autocorelation the issue of non-stationary which could lead to spurious regression also matter in this specification. Generalized method of moments (GMM) appears as the appropriate econometric technique to deal with econometric problems raised by the above specification.

Contribution of FDI and imports on horizontal export diversification is given as follow:

$$\frac{\partial HED}{\partial FDI} = \left(\beta_2 + \beta_3 \times know\right) \quad (11)$$

$$\frac{\partial HED}{\partial IMP} = \left(\alpha_2 + \alpha_3 \times know\right) \quad (12)$$

Coefficients on interaction term when statistically significant, affect the total contribution of FDI and import on horizontal diversification. Sign of these coefficients means two things:

- β_3 or α_3 (+): education accelerates knowledge sharing from FDI inflows or imports from the north and the south on export diversification;
- β_3 or α_3 (-): this sign can be explained by two things.

First, lack of education reduces the marginal contribution of FDI inflows or imports from the north and the south on export diversification. In this case, knowledge sharing is stifle by the lack of available skills in the host economy. Second, negative sign on interaction term means that FDI inflows are directed to the sectors with little content in labor. In this case, knowledge sharing is crowded out by sectors with little content in labor such as oil exploration. As a consequence, we have development of underemployment and informal sector in the host economy.

Vertical export diversification

In this section we present the model used to estimate the effects of FDI inflows and imports from the north or the south on vertical export diversification controlling for endogeneity. Specifically, we model the probability for a country to move from the exports of primary commodities to the exports of manufactured products. The econometric model is given as follow:

$$VED^{*}_{i,t} = \beta_0 + \beta_1 Y_{i,t-1} + \beta_2^{'} X_{i,t-1} + \varepsilon_{i,t} \tag{6}$$

$$VED_{i,t} = \begin{cases} 1 & if \quad VED^{*}_{i,t} > 0 \\ 0 & otherwise \end{cases} \tag{7}$$

Where VED is the observable variable and $VED^{*}_{i,t}$ unobservable variable which is a capacity of a country to export more diversified manufactured products than primary products. $Y_{i,t-1}$ is a vector of endogenous variables and $X_{i,t-1}$ is a vector of exogenous variables. Endogenous and exogenous variables are the same considered in the horizontal export diversification equation. Probability to move from exports of primary commodities to exports of manufactured products is estimated using random-effects probit model. Two approaches are adopted in this paper: in this first approach, we assume no endogeneity in that case we apply a simple random-effects probit regression. In the second approach, we consider endogeneity of FDI inflows and imports in the equation. In that case we follow Vella and Verbeek (1999) to estimate two-step panel data for a censored endogenous variable. In this case only FDI inflows can be considered as endogenous variable to be censored. Negative FDI inflows which are considered as a disinvestment cannot be related to the probability to move exports of primary commodities to exports of manufactured products.

Estimation technique

GMM estimation technique

Dynamic panel estimation developed by Arellano and Bond (1991) for GMM estimator in first difference and system GMM developed by Blundel and Bond (1998) are applied in this study to control for the issue of endogeneity raised previously. To control for time-specific effects and contemporaneous correlation among individuals across time, we follow Rodman (2006) by including time dummies in the regression.

Difference-GMM has been initially developed to correct endogeneity by eliminating individual country effects by taking all the variables in first difference.

Probit regression

In this model, we measure the probability of moving from the exports of primary products to the exports of manufacturing products. The dependant variable is binary which takes value 1 (the country produces more manufacturing goods than primary goods) and 0 (the country produces more primary goods than manufacturing goods). In such a model, OLS estimator will be biased. biased and nonlinear estimator applied without taking into account the problem of endogeneity will also be baised. Two approaches are considered: in the first, random-effects probit regression is estimated assuming no endogeneity. In the second approach, we assume that there is endogeneity problem. In this latter case, we apply the two-step panel data for censored endogenous variable proposed by Vella and Verbeek (1999). The particularity of this estimation technique is that the authors propose to separate time-invariant individual effects from individual time effects, and capture the state dependence producing endogeneity (Salas, 2014).

In the first step, endogenous regressors are estimated using exogenous variables and appropriate instruments and residuals obtained from this step and decomposed into individual and time effects are then included in the final regression which is carried out in the second step. The primary regression to be estimated in given as follow:

$$VED_{i,t}^{*} = \beta_0 + \beta_1 Y_{i,t-1} + \beta_2^{'} X_{i,t-1} + \mu_i + \eta_{i,t} \tag{13}$$

$VED_{i,t}^{*}$ is the unobservable variable where $VED_{i,t} = 1$ if $VED_{i,t}^{*}>0$ which means that a country i at time t has exported more manufactured products than primary commodities. $X_{i,t-1}$ is a vector of exogenous variables and $Y_{i,t-1}$ is the endogenous variable which censored to the left. The endogenous variable is estimated using random-effects tobit as follow:

$$Y_{i,t}^{*} = \gamma_0 + \gamma_1 Y_{i,t-1} + \gamma_2^{'} X_{i,t-1} + \phi_i + \upsilon_{i,t} \tag{14}$$

$Y_{i,t}^{*}$ is the FDI inflows considered to be unobservable so that observable endogenous variable $Y_{i,t} = Y_{i,t}^{*}$ if $Y_{i,t}^{*}>0$ and 0 otherwise. The lagged value of dependent variable is included in the model to control of state dependence. Since presence of lagged value of the independent variable

among regressors is supposed again to cause endogeneity problem due to its correlation with individual effects ϕ_i , endogenous variable in equation (14) is estimated using random-effects tobit technique with the following equation:

$$Y_{i,t-1} = \gamma_0 + \gamma_1^{'} X_{i,t-2} + \omega_{i,t-1} \tag{15}$$

To correct for endogeneity in this last equation, Heckman (1981) suggest to use all pre-sample information on the exogenous variable[9]. The fitted value of the above estimation will be included in equation (14) for estimation. To control for endogeneity in the final regression, we include $u_{i,t} = \phi_i + \upsilon_{i,t}$ and $\overline{u}_i = T^{-1}\sum_{t=1}^{T} u_{i,t}$ assuming that $E\left\{\theta_{i,t} \middle| X_{i,t-1}, u_{i,t}\right\} = \tau_1 u_{i,t} + \tau_2 \overline{u}_i$ allow for heteroskedasticity and autocorrelation in $\eta_{i,t}$ where $\theta_{i,t} = \mu_i + \eta_{i,t}$. The final regression which is carried out in the last step is given as follow:

$$VED_{i,t}^{*} = \beta_0 + \beta_1 Y_{i,t-1} + \beta_2^{'} X_{i,t-1} + \tau_1 u_{i,t} + \tau_2 \overline{u}_i + \theta_{i,t} \tag{16}$$

This equation is estimated using random-effects probit technique and the endogeneity test is the joint significance of τ_1 and τ_2.

Empirical results

Horizontal diversification

Before taking about the effects of our interest variables on export diversification, we first present the general results of other control variables on export diversification. Table 1 below summarizes results of the main determinants of export diversification taking into account different levels of education as indicators of knowledge as well as the interaction variable between knowledge and our variables of interest. From column 1 to 4 in table 1, knowledge indicator is respectively secondary, primary and tertiary education. Equation 4 includes disaggregated values of our variables of interest imports and foreign direct investment (FDI) by origin (north and south).

Overall, lagged value of export diversification significantly affects export diversification. This result cannot be generalized when we control for other knowledge indicator such as primary and tertiary education. Another control variable such as income level or the level of economic

[9] See Vella and Vebeek (1999)

development significantly affects export diversification as already found in the literature (Amighini and Sanfilippo, 2011;). Export diversification increases by 0.56%, 1% and 2.38% following an increase of per capita GDP of 1% and when knowledge is respectively controlled primary, secondary and tertiary education. This result reveals that although country at an early stage of economic development has larger opportunity to diversify (Amighini and Sanfilippo, 2011), this diversification is more pronounced when the stock of human with high level of knowledge is important.

As proxy of macroeconomic stability, inflation although statistically significant in equation 3 and 4, does not have an expected sign. This result is not surprising since other studies (Osakwe, 2007) found that inflation is not statistically significant in the export diversification regression. Another variable used to proxy macroeconomic stability is the terms of trade. This variable is only statistically significant at 1% level in equation 4. Population size is not statistically significant whereas geographical location proxy by landlock is drop due to multicolinearity problem.

Natural resources endowment negatively affects export diversification. This effect is more important when knowledge is proxy by primary education meaning that export diversification will be difficult in a country with important natural resources endowment and low level of education. This result highlights the fact that investment in education is a key for a country to fully take advantage of it natural resources endowment[10].

Concerning FDI, imports and knowledge sharing, empirical results show that FDI inflows have no effect on export diversification of selected countries. This result is not new in the literature. Amighini and Sanfiloppo (2014) and Iwamoto and Nabeshima (2012) have that FDI does not statistically affects export diversification. Iwamoto and Nabeshima (2012) explain these results by two facts. On the one hand, multinational companies are not fully involved in host country's export activities. On the other hand, lack of capabilities transfer could also the results. Manufactured imports are positively related to export diversification in selected countries. In equation 1 which includes secondary education as proxy of knowledge, an increase of imports as a percentage of GDP by 1% leads to the rise of export diversification index by 0.51%. This

[10] Agosin et al. (2012) have already pointed out that country with higher education can take advantage of positive terms of trade to diversify economy. Since natural resources endowment is highly correlated with the terms of trade shocks in selected economies, our conclusion seems plausible.

contribution is little high 0.55% when primary education is considered and 0.27% when tertiary education is included. As policy implication, we can conclude that country with a stock of human capital endowed with high level of knowledge do not necessary need imports products to diversify its economy.

In equation 4 where disaggregated data of imports and FDI inflows are considered, we find the strongest impact of imports coming from the south (China) and FDI inflows coming from the north (USA) on export diversification of selected economies. These results corroborate the findings of Amighini and Sanfilippo (2014) and He (2013) only for imports.

This equation also includes all the levels of education and we find that tertiary education positively affects export diversification. An increase of the ratio of tertiary education by 1% leads to the rise of export diversification index by 0.043%. This result confirms the finding of Ogosin et al. (2012) who finds that human capital accumulation positively affects export diversification. They also find that country with higher education can takes advantage of positive terms of trade to diversify their economy.

Table 2 summarizes results of export diversification determinants using disaggregated data of imports. Equation 1-3 presents results of export diversification determinants using imports of chemical manufactured products. Imports of these products significantly affect export diversification when secondary and primary educations are included in the regression. FDI inflows are not statistically significant in all the specifications. Concerning control variables, natural resources endowment negatively affects export diversification in all specifications. The strongest impact is found with primary education meaning that for two countries with similar natural resources endowment and different levels of education, export diversification is stronger in country with high level of education. Interaction terms when statistically significant have negative sign. Therefore, there is no knowledge sharing from FDI inflows and imports from north or the south through education. In other words, Imports of transport equipment significantly affect export diversification. We also find positive relationship between imports of other manufactured products and export diversification.

In sum, export diversification is positively related to imports of different manufactured products. FDI inflows are not statistically significant. Natural resources endowment appears as a constraint to export diversification. There is no evidence of knowledge sharing from imports and FDI

inflows from the north or the south through education. However, the level of education matters on the effects of natural resources endowment on export diversification. Indeed, natural resources endowment has the strongest impact on export diversification in a country with low level of education. In other words, countries with high level of education could take advantage of natural resources endowment to improve export diversification.

Vertical diversification

Table 3 summarizes results of vertical exports diversification with random-effects probit without assumption of endogeneity. Equations 1-3 present results of vertical exports diversification with respectively secondary, primary and tertiary education. Equations 4-6 present results with disaggregated values of imports. Finally, equation 7 presents results with disaggregated values of imports by origin.

Probability to export more manufactured products increases with the level of economic development in equation 1. In equation 2, this probability increases with FDI inflows and reduces with inflation. Although the level of education does not matter in the regression of the first two equations, tertiary education included in equation 3 positively affects probability to export more manufactured products. In addition, though the interaction term between FDI inflows and the level of education is positive, it is not significant leading to the conclusion that there no is evidence of knowledge sharing from FDI inflows on vertical diversification.

Using disaggregated values of imports, probability to vertically diversify increases with FDI inflows and reduces with imports of chemical manufactured products and domestic investment. Since the expected sign on domestic investment was positive, the results signal resources misallocation within the economy (Amighini and Sanfilippo, 2014). Probability to vertically diversify is positively related with FDI inflows and negatively affected by inflation in equation 5. Higher inflation is harmful to competitiveness which is critical in the export market of manufactured goods. In equation 6, imports of manufactured transport equipment and tertiary education positively affect the probability to vertically diversify whereas inflation and imports of other manufactured products have a negative effect. This results reveal that more tariff preferential should be given to African imports of machinery and transport equipment to help the countries vertically diversify their economies. However, disaggregating imports by origin in equation 7, we find that imports from China negatively affect probability to vertically diversify

whereas tertiary education has a positive effect. Our results are consistent with the findings of Sheridan (2014) who concludes that a minimum level of human capital is needed before it is beneficial for a country to transition from a reliance on primary products to manufacturing products. Moreover, Giovannetti and Sanfilippo (2009) have found that Chinese exports negatively affect African exports for manufacturing products. therefore, our findings that imports from china reduce probability of selected countries to move from exports of primary products to exports of manufactured products corroborate Giovannetti and Sanfilippo (2009) results.

To sum up, there is evidence that for a country to vertically diversify it economy or export more manufactured goods, attention should be paid to the attractiveness of FDI and investment in human capital, particularly in the higher education. By attracting FDI, countries can help set up forward and backward linkages within industry between domestic firms and foreign companies.

Probit regression with endogeneity

Table 4 presents results of vertical exports diversification with correction endogeneity using Vella and Verbeek (1999) two-step estimation. Endogeneity test is carried out on the coefficients of time invariant individual effects and time effects. The test statistics are given in the last row of the table. We find no evidence of endogeneity for all specifications. As summary, we again find that imports from the south reduce the likelihood to move for the exports of primary products to the exports of manufactured goods. On the contrary, imports from the north positively affect probability to vertically diversify economies of selected countries. Higher education is also an important input that positively affects probability to vertically diversify.

Conclusion and policy recommendations

One of the unsettled issues is diversification of exports products in Africa. This issue is still relevant given the good economic growth registered by the countries in the continent over the last decade due to the growing demand of raw material from emerging economies. Sustainability of this economic performance has been questioned.

Unlike many studies on export diversification in Africa, this paper addresses horizontal and vertical exports diversification separately. Moreover, knowledge sharing from trade and investment flows coming from the north and the south is taking into account through education.

Although we find no evidence of knowledge sharing through education, our results reveal that lack of education reduces the contribution of FDI inflows and imports on exports diversification.

Overall, imports have a positive impact on exports diversification and negative effect on vertical exports diversification. Imports from the south have the strongest impact on the horizontal exports diversification. Concerning vertical exports diversification, imports from the south negatively affect probability to export more manufactured products.

FDI inflows have no impact on horizontal exports diversification, but positively affect probability to export more manufactured goods. By origin, we find that FDI inflows from the north have the strongest impact on horizontal and vertical exports diversification. FDI inflows from the south have no impact on horizontal exports diversification.

As policy recommendation, different policies for horizontal and vertical diversification should be put in place. Incentive mechanisms to attract more FDI and further investment in human capital are a way forward to diversify economies of selected countries.

References

[1] Agosin, M., R., Alvarez, R. and Bravo-Ortega (2012). "Determinants of export diversification around the world: 1962-2000", the World Economy, vol. 35, Issue 3

[2] Alemu, A. (2008). "Determinants of vertical and horizontal export diversification: evidence from Sub-Saharan Africa and East Asia", Ethiopian Journal of Economics, vol. 17, N^{o} 2

[3] Arellano, M., and Bond, S. (1991). "Some tests of specification for panel data: Monte Carlo evidence and application to employment equations". Review of Economic Studies, 58,pp. 227–297.

[4] Amighini, A. and Sanfilippo, M. (2014). "Impact of South–South FDI and Trade on the Export Upgrading of African Economies", World Development Vol. 64, pp. 1–17

[5] Banga, R. (2006). "The export-diversifying impact of Japanese and US foreign direct investments in the Indian manufacturing sector", Journal of International Studies, 37, pp. 558-568

[6] Beata S. Javorcik (2008). "Can Survey Evidence Shed Light on Spillovers from Foreign Direct Investment?", The World Bank Research Observer, vol. 23, no. 2

[7] Blundell, R. W., and Bond, S. R. (1998). "Initial conditions and moment restrictions in dynamic panel data model". Journal of Econometrics, 87, pp. 115–143.

[8] Collier, P. (2006). "African growth: why a 'big push'?", Journal of African Economies, vol. 15, Issue 2, PP. 188-211

[9] Das, G., G.(2012). "Globalization, socio-institutional factors and North–South knowledge diffusion: Role of India and China as Southern growth progenitors", Technological Forecasting and Social Change 79 pp. 620–637

[10] DIERK HERZER* and FELICITAS NOWAK-LEHMANN D (2005). "What does export diversification do for growth? An econometric Analysis", Ibero-America Institute for Economic Research, University of Goettingen, Platz der Goettinger Sieben 3, 37073 Goettingen, Germany

[11] Giovannetti, G. and Sanfilippo, M. (2009). "Do Chinese exports crowd-out African goods? An econometric analysis by country and sector", European Journal of Development Research, vol. 21, 4, pp. 506-530

[12] Hammouda, B.,H., Karingi, S. N., Njuguna, A. E., and Sadni-Jallab, M. (2006). Diversification: Towards a new paradigm for Africa's development. Africa Trade Policy Centre Work in Progress N. 35. Addis Ababa: UNECA.

[13] Harding, T. and Javorcik, B., S. (2012). "Foreign direct investment and export upgrading?" The Review of Economics and Statistics, 94(4), pp.964–980

[14] HE, Y. (2013). "Does China's trade expansion help African development? —an empirical estimation", China Economic Review 26 (2013) pp. 28–38

[15] Iwamoto, M. & Nabeshima, K. (2012). "Can FDI promote export diversification and sophistication of host countries? Dynamic panel system GMM analysis", IDE Discussion Paper N. 347. Chiba: IDE/JETRO.

[16] Javorcik, Beata S.; Spatareanu, Mariana (2009). "Tough Love: Do Czech Suppliers Learn from Their Relationships with Multinationals?", LICOS Discussion Paper, No.249

[17] Johnson, S., Ostry, J., D. Subramanian, A. (2007). "The prospects for sustained growth in africa: benchmarking the constraints", NBER Working Paper 13120

[18] Klinger, B. and Lederman, D. (2011) “Export discoveries, diversification and barriers to entry”, Economic Systems 35 pp. 64–83

[19] Mayer, J. (1996). “implications of new trade and endogenous growth theories for diversification policies of commodity-dependent countries”, UNCTAD

[20] Naudé, W., Bosker, M. and Matthee, M. (2010). “Export specialization and local economic growth”, World Economy, vol. 33, Issue 4, PP. 552-572

[21] Naudé, W. and Rossouw, R. (2011). “Export diversification and economic performance: evidence from Brazil, China, India and South Africa”, volume 44, PP. 99-134

[22] Omgba, L.D. Institutional foundations of export diversification patterns in oil-producing countries. Journal of Comparative Economics (2014), http://dx.doi.org/10.1016/j.jce.2014.02.001

[23] Osakwe, P. N. (2007). Foreign aid, resources and export diversification in Africa: A new test of existing theories. Africa Trade Policy Centre Working Paper N. 61. Economic Commission for Africa

[24] Page, J. (2012). “can Africa industrialise?”, Journal of African Economies, volume 21, Issue 2, PP. 86-124

[25] Parteka A.and Tamberi M. (2011). “Export Diversification and Development: an Empirical Assessment”. Universita' Politecnica delle Marche, Dipartimento di Scienze Economiche e Sociali. Quaderni di Ricerca n° 359

[26] Parteka, A. and Tamberi M. (2013). “Product diversification, relative specialisation and economic development: Import–export analysis”, Journal of Macroeconomics 38, 121–135

[27] Roodman, D. (2009). “practitioners’ corner a note on the theme of Too Many Instruments”, Oxford Bulletin of Economics and Statistics, 71, 1 (2009)

[28] Roodman, D. (2009). “How to do xtabond2: An introduction to difference and system GMM in Stata”. Stata Journal, 9(1), pp. 86-136.

[29] SALAS, V., B. (2014). “International Remittances and Human Capital Formation”, World Development Vol. 59, pp. 224–237

[30] Sheridan, B.J.(2014). “Manufacturing exports and growth: When is a developing country ready to transition from primary exports to manufacturing exports?”, Journal of Macroeconomics (2014), doi: http:// dx.doi.org/10.1016/j.jmacro.2014.06.002

[31] Timothy G. Taylor (2007); “Export diversification in Latin America and the Caribbean”, The Journal of the Caribbean Agro-Economic Society (CAES),. 7 (1) pp. 157-175

[32] UNCTAD, (2013b), Handbook of Statistics, (Geneva: United Nations).

[33] Vella, F. and Verbeek, M (1999). “Two-step estimation of panel data models with censored endogenous variables and selection bias”, Journal of Econometrics, 90, pp. 239Ð263

Annexes

Table1 : results of horizontal exports diversification (GMM estimation)

variables	**Equation 1**	**Equation 2**	**Equation 3**	**Equation 4**
LHED_1	0.258213*** (0.088068)	0.050086 (0.160375)	-0.07237 (0.168656)	-0.28939*** (0.058889)
LIMP_MANUF_GDP_1	0.516467** (0.243575)	0.555865*** (0.127901)	0.278102** (0.131099)	
LIMP_USA_GDP_1				0.232599** (0.094752)
LIMP_FRANCE_GDP_1				-0.74418** (0.325326)
LIMP_CHINA_GDP_1				0.58753*** (0.19996)
LFDI_INF_GDP_1	0.008201 (0.035671)	-0.03819 (0.032568)	0.011242 (0.020347)	
INFL_1	0.013254 (0.014355)	-0.00048 (0.008282)	0.026242** (0.011953)	0.069412*** (0.021137)
FDI_USA_GDP_1				0.240457*** (0.064821)
FDI_FRANCE_GDP_1				0.006564 (0.010234)
FDI_CHINA_GDP_1				0.060339 (0.113823)
LGDP_PC_1	1.088069** (0.450682)	0.560809* (0.332734)	-2.3878*** (0.75117)	-4.08979*** (0.338102)
LINV_GDP_1	-0.19772 (0.175093)	0.079081 (0.209115)	-0.17905 (0.126628)	-0.50492*** (0.138006)
PRIMARY_1		-0.01814** (0.008253)		-0.03912*** (0.014521)
SECON_1	0.002238 (0.008668)			-0.00162 (0.004598)
TERTIA_1			0.020949 (0.03199)	0.043877** (0.018768)

LLOCK_1				
LTOT_1	0.001686 (0.207101)	0.113273 (0.154647)	-0.30511 (0.386047)	-1.83147*** (0.207768)
LPOP_1	-2.79424 (3.225427)	0.251973 (3.286743)	0.857614 (1.667026)	-9.31349 (9.820355)
LNAT_RES_GDP_1	-0.09586** (0.047914)	-0.14022*** (0.045156)	-0.05327 (0.033778)	-0.02786 (0.057452)
FDI*PRIMARY		-0.00053** (0.000255)		
IMP*PRIMARY		-0.00283 (0.001824)		
FDI*SECON	-0.00286** (0.00143)			
IMP*SECON	-0.00188 (0.003233)			
FDI*TERTIA			-0.00094 (0.004097)	
IMP*TERTIA			-0.02567** (0.007963)	
NUMBER OF OBS.	92	87	71	35
NUMBER OF INSTRUMENTS	83	73	70	35
AR(2) TEST	1.6	-0.5	-0.93	-1.71
SARGAN TEST	106.34	85.78	79.6	28.25

Note: values in parentheses are robust standard errors. *, **, *** indicate significance at 10%, 5% and 1%

Table 2 : results of horizontal exports diversification (GMM estimation)

variables	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6	Equation 7	Equation 8	Equation 9
LHED_1	0.2769648** (0.11717)	0.104258 (0.201393)	-0.10453 (0.171239)	0.227041*** (0.077196)	0.019311 (0.169597)	-0.06646 (0.170052)	0.247139*** (0.091311)	0.020034 (0.165156)	-0.06941 (0.164901)
LIMP_MANUF_GDP_1									
LIMP_CHEM_MANUF_GDP_1	0.476155 (0.354469)	0.468922** (0.189417)	-0.08624 (0.138003)						
LIMP_TRANS_MANUF_GDP_1				0.441874** (0.174586)	0.340704*** (0.079555)	0.29338** (0.117694)			
LIMP_OTHER_MANUF_GDP_1							0.390098* (0.20243)	0.385353*** (0.078048)	0.220334* (0.118686)
LFDI_INF_GDP_1	-0.00022 (0.038895)	-0.07498* (0.040114)	-0.00078 (0.022979)	0.008557 (0.040262)	-0.03772 (0.031146)	0.012247 (0.018733)	0.003633 (0.034451)	-0.05554 (0.034406)	0.007314 (0.020993)
INFL_1	0.012639 (0.014594)	0.007664 (0.009407)	0.024707 (0.011164)	0.014512 (0.015093)	0.00233 (0.008599)	0.02831** (0.011665)	0.011727 (0.013981)	-0.0026 (0.008696)	0.025356** (0.012276)
LGDP_PC_1	1.159433** (0.486356)	0.726129 (0.424379)	-2.65486 (0.752874)	1.134147** (0.477842)	0.557763 (0.379636)	-2.37287*** (0.768203)	1.091541 (0.456458)	-0.757961** (0.304151)	-2.42749*** (0.72396)
LINV_GDP_1	-0.18232 (0.225967)	-0.00953* (0.206462)	0.001945 (0.105409)	-0.14491 (0.142089)	0.164837 (0.216188)	-0.17793 (0.131946)	-0.1475 (0.177611)	0.146594 (0.212596)	-0.15263 (0.126488)
PRIMARY_1		-0.01618* (0.009494)			-0.01663** (0.008323)			-0.02295*** (0.008533)	
SECON_1	0.001253 (0.008631)			0.002836 (0.009067)			0.002247 (0.007504)		
TERTIA_1			-0.00418 (0.031236)			0.014014 (0.032706)			0.023038 (0.0304)
LTOT_1	-0.05162 (0.218851)	0.033617 (0.253301)	-0.21415 (0.439395)	0.006621 (0.230589)	0.155783 (0.177889)	-0.29028 (0.364889)	0.052609 (0.260469)	0.016191 (0.205521)	-0.24448 (0.396851)
LPOP_1	-1.64648 (2.917663)	1.491748 (3.251796)	3.251796** (1.64095)	-3.92047 (2.980867)	0.69663 (3.189207)	0.280083 (1.703691)	-2.21176 (3.408328)	0.475282 (3.079412)	1.458531 (1.706013)
LNAT_RES_GDP_1	-0.13232** (0.041072)	-0.2025*** (0.04535)	-0.0784*** (0.029103)	-0.08007* (0.046706)	-0.15354*** (0.049722)	-0.04376 (0.036304)	-0.11082** (0.046312)	-0.15561*** (0.053179)	-0.06423** (0.029007)
FDI*PRIMARY		-0.0008*** (0.000311)			-0.00061** (0.000239)			-0.00044 (0.000324)	

IMP*PRIMARY		-0.00353* (0.001954)			-0.00352* (0.001995)			-0.00238 (0.001997)	
FDI*SECON	-0.00315* (0.001623)			-0.00342** (0.001571)			-0.00244* (0.001395)		
IMP*SECON	-0.00038 (0.003307)			-0.00191 (0.003187)			-0.00121 (0.003137)		
FDI*TERTIA			-0.00082 (0.003905)			-0.00212 (0.003967)			-0.00071 (0.004083)
IMP*TERTIA			-0.01368* (0.007325)			-0.0249*** (0.007754)			-0.0254*** (0.008098)
NUMBER OF OBS.	92	87	70	92	87	71	92	87	71
NUMBER OF INSTRUMENTS	83	73	71	83	73	70	83	73	70
AR(2) TEST	1.22	-0.56	-0.9	1.68	-0.7	-0.63	1.52	-0.63	-1.05
SARGAN TEST	102.39	79.51	75.04	107.34	90.67	78.98	107.63	87.28	79.35

***Note**: Note: values in parentheses are robust standard errors. *, **, *** indicate significance at 10%, 5% and 1%

Table 3: results of vertical exports diversification (random-effects probit estimation)

variables	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6	Equation 7
LFDI_INF_GDP	0.1254296	0.9293231**	-0.2309914	1.410703*	0.5325401*	1.747323	
	(0.4058287)	(0.4114024)	(0.7978742)	(0.7976706)	(0.275293)	(1.894865)	
LIMP_MANUF_GDP_1	0.4152273	0.3621231	-4.529166				
	(1.497408)	(1.600825)	(3.682554)				
LIMP_CHEM_MANUF_GDP_1				-4.937748*	-.4963783	-3.846985	
				(2.556711)	(0.7488966)	(4.041855)	
LIMP_TRANS_MANUF_GDP_1				5.34994	0.9584865	12.00385*	
				(2.835157)	(1.284432)	(6.976237)	
LIMP_OTHER_MANUF_GDP_1				2.173704	-1.614822	-19.93869*	
				(2.550581)	(1.007884)	(11.62423)	
LIMP_USA_GDP							0.5824658
							(0.569401)
LIMP_FRANC~P							-0.1745989
							(0.8137715)
LIMP_CHINA~P							-1.307367*
							(0.7471023)
LINV_GDP	-1.942545	-0.5804385	-1.450623	-8.0395*	-.3707675	-19.05814	-1.519552
	(1.496069)	(1.233217)	(2.677358)	(4.458516)	(1.024978)	(12.7201)	(1.904536)
LTOT	0.0597346	1.526547	-2.543606	1.976449	1.306774*	-3.522657	1.135309
	(0.8176711)	(0.9621333)	(1.971855)	(1.932559)	(0.6867233)	(3.728604)	(1.389172)
INFL	-0.0242547	-0.100584**	-.355118*	0.0213248	-.0877085*	-0.95925**	-0.1971421
	(0.043259)	(0.0442821)	(0.2002788)	(0.073128)	(0.0359239)	(0.486861)	(0.129151)
LGDP_PC	2.468441**	-.0696477	5.632775	1.843676	-0.4869489	11.22268	1.862762
	(1.190787)	(0.8145146)	(3.738048)	(2.165456)	(0.6061659)	(8.274181)	(1.465894)
LNAT_RES_GDP	-0.4678234	-0.322192	-1.686191	-.7889491	-0.2684807	-5.126206	-.9046253
	(0.3118804)	(0.2648092)	(1.152466)	(0.6220033)	(0.2818821)	(3.319178)	(0.7020745)

LPOP	0.3270234 (0.3824675)	0.0698746 (0.3983844)	0.9135943 (1.079225)				
SECON	0.0405929 (0.0943832)			-0.1376084 (0.1112599)			
PRIMARY		0.0737044 (0.0455218)			0.0047941 (0.0188022)		
TERTIA			1.737608* (0.9827766)			1.230513 (0.6017985)	0.7702854 (0.4428907)
interact_~FS	0.0137771 (0.0098587)	0.0002105 (0.0040726)	0.0885437 (0.1807097)				
interact_~PS	-0.0461195 (0.0286034)	-.0327356* (0.0167751)	-0.586754* (0.3476881)				
LLOCK	0.0606149 (0.9918279)	-.6772946 (1.002331)	5.41523 (4.258081)	1.113169 (3.11834)	-.0400868 (0.7921767)	14.72155 (9.364794)	5.912084 (3.764205)
_cons	-9.075241 (7.102955)	-2.184422 (8.223185)	-9.738391 (14.99585)	3.39528 (13.5361)	1.693387 (4.801361)	33.33558 (25.7563)	-12.90369 (8.049035)

Note: Note: values in parentheses are robust standard errors. *, **, *** indicate significance at 10%, 5% and 1%

Table 4: results of vertical exports diversification (Vella and Verbeek (1999) two-step estimation)

variables	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6	Equation 7	Equation 8
LFDI_INF_GDP_1	1.638399 (1.01477)	0.678334 (0.417524)	0.229572 (0.782062)	0.214925 (0.64964)	0.48296 (0.565631)	-0.51159 (1.05019)	4.97681** (2.422)	0.638268 (1.53480)
LIMP_MANUF_GDP_1	-5.66925* (3.20054)	-1.6783 (1.638321)	-6.90724* (3.847221)					
LIMP_CHEM_MANUF_GDP_1							-14.6144** (6.320821)	-4.49845 (3.55715)
LIMP_TRANS_MANUF_GDP_1							7.08048* (4.182124)	5.719419 (5.76011)
LIMP_OTHER_MANUF_GDP_1							11.84038* (6.315919)	-9.73532* (5.61087)
LIMP_FRANCE_GDP				4.37497 (2.76898)	3.157728* (1.838898)	3.156709 (2.49936)		
LIMP_CHINA_GDP				-4.0822** (1.85041)	-1.20169** (0.565029)	-0.9037* (0.50882)		
LIMP_USA_GDP				-1.09984 (1.08777)	1.779429* (1.073604)	-0.9673 (1.02094)		
INFL_1								
LGDP_PC_1	2.138933 (1.96723)	4.74914*** (1.669013)	-7.54972 (9.859083)	3.595235 (3.62723)	6.949873** (2.752448)	5.689451 (6.85438)	14.55207 (10.22763)	-16.5883 (13.9681)
LINV_GDP_1	-6.19426 (5.39937)	-3.31756* (1.897505)	-18.3308 (22.84376)	-7.88964* (4.77541)	-7.09617** (3.012962)	-3.43615 (6.63200)	-31.4106** (12.4191)	-30.5195 (30.3962)
PRIMARY_1	-0.01273 (0.04943)			0.141246 (0.10717)				

SECON_1		-0.12295** (0.054854)			-0.07463 (0.113594)		-0.75006* (0.416375)	
TERTIA_1			2.084785** (1.032158)			0.548595 (0.90354)		3.233073* (1.81843)
LTOT_1	0.87286 (2.19050)	-0.70806 (0.895213)	7.938589 (8.597026)	4.843191 (3.44993)	-1.18031 (1.874284)	-1.15631 (4.11480)	6.829721 (6.047121)	13.63239 (11.8050)
LPOP_1	-.5309317 (0.97787)	0.90984 (0.681796)	-10.3949 (7.589599)	2.892439 (2.16451)	5.207305** (2.624686)	3.655055 (5.11599)	6.100372 (3.906456)	-17.9692* (10.7001)
LNAT_RES_GDP_1	-1.74768 (1.25236)	-0.81952* (0.432232)	-1.83235 (1.273262)	-0.90133 (1.25100)	-0.88199 (0.651177)	-1.082 (1.10203)	-1.80936 (2.006634)	-3.0673 (2.07662)
LLOCK	2.960214 (3.63926)	0.925732 (1.385307)	10.74192* (5.587591)	9.708157* (5.22199)	4.110678 (2.949817)	9.482193 (6.46099)	-0.63004 (8.752775)	11.17693* (6.27292)
uit	1.578406 (1.54365)	0.512143 (0.84618)	-42.9287 (50.3333)	0.886862 (2.02997)	1.348734 (1.494818)	-2.50971 (12.4944)	2.40146 (3.993823)	-66.2124 (68.3061)
ui	-8.47798 (8.7294)1	3.539198 (4.058949)	-10.2009 (6.202238)	-15.1124 (9.53481)	9.474686 (6.257792)	0.092315 (8.05254)	13.48669 (19.43695)	-16.3018 (15.1530)
constant	27.91548 (23.3434)	-14.1307 (10.47181)	185.7646 (182.0436)	-61.5299* (36.7408)	-64.7357** (31.03438)	-58.6276 (79.3235)	-67.5364 (54.75181)	320.649 (240.699)
Observations	104	102	89	86	91	81	102	89
Endogeneity (F-test)	1.28	1.49	3.04	2.57	3.25	0.04	0.82	2.34

Note: Note: values in parentheses are robust standard errors. *, **, *** indicate significance at 10%, 5% and 1%

Table 5 : List of products

Group of products	SITC Codes revision 3
Raw materials • Agricultural raw materials • Ores, metals, precious stones and non-monetary gold • Fuels	 2-(22+27+28) 27+28+68+667+971 3
Manufactured products • Chemical products • Machinery and transport equipment • Other manufactured products	5+6+7+8-(667+68) 5 7 6+8-6-(667+68)
Natural resources	
Mineral fuels, lubricants and related materials • Coals, coke and briquette • Petroleum, petroleum products and related materials • Gas, natural and manufactured • Electric curant	3 32 33 34 35
Ores, metals, precious stones and non-monetary gold • Crude fertilizers, other than those of division 56, and crude minerals (excluding coal, petroleum and precious stones) • Metalliferous ores and metal scrap • Non-ferrous metal • Pearls, precious and semi-precious stones • Gold, non-monetary (excluding gold ores and concentrates)	27+28+68+667+971 27 28 68 667 971

Source: Handbook of trade statistics (2013)

Table 6: summary of data

Variable	**Description of variables**	**Expected sign**	**Data sources**
HED	Horizontal export diversification		
VED	Vertical export diversification		
IMP_MANUF_GDP	Imports of manufactured products in % of GDP	+	UNCOMTRADE
IMP_CHEM_MANUF_GDP	Imports of chemical manufactured products in % of GDP	+	UNCTAD
IMP_TRANS_MANUF_GDP	Imports of transport manufactured products in % of GDP	+	UNCTAD
IMP_USA_GDP	Imports from USA in % of GDP	+	UNCOMTRADE
IMP_OTHER_MANUF_GDP	Imports of other manufactured products	+	UNCTAD

IMP_FRANCE_GDP	Imports from France in % of GDP	+	UNCOMTRADE
IMP_CHINA_GDP	Imports from China in % of GDP	+	UNCOMTRADE
FDI_INF_GDP	FDI inflows in % of GDP	+	UNCTAD
INFL	Inflation, average end of period in %	-	WDI
FDI_USA_GDP	FDI inflows from USA in % of GDP	+	UNCTAD
FDI_FRANCE_GDP	FDI inflows from France in % of GDP	+	UNCTAD
FDI_CHINA_~P	FDI inflows from China in % of GDP	+	UNCTAD
GDP_PC	GDP per capita in US dollar	+	WDI
INV_GDP	Investment in % of GDP		WDI
PRIMARY	Ratio of primary school enrolment in %		WDI
SECON	Ratio of secondary school enrolment in%		WDI
TERTIA	Ratio of tertiary school enrolment in %		WDI
LLOCK	Dummy variable, 1 if landlocked and 0 if not	-	
TOT	Terms of trade	-	UNCTAD
POP	Population	+	UNCTAD
NAT_RES_GDP	Share of natural resources in % of GDP	-	UNCTAD

Table 7: descriptive statistics

Variable	Obs	Mean	Std. Dev	Min	Max
HED	177	53.4183	26.99765	0.68522	91.69477
IMP_MANUF_GDP	180	17.53992	7.113285	3.376196	62.75333
IMP_CHEM_MANUF_GDP	180	2.862607	1.208308	0.540031	5.784293
IMP_TRANS_MANUF_GDP	180	7.859247	4.209968	1.426845	33.81273
IMP_USA_GDP	180	1.396359	1.562919	0	13.53465
IMP_OTHER_MANUF_GDP	180	6.818069	3.782759	1.236884	23.15631
IMP_FRANCE_GDP	180	3.5272	2.492365	0	9.932488
IMP_CHINA_GDP	180	1.729899	1.984283	0	17.49794
FDI_INF_GDP	180	5.12593	8.013269	-5.14866	64.39023
INFL	180	4.530906	5.216985	-7.44	32.906
FDI_INWARD_STOCK_GDP	177	28.95999	29.86438	0.561006	153.6179
FDI_USA_GDP	150	5.476926	22.02584	-1.37186	170.4483
FDI_FRANCE_GDP	180	3.958542	6.629833	-0.31024	36.24454
FDI_CHINA_~P	157	0.575824	0.983883	0	6.699907
GDP_PC	180	2097.048	3998.686	160.339	23432.39
INV_GDP	180	25.11137	17.17572	6.59	147.879
REER	96	102.1757	9.660157	71.29583	134.8793
PRIMARY	138	89.22749	23.08254	35.58133	139.6437
SECON	134	29.25004	14.65075	6.83248	65.69787
TERTIA	112	4.333677	2.921156	0.62955	14.76735
LLOCK	180	0.333333	0.47272	0	1
TOT	180	127.7895	48.6929	21.21808	236.4172
POP	180	19506.25	34697.96	534.592	168833.8
NAT_RES_GDP	180	22.24232	27.82892	0.038529	105.8654