Journal of Advances in Economics and Finance, Vol. 2, No. 3, August 2017
https://dx.doi.org/10.22606/jaef.2017.23002

Export Commodity Prices and Long-Run Growth of African Economies

Solomon Abayomi Olakojo, Ph.D[1].

Department of Economies, University of Ibadan, Ibadan, Nigeria
Email: solomonolakojo@gmail.com

Abstract. Government revenue in most African countries is based on export proceeds from few primary commodities. This limits their ability to manoeuvre in case of negative exogenous price shocks, with undesired effects on economic growth. This study, therefore, investigates the effect of primary commodity prices on long-run growth of 24 primary commodity-based African economies between 1980 and 2015. A neoclassical growth model, complimented with Keynesian national income identity, was estimated with Pooled Mean Group heterogeneous panel data regression. The result reveals a significant positive inelastic effect of primary commodity export prices on economic growth in the long run, especially among the less diversified African countries. Thus, Africa has less to gain from export prices increase in the long run. Hence, there is a need for African countries to intensify efforts at diversifying production and export base to minimise the impact of negative price shocks on their long run growth.

Keywords: Africa, primary commodities export prices, long-run growth, heterogeneous panel data.

1 Introduction

A theoretical link exists between economic performance and export prices. Unfavourable movement in export commodity prices may be due to two main reasons; first, when there is a substantial supply of export goods in excess of demand and, second when there is a substantial increase in value of tradable currency relative to the exporting countries' currencies. Thus, a fall in commodity prices is highly associated with exogenous factors which "small" exporting countries have little or no control over. The link between these two reasons and economic growth can be explained within the concept of Keynesian income identity for an open economy, where gross output is a function of domestic and trade variables; and "immizerising growth" in which growth is heavily export biased leading to a fall in terms of trade of the exporting countries.

Majority of African economies export primary commodities mostly in raw forms. One of the reasons is because of low level of industrialization hindering active participation in global value chain (GVC). Besides, most developing African countries are monocultured economies depending on few exportable primary commodities as a source of government revenue and foreign exchange earnings. Since the individual developing African economy is "small" and cannot influence the prices of these primary commodities and is often over-dependent on these commodities, a fall in prices implies less government revenue and foreign exchange reserves. In most cases, there is less room for manoeuvring because most developing African economies are also less diversified in primary commodity exports.

To buttress the above, the period of fall in commodity prices is often associated with fall in government revenue and by implication fall in government investment expenditure, debt increase and decline economic growth especially among sub-Saharan African economies. For instance, during the global financial crisis of 2008/2009 commodity prices index (oil and non-oil) fell from 172.49 point in 2008 to record about 116.8 point in 2009. During the same periods, African GDP growth fell from 5.05% to about 1.95%, respectively. Similarly, in the midst of the recent fall in commodity prices, the world economic outlook of International Monetary Fund (IMF) of October, 2015 indicates that global growth

[1] The Author acknowledges the contribution of Okpanachi Enemaku (Research Assistant at Centre for the Study of the Economies of Africa) in area of data gathering and literature review.

remains moderate, characterized with uneven prospects across the main countries and regions. The outlook indicates growth in advanced economies to improve (especially among the primary commodities importing economies), while growth in emerging market and developing economies is projected to be lower. This development reflects weaker growth prospects for primary commodities exporting economies, especially the oil-exporting countries.

Given the aforementioned, the questions are: Is African growth hinged on export of primary commodity prices? Does this vary across the African primary commodity exporters? Answers to these questions will shed lights on the policy options to minimize exogenous shocks and better achieved the desired African growth transformation.

The broad objective of this study is to investigate the impact of primary commodity prices on long run growth of SSA economies. Specifically, it seeks to: analyse the impact of oil and non-oil (agriculture and non-oil mineral resources) commodity prices on growth dynamics of African economies; and examine the impact of primary commodity prices across the SSA countries based on level of diversification in the primary commodities exports.

The rest of the paper is organized as follows: besides the introductory section, section two presents the trend analysis focusing on the stylize facts of African main exports, prices and growth. Section three presents literature review and theoretical framework. Section four is on methodology, while section five presents the results. Conclusion and policy lessons are what followed in section six.

2 Commodities Prices and African Growth Performance: Stylize Facts

Africa is highly endowed with basic primary commodity inputs and commodities that would normally form the foundation industrialization and GVC. However, most of its primary commodities are export in raw forms partly due to low level of industrialization to convert to semi-finished or finished products. This makes the export of these commodities to have low share of labour in them, resulting in "jobless growth." Besides, the economies are vulnerable to exogenous shocks because individual African country's exporting these commodities is too small in world share to have significant effect on world prices. In order words, most African countries are price takers and since the prices of the primary commodities behave differently from the prices of manufactured goods [1] which are relatively more stable, there is less room for African countries to adjust in the case of external shocks.

Table 1. African countries and major export commodities, 2014 (HS 4 Codes)

S/N	*Countries*	*Main commodity export*	*% in total export*	*% of total export in GDP*
1	Algeria	Crude petroleum oils	38.6	29.8
2	Angola	Crude petroleum oils	96.1	58.5
3	Benin	Cotton, not carded or combed	30.3	18.9
4	Botswana	Diamonds, not mounted or set	84.9	49.8
5	Burkina Faso	Gold unwrought or in semi-manufactured forms	51.4	28.3
6	Burundi	Coffee	36.5	7.8
7	Cameroon	Crude petroleum oils	47.9	21.6
8	Cape Verde	Fish, Frozen, Whole	44.1	NA
9	Chad	Crude petroleum oils	95.1	34.2
10	Congo DRC	Refined copper and copper alloys, unwrought	28.6	33.3
11	Congo Republic	Crude petroleum oils	61.2	80.1
12	Cote d'Ivoire	Cocoa beans, whole or broken, raw or roasted	23.5	43.4
13	Egypt	Crude petroleum oils	11.4	15.2
14	Equatorial Guinea	Crude petroleum oils	68.2	88
15	Eritrea	Copper ores and concentrates	93.7	NA
16	Ethiopia	Coffee	18.1	11.7
17	Gabon	Crude petroleum oils	81.5	51

18	Gambia	Woven fabrics of synth. filam yarn (incl. hd no 54.05)	58.6	NA
19	Ghana	Crude petroleum oils	32.5	38.9
20	Guinea	Gold unwrought or in semi-manufactured forms	50	27.6
21	Guinea Bissau	Brazil nuts, cashew nuts & coconuts	68	16.4
22	Kenya	Tea	14.8	16.4
23	Lesotho	Diamonds, not mounted or set	40.5	NA
24	Libya	Crude petroleum oils	78.5	33.5
25	Liberia	Iron ores & concentrates; including roasted iron pyrites	39.4	25.8
26	Madagascar	Unwrought nickel	26.8	NA
27	Malawi	Tobacco	45.5	45.8
28	Mali	Cotton	38	NA
29	Mauritania	Iron ores & concentrates; including roasted iron pyrites	39.9	47.8
30	Mauritius	Prepared/preserved fish & caviar	12	53.7
31	Niger	Uranium or thorium ores and concentrates	45.6	17.8
32	Nigeria	Crude petroleum oils	72.9	16.1
33	Rwanda	Niobium, Tantalum, or zirconium ore and concentrates	15.8	14.9
34	Sierra Leone	Tin ores and concentrates	84.7	41.3
35	South Africa	Iron ores & concentrates; including roasted iron pyrites	7.4	31.3
36	Seychelles	Prepared/preserved fish & caviar	36.4	84.1
37	Tanzania	Gold unwrought or in semi-manufactured forms	23.2	19.5
38	Uganda	Coffee	18.1	19.8
39	Zambia	Refined copper and copper alloys, unwrought	73.3	40.9
40	Zimbabwe	Tobacco	26.4	26.5

Sources: ITC trade map database and WDI (2015)
Note: NA indicates the data that are not available.

Africa continent is rich in several primary products which can be broadly categorized into agriculture, oil, non-oil metallic minerals and precious stones (Table 1). The Table shows a significant diversity in primary resources endowment among African countries but some of the African countries (such as Angola, Botswana, Chad, Eritrea, Gabon, Libya, Nigeria and Sierra Leone) are monoculture economies with the major exporting commodity accounting for over 70% of the total export. However, some of them are well diversified in few exporting primary commodities. Included in this category are: South Africa, Egypt, Kenya and Mauritius. The diversity in primary commodities exports may be healthy for these economies because prices of different commodities do not move in parallel, although fluctuations in world demand impart common components to many price series [1].

Trade is important to African growth. This is indicated in Table 1 where export in some countries accounts for over 50% of GDP. Countries in this category are Congo Republic, Equatorial Guinea, Seychelles, Angola, Gabon and Mauritius. Hence, these countries are potentially more vulnerable to fluctuation in prices of primary commodities accounting for significant proportion of total export earnings. Some of the African economies are also characterised with low proportion of exports in GDP. A good example in this category is Nigeria, although oil revenue accounts for about 67.5% of total government revenue in 2014 [2].

Moreover, it has been noted by Deaton [1] that the use of commodity price indexes makes more sense for industrialized importers than for the exporters because prices of different commodities do not move in parallel. However, fluctuations in the world demand for these primary commodities often affect their

prices simultaneously. These stances are roughly confirmed in Figure 1[2]. The Figure indicates that agricultural commodities prices are relatively higher than oil and metal prices until 2005. This implies there is need to add value (by actively participating in the GVC) to the raw agriculture primary products to attract higher prices in the world market. Relating primary commodities prices to African economic growth, it is noticed that the prices trends are roughly correlated with growth and become very glaring upward from 2005.

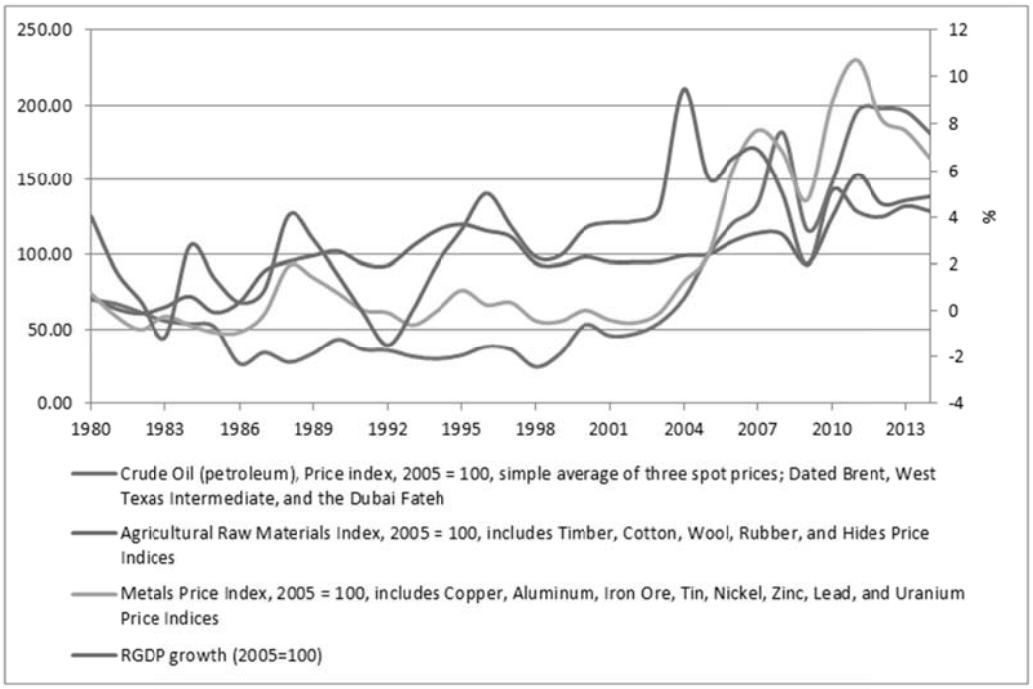

Figure 1. Commodities prices and growth trend, 1980-2015.

Source: IMF yearly commodity prices and WDI (2015)

3 Literature Review and Theoretical Framework

3.1 Theoretical Literature Review

The link between primary export commodity prices and economic growth is less explicit in growth theories. However, trade theories have implications for growth. For instance, the immiserizing growth, a theoretical situation proposed by Bhagwati [3], where economic growth could result in a country being worse off than before the growth especially if growth is heavily export biased leading to fall in terms of trade. Hence, the fall in terms of trade may be so large as to outweigh the gains from growth. However, this is only valid if the growing country is able to influence world prices. Since most developing exporting economies are individually small, the tenability of this stance is weak. Meanwhile, some commodities may have exception. For instance, the current economic crises among the oil exporting countries has been blamed on oil glut emanating from excess supply. This implies the possibility of immiserizing growth among the countries producing similar primary commodities.

[2] Note that the three prices indexes can further be disaggregated into specific commodities prices. The disaggregated analysis, related to prices of each African country's primary commodity export, is expected subsequently in section five. This follows Deaton [1] that the use of commodity price indexes is more adequate for industrialized importers than for the exporters with heterogeneous primary commodity exports.

The Prebisch-Singer Hypothesis (PSH) suggests that over the long run the price of primary goods declines in proportion to manufactured goods. This theory means that economies with primary good dependences may lose out from a reduction in the relative price of exports in terms of imports. The Hypothesis suggests that a temporary increase in revenue may occur as a result of increase in world commodity prices but this price might lead to economic instability. That is, the demand for these primary commodities will fall and the prices will also fall leading to excess government expenditure, compared to the revenue from these primary goods, and balance of trade deficit. The advice for primary good dependent countries is to diversify their economies by using revenues from primary commodity exports to fund other sectors of the economies. However, Bleaney and Greenaway [4] found a significant downward trend in terms of trade when data before 1925 (when primary product prices were quite high) are considered. This is not the case after 1925. It was also noted that the prices for food, metals, and other groups of primary products behaved differently, suggesting that support for the PSH based on primary commodity prices in general may suffer from aggregation problems and thus be misleading [5].

Related to PSH, Kalumbu and Sheefeni [6] added another dimension. According them, the non-renewable nature of natural resources its extraction makes it deplete over time. This theory further postulates that, in the long run, natural resources dependent economies might have balance of trade deficit from resources depletion and consequently reduction in economic growth.

However, Tilton [5] had a different opinion from PSH. He stated that Prebisch policy advice on diversification of primary commodity dependent economies is poor. According to Tilton [5], the prices of most goods are dependent on their production costs. Hence, a fall in prices of primary products is often accompanied by a corresponding or increasing fall in cost of production, while the profits, producer surplus, and wealth that the country realizes are rising, increasing the benefits it reaps from its primary product production and trade. Tilton [5], recognized that falling costs can conceivably offset the adverse effects of lower prices and declining terms of trade for primary product producers. Arezki et al. [7] made reference of the income elasticity of demand as a factor influencing commodity prices and consequently economics growth. The income elasticity of demand for most commodities is inelastic, so as income of primary commodity importers increases, growth in demand increases less proportionately resulting in a slow development of primary commodities exporting economies.

In the extended Solow model, the long-term economic growth rate is influenced by the growth rate in the population and that of technological progress. The technological progress is related to capital accumulation. With rising global commodity prices, national savings will increase leading to increase in investment and capital accumulation. As capital is accumulated, the economy will increase the output of its export sectors, leading to extra growth in national savings and an additional contribution to increasing capital. In sum, increasing oil prices provide an additional source of investment funding, which may have a positive impact on accumulated capital within the domestic economy and, consequently, on the physical output of products and services [8].

Finally, increase in prices of primary commodities, besides that it creates extra income that may be invested in the domestic economy, it also creates an impression that the risk-adjusted returns on investments in domestic physical capital converges with risk-adjusted returns on investments in foreign assets. Hence, foreigners become more comfortable investing in domestic economy thus creating additional capital accumulation that can influence economic growth positively.

3.2 Empirical Literature

Few studies exist on the relationship between export commodity prices and economic growth. For instance, Idrisov, Kazakova and Polbi [8] conducted a theoretical analysis and considered the mechanisms behind the positive correlation between the output of the Russian economy and global oil prices using dynamic stochastic general equilibrium model (DSGE). The basic result is that a constant increase in oil prices cannot influence the long-term economic growth rate and only predetermines short-term transitional trends from a long-term equilibrium to another. Also, Kurihara [9] examines the relationship between oil prices and economic growth in United States, European Union and Japan. The Study shows that oil price increases cause positive economic growth. Besides, appreciation of each domestic currency brings economic growth. However, VAR results show that these effects only last for about a year.

Further, Tiawara [10] examined the effect of commodity prices on African economic welfare by applying a panel modeling and constructed impulse responses using a panel data of 49 African countries between 1999 and 2014. The impulse response functions indicate that an increase in commodity price is more likely to benefit the African economies than hurting them. Beside, Gruss [11] analyzed the effect of commodity price cycle on output growth in Latin America and the Caribbean utilizing Global VAR covering 30 economies between 1970 and 2013. The analysis suggests that growth in the years ahead for the average commodity exporter in the region could be significantly lower than during the commodity boom, even if commodity prices were to remain stable at their current still-high levels. The results caution against trying to offset the current economic slowdown with demand-side stimulus and underscore the need for ambitious structural reforms to secure strong growth over the medium term.

Moreover, Kalumbu and Sheefeni [6] empirically examined the impact of terms of trade on the Namibian economy utilizing data from 1980 to 2012 estimated with Vector Autoregressive (VAR) model. The results indicate that there is a negative significant relationship between Namibian economic growth and terms of trade. The study however was limited to the use of terms of trade as the only determinant of economic growth.

The PSH was tested by Arezki et al [7]. The significance of the primary commodity sector in a national economy generally declines in the process of economic development. Arezki, et al [7] made use of 25 primary commodity prices covering a time period from 1900 to 2005. The time data was divided into 3 sets; 8 of the 25 commodities had data from 1650 to 2005, 15 commodities from 1872 to 2005, and 2 from 1900 to 2005. Their results show that all the series are stationary after allowing for endogenous multiple breaks. The result also showed that in majority of the cases, the PSH is not rejected.

Moreover, Cavalcanti, Mohaddes and Raissi [12] investigated commodity price volatility and growth of 118 countries utilizing General Method of Moments (GMM) and augmented version of the pooled mean group (CPMG) estimator. The results showed that commodity term of trade volatility affects output growth negatively. Collier and Goderis [13] examined relationship between commodity prices and growth in selected African countries using VAR. The basic result is that increases in commodity prices significantly raise the growth of primary commodity exporters. Similarly, Deaton [14] investigated the impact of commodity prices on growth 35 African economies using OLS and VAR. The basic result is that commodity prices affect economic growth in Africa.

Dehn [15] tested the effects of ex post shocks and ex ante price uncertainty on economic growth estimating pooled OLS and FE (EG). The shock and uncertainty variables are constructed using a new data set of unique aggregate commodity price indices for 113 developing countries over the period 1957Q1-1997Q4. The analysis shows that per capita growth rates are significantly reduced by large discrete negative commodity price shocks. The magnitude of the effect of negative shocks on growth is very substantial, and appears to work independently of investment, which suggests that adjustment is achieved through severe reductions in capacity utilization. Negative shocks remain highly significant after controlling for government economic policy and institutional quality, which indicates that the result is not attributable exclusively to inappropriate policy responses on the part of governments. The study also shows that positive shocks have no lasting impact on growth.

3.3 Theoretical Framework

The theoretical linkage between commodity prices and growth in this study will be based on the Neoclassical Solow growth model relating to the Keynesian national income identity. The Gross domestic product is assumed to be a function of domestic absorption and trade:

$$Y(t) = C(t) + I(t) + G(t) + X(t) - M(t) \quad (1)$$

Y is GDP, C is domestic consumption expenditure on domestic goods, I is investment expenditure by domestic firms, G is government expenditure, X is the value of export and M is expenditure on foreign imports. Hence, equation (1) can be expressed as:

$$Y(t) = DA(t) + I(t) + NE(t) \quad (2)$$

DA is domestic assumption which is summation of private domestic consumption and government expenditure, NX is net export (X-M).

Since prices are associated with export (px) and import (pm), it is logical to express equation (2) as:

$$YDA = I(r, y) + P_x ex(y, y^*) - P_m em(y, y^*) \quad (3)$$

where, YDA is the expression for Y-DA (national savings; private and public), I is private domestic investment, r is real interest rate, y is the domestic (developing countries) output, y* is foreign (developed countries) output and e is the exchange rate representing the value of foreign currencies relative to the domestic exporting countries' currencies. In reality, trade does not always balance, thus Px≠ Pm. The response of export to exchange rate depends on the supply response. In most developing countries, the supply response is weak, making the exchange rate elasticity of export supply to be inelastic and price elasticity of export to be almost perfectly elastic (an attribute of a small open economies as price takers) but prices can change given the demand conditions. Given the assumption that countries specialize in different commodities with developing countries specializing in production and export of primary commodities and developed foreign countries specializing in the production and export of manufactured goods, an exchange is possible with a need for domestic primary raw materials products to meet rising foreign output; thus domestic or developing countries exports are a function of both domestic and foreign outputs.

However, similar thing is not replicated in the case of import not only because of differences in specialization (making developing countries to be net importers of manufacture goods) but also because most developing countries are import dependent, with exchange rate and import price inelastic demand. That is, developed countries trading partners are not necessarily price takers. They are "big" enough to influence the world price in their areas of specialization (manufactured goods). Besides, changes in developed countries' demand for the primary products may be "big" enough to influence the world price for these commodities. In order words, export of primary products is foreign-income inelastic. Hence, rise in foreign income does not necessarily increase the demand for the primary products significantly.

Taking total derivative of equation (3) and assuming that Px and Pm are international price which are exogenously determined and do not change is response to changes domestic income or absorption gives:

$$d(YDA) = I(r)^{l}\left[\frac{\partial I}{\partial y}dy + \frac{\partial I}{\partial r}dr\right] + d(P_x) + \frac{\partial e}{\partial YDA}d(YDA) + x(y,y^*)^{l}\left[\frac{\partial x}{\partial y}dy + \frac{\partial x}{\partial y^*}dy^*\right] - d(P_m) - \frac{\partial e}{\partial YDA}d(YDA) - x(y,y^*)^{l}\left[\frac{\partial m}{\partial y}dy + \frac{\partial m}{\partial y^*}dy^*\right] = 0 \quad (4)$$

Simplifying equation (4) gives:

$$d(YDA)\left[1 - \frac{\partial x(y,y^*)}{\partial YDA}\left[\frac{\partial x}{\partial y}dy + \frac{\partial x}{\partial y^*}dy^*\right] + \frac{\partial m(y,y^*)}{\partial YDA}\left[\frac{\partial m}{\partial y}dy + \frac{\partial m}{\partial y^*}dy^*\right] + \frac{\partial I(y,r)}{\partial YDA}\left[\frac{\partial I}{\partial y}dy + \frac{\partial I}{\partial r}dr\right]\right] = d(P_x) - d(P_m) \quad (5)$$

Hence,

$$d(YDA) = \frac{d(P_x) - d(P_m)}{\left[1 - \frac{\partial x(y,y^*)}{\partial YDA}\left[\frac{\partial x}{\partial y}dy + \frac{\partial x}{\partial y^*}dy^*\right] + \frac{\partial m(y,y^*)}{\partial YDA}\left[\frac{\partial m}{\partial y}dy + \frac{\partial m}{\partial y^*}dy^*\right] + \frac{\partial I(y,r)}{\partial YDA}\left[\frac{\partial I}{\partial y}dy + \frac{\partial I}{\partial r}dr\right]\right]} \quad (6)$$

where

$\frac{\partial x(y,y^*)}{\partial YDA}\left[\frac{\partial x}{\partial y}dy + \frac{\partial x}{\partial y^*}dy^*\right]$ is marginal propensity to export (MPE), $\frac{\partial m(y,y^*)}{\partial YDA}\left[\frac{\partial m}{\partial y}dy + \frac{\partial m}{\partial y^*}dy^*\right]$ is marginal propensity to import (MPM) and $\frac{\partial I(y,r)}{\partial YDA}\left[\frac{\partial I}{\partial y}dy + \frac{\partial I}{\partial r}dr\right]$ is the marginal propensity to invest. The summation is assumed to be less than unity.

Hence,

$$\frac{d(YDA)}{d(P_x)} > 0 \quad (7)$$

and

$$\frac{d(YDA)}{d(P_m)} < 0 \quad (8)$$

Equation (7) and (8) suggest that a positive change in prices of export commodities improves the national savings position only when domestic income is greater than domestic absorption and when the

marginal propensity to export and invest is greater than zero, while increase in import prices hampers national savings when domestic absorption is higher than domestic income and marginal propensity to import and invest are greater than zero. In the latter case, it implies domestic consumption and investment is externally sourced. Hence, it could be concluded that increase in export prices is growth enhancing in the short run.

3.3.1 Dynamics of the Economy

Taking from the Solow growth model, dynamics of economy is assumed to be dynamics of capital stock. If change in capital stock is represented as:

$$\dot{K}(t) = sY(t) - \rho K(t) \tag{9}$$

Change in capital stock is a function of savings rate (proportion of output not consumed) and level at which existing stock of capital depreciates.

Divide equation (9) through by K(t) gives:

$$\frac{\dot{K}(t)}{K(t)} = s\frac{Y(t)}{K(t)} - \rho \tag{10}$$

Capital stock per unit of effective labour (emanating from a Cobb-Douglass production function) is represented by:

$$k(t) = \frac{K(t)}{A(t)L(t)} \tag{11}$$

Expression in equation (12) means capital stock per unit of effective labour.

Linearizing and differentiating equation (12) with respect to t, observing that K(t), A(t) and L(t) all depend on time (using the product, quotient and chain rule), substituting equation (11) and assuming break-even in the long run gives:

$$y(t) = \frac{(n + g + \rho)k(t)}{s} \tag{12}$$

Hence,

$$y(t) = \frac{(n + g + \rho)k(t)}{d(P_x) - d(P_m)} \Bigg/ \left[1 - \frac{\partial x(y,y^*)}{\partial YDA}\left[\frac{\partial x}{\partial y}dy + \frac{\partial x}{\partial y^*}dy^*\right] + \frac{\partial m(y,y^*)}{\partial YDA}\left[\frac{\partial m}{\partial y}dy + \frac{\partial m}{\partial y^*}dy^*\right] + \frac{\partial I(y,r)}{\partial YDA}\left[\frac{\partial I}{\partial y}dy + \frac{\partial I}{\partial r}dr\right]\right] \tag{13}$$

Rearranging (12) gives:

$$y(t) = (n + g + \rho)k(t)\left[1 - \left[\frac{\partial x(y,y^*)}{\partial YDA}\left[\frac{\partial x}{\partial y}dy + \frac{\partial x}{\partial y^*}dy^*\right] + \frac{\partial m(y,y^*)}{\partial YDA}\left[\frac{\partial m}{\partial y}dy + \frac{\partial m}{\partial y^*}dy^*\right] + \frac{\partial I(y,r)}{\partial YDA}\left[\frac{\partial I}{\partial y}dy + \frac{\partial I}{\partial r}dr\right]\right]\right]\left(d(P_x) - d(P_m)\right)^{-1} \tag{14}$$

In the long run, however, equation (15) implies that countries depending only on export of primary commodities will be worse off. This is because of the inverse relationship between prices of primary commodities/marginal propensity to export and growth of output per labour. This argument is rooted in the "immiserizing growth" in which growth is heavily export biased leading to a fall in terms of trade of the exporting countries and consequent decline in growth. Besides, other reasons based on PSH are income demand elasticity of export and wealth effect. The argument is that primary products, unlike manufactured products, are necessity goods with income inelastic attribute. Hence, increase in world income increases the demand and prices of manufacturing products (which most developing countries import) relative to primary goods (which most developing countries exports). This is because higher income is associated with increased demand for cleaner products (income effect), which characterised manufactured goods. Hence, for developing countries to import the same amount they have been importing before there will be a need to export more, even at a very low price, to raise enough revenue to finance import (wealth effect). This is injurious to the economy because it will have a negative effect on the welfare and quality of life of people in developing countries.

4 Methodology

4.1 Model Specification

Based on equation (15) the equation to be estimated is specified as:

$$G = f(Px, Pm, x/G, m/G, I/G, n, g, \rho) \tag{15}$$

where G is RGDP per capita, Px is prices of export, Pm[3] is prices of import (proxy with exchange rate), x/G is proportion of export in GDP (a proxy for marginal propensity to export), m/G is proportion of import in GDP (a proxy for marginal propensity to import), I/G is proportion of gross fixed capital formation divided in GDP (a proxy for marginal propensity to invest), n is population growth, g[4] is growth rate of capital per labour, ρ is rate of depreciation on existing capital. The expectations regarding the explanatory variables are that Px, x/G and I/G have significant positive coefficients, while Pm, m/G (if trade is dominated by final consumption goods) and ρ [5] have significant negative coefficients. The impact of n[6] is ambiguous, depending on the level of unemployment, dependant and aged population. If Px and Px/G have insignificant positive coefficient it means there is a leakage and the proceeds from exports are not invested efficiently (this is particularly relevant to countries with less diversified primary commodity exports). If Px and Px/G are significantly negative, there is an evidence of immesirizing growth in the long run. Also, if Pm and m/G are insignificantly negative the economy is not import dependent but if they are significantly positive it implies imports are mainly intermediate productive inputs.

4.2 Estimation Technique

In terms of sequencing, this study first tests the panel unit root utilizing Im, Pesaran and Shin (IPS) unit root test to confirm the stationarity property of the panel data. The IPS's t-bar, t-tilde-bar, and Z-t-tilde-bar statistics assume that the number of time periods, T, is fixed. When there are no gaps in the data, IPS reports exact critical values for the t-bar statistic that are predicated on the number of panels, N, also being fixed. The other two statistics (t-tilde-bar and Z-t-tilde-bar[7] statistics) assume N tends to infinity. Subsequently, the study tests for panel cointegration in order to confirm a long run relationship among the variables of the model. There are two major ways of testing cointegration: the Johansen cointegration type (which required that all of the series must be integrated of order 1) and residual type (which indicates that the linear combination of the model variables must be integrated of order zero). The later allows testing for cointegration when variables are of different orders of integration. Given the need to establish consistency of the PMG estimator and the differences in the order of stationarity the variables, this study employs Pedroni [16, 17] residual-based test which assumes a single cointegrating vector but allows the coefficients of each cointegration relation to differ among countries. The test presents seven different statistics (including panel-v, panel-rho, group-rho, panel-t (non-parametric), group-t (non-parametric), panel-adf (parametric t), and group-adf (parametric t)) and also extends the

[3] Prices of import is proxy with exchange rate of domestic currency per unit of dollar (dollar is assumed to be the major tradable currency) since depreciation of exchange rate indicate that imported commodities are relatively expensive in terms of domestic currency.

[4] g is excluded from the estimations not only because of potential collinearity with marginal propensity to invest (I/G) but also because of inadequate labour data covering the scope of the study.

[5] ρ will be excluded from the estimations due to lack of data on depreciation on existing capital.

[6] Population growth could be an important factor driving growth if it is made up of huge labour force that is gainfully employed. However, it will have significant negative effect on growth if unemployment is endemic and population is dominated by dependants and aged population (i.e. population of between 0 to 18 and 70 and above).

[7] For the asymptotic normal distribution of Z-t-tilde-bar to hold, T must be at least 5 if the dataset is strongly balanced and the deterministic part of the model includes only panel-specific means or at least 6 if time trends are also included. If the data are not strongly balanced, then T must be at least 9 for the asymptotic distribution to hold.

Dynamic Ordinary Least Squares (OLS) technique of estimating the cointegrating vector in a single equation to panel time series data (medium to large N, large T). The first four are based on pooling and the other three on the between dimension.

Further and in terms of estimation technique, this study is characterised with relatively Larger N (24) and T (1980-2014) panel; hence, the issues such as nonstationarity, spurious regression, co-integration, parameters heterogeneity across countries and serially correlation of the regressors are of concern. Therefore, it relies on the Pooled Mean Group (PMG) estimator of Pesaran, Shin, and Smith [18] which is an improvement over Mean Group (MG) estimator. These techniques are suitable when parameters are heterogeneous across cross-sectional observations. Besides, PMG has a feature implying an error correction model in which the short-run dynamics of the variables in the system are influenced by the deviation from long run equilibrium. That is, it accounts for the error-correcting speed of adjustment making it suitable in estimating non-stationary panels. Also, PMG is an intermediate estimator that allows the intercept, short-run coefficients, and error variances to differ across the groups (as would the MG estimator) but constrains the long-run coefficients to be equal across groups (as would the fixed effect estimator). The estimator can be specified as:

$$y_{it} = \sum_{j=1}^{k} \alpha_{ij} y_{i,t-j} + \sum_{j=0}^{l} \beta_{ij} x_{i,t-j} + \mu_i + \varepsilon_{it} \tag{16}$$

where X_{it} is a k × 1 vector of explanatory variables; β_{it} are the k × 1 coefficient vectors; α_{ij} are scalars; μ_i is the group-specific effect; and the white noise error terms, ε_{it}. Hence, if the variables in equation (17) are, for instance, I(1) and cointegrated, then the error term is an I(0) process for all i. Thus equation (17) can be re-parameterized into an error correction equation in the form;

$$\Delta y_{it} = \lambda_i (y_{i,t-1} - \omega_i x_{it}) + \sum_{j=1}^{k} \alpha_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{l} \beta_{ij} \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \tag{17}$$

where $\lambda_i = -(1 - \sum_{j=1}^{p} \lambda_{ij})$ and $\omega_i = \sum_{j=0}^{q} \beta_{ij} / (1 - \sum_k \alpha_{ik})$. The parameter λ_i is the error-correcting speed of adjustment term. If $\lambda_i = 0$, then there would be no evidence for a long-run relationship. Hence, λ_i is expected to be significantly negative under the prior assumption that the variables show a return to a long-run equilibrium. Of particular importance is the vector ω_i, which is a measure of long-run relationships between the variables.

4.3 Data and Measurement

This study sampled 24 countries (Table A1) and uses annual data between 1980 and 2015 sourced from World Bank's *World Development Indicators* and International Monetary Fund's data base. The variables considered are RDGP per capita, primary commodity export prices measured in US dollars (this is based on the prices of major commodity export of selected countries and not commodity price index), official exchange rate (domestic currency per unit of dollar), export of goods and services as percentage of GDP, import of goods and services as percentage of GDP, gross fixed capital formation as percentage of GDP and total population.

5 Results and Discussion

5.1 Panel Unit Root and Cointegration Test

Presented in Table 2 is the panel unit root tests conducted utilizing Im, Pesaran and Shin (IPS) unit root test. The null hypothesis that all panels contain unit root is rejected at 5 percent level of significance, except in the case of RGDP per capita, primary export commodity prices and population that are stationary at first difference. Given the characteristics of the alternative hypothesis, it implies that some panels are stationary at level among the stationary series. The unit root result has implications. First, non-stationarity of the RGDP per capita, commodity prices and population implies

that economic growth, commodity prices and population are less predictable among many African countries, respectively.

Table 2. Im, pesaran and shin panel unit root test

	Test at Level				*Test at first difference*				*Remarks*
Variables	t-bar	t-tilde-bar	Z-t-tilde-bar	P-value	t-bar	t-tilde-bar	Z-t-tilde-bar	P-value	
logRGDPPC	-0.7456	-0.6921	4.6789	1.000	-4.5268	-3.4375	-12.2853	0.000	I(1)
LogER	-2.4424	-2.115	-4.0977	0.000	-	-	-	-	I(0)
LogPrice	-0.9236	-0.884	3.4967	0.9998	-5.3149	-3.853	-14.8471	0.000	I(1)
LogMexp	-1.9337	-1.8277	-2.3268	0.01	-	-	-	-	I(0)
LogMimp	-2.0425	-1.9207	-2.9008	0.0019	-	-	-	-	I(0)
LogMinvest	-1.9913	-1.8569	-2.5206	0.0059	-	-	-	-	I(0)
LogPopu	-2.662	-1.3539	0.5985	0.7253	-1.5138	-1.3359	-1.696	0.045	I(1)

Source: Computed with Stata

Relating to population, the entry and exit characteristics of the population are quite high. This is may be rooted in weak health care system in most African countries. The reason for the stationarity of exchange rate could be explained within the context of managed floating exchange rate most African countries operate. This implies that exchange rate in among many African countries is not significantly volatile.

Also, presented in Table 3 is the panel cointegration test. The outcomes broadly reject the null hypothesis of no cointegration, with five out of the seven tests pointing to the conclusion that the series share a common long run trend. Hence, this allows for the estimation of the empirical model with the PMG estimator.

Table 3. Panel cointegration test

Test Statistics	*H0: No cointegration*
Panel v-Statistic	4.639***
Panel ρ -Statistic	2.903***
Panel PP-Statistic	-1.012
Panel ADF-Statistic	-3.327***
Group ρ -Statistic	4.293***
Group PP-Statistic	0.023
Group ADF-Statistic	-3.257***

Source: Computed by Author with stata

Note: *** implies rejection of the null hypothesis at 1% significance level

5.2 Commodity Prices and Long-Run Growth

The regression analysis (Table 4) confirms the theoretical arguments where primary commodity prices are found to positively influence growth per capita in the long run[8] (the impact is inelastic[9], nevertheless) especially among the oil exporters, metal commodity exporters and less diversified primary commodities African exporters. This implies that the countries in this category could only expect positive growth in the long run if and only if the prices of the primary commodities keep increasing. Continuous increase in commodity prices may not be the case, nevertheless. However, increase in agricultural commodity prices is not expected to have significant positive effects on growth in the long. The reason for this is that

[8] Note that only the long run estimates is of interest because growth is assumed to have adjusted from short run disequilibrium to its long run equilibrium.

[9] This means that growth will respond less proportionally to a percentage increase in commodity prices.

most of the African countries are somewhat diversified in their primary commodity exports (see Table A1). Hence, increase in prices of agricultural commodities export alone will not be enough to drive growth. In the case of insignificant impact of commodity prices among the very less diversified economies (those with only one commodity accounting for more than 75% of total exports), there is a leakage and the proceeds from exports are not invested efficiently.

Table 4. Heterogeneous panel data estimates

Long Run	*AE*	*OE*	*ACE*	*MCE*	*VLDE*	*LDE*	*DE*	*WDE*
D.logrgdppc	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
logprice	-0.040 (-1.84)*	0.413 (6.83)***	0.002 (0.06)	0.049 (6.19)***	0.006 (0.15)	0.962 (2.62)**	-0.051 (-1.55)	-0.018 (-0.83)
loger	-0.031 (-5.83)***	0.069 (2.47)**	-0.055 (-2.65)**	-0.033 (-16.43)***	0.011 (0.22)	1.028 (1.97)**	-0.022 (-3.03)***	-0.311 (-3.93)***
logmexp	0.112 (2.21)**	0.372 (3.52)***	-0.059 (-0.87)	0.100 (2.59)***	0.434 (5.04)***	3.389 (5.96)***	0.246 (3.49)***	0.185 (2.11)**
logmimp	0.444 (4.61)***	-0.152 (-1.73)*	0.270 (1.8)*	0.157 (3.37)***	-0.158 (-1.00)	-1.561 (-4.13)***	0.447 (3.62)***	0.303 (2.11)**
logminvest	0.367 (6.86)***	0.278 (3.7)***	0.425 (3.67)***	0.115 (3.83)***	0.145 (1.59)	1.376 (2.84)***	0.480 (6.54)***	-0.015 (-0.12)
logpopu	0.369 (4.98)***	-1.086 (-4.44)***	0.649 (5.87)***	-0.025 (-0.52)	-0.004 (-0.04)	-3.037 (-2.41)**	0.171 (1.42)	1.124 (3.89)***
Short Run								
ec	-0.083 (-4.5)***	-0.095 (-2.82)***	-0.097 (-2.73)***	-0.269 (-3.15)***	-0.294 (-2.32)**	-0.065 (-1.39)	-0.084 (-3.41)***	-0.162 (-2.63)***
D1.logprice	0.003 (0.43)	-0.005 (-0.24)	-0.025 (-2.86)***	-0.001 (-0.2)	-0.051 (-1.75)*	-0.037 (-1.78)*	-0.005 (-0.72)	-0.001 (-0.07)
D1.logpopu	-0.122 (-0.08)	-2.919 (-2.47)**	0.046 (0.05)	-1.662 (-1.55)	7.267 (0.81)	-5.719 (-1.31)	0.262 (0.24)	0.199 (0.1)
_cons	-0.142 (-2.03)**	2.037 (2.97)***	-0.598 (-2.55)**	1.665 (2.3)**	1.698 (2.07)**	1.957 (1.63)	0.034 (1.65)*	-2.066 (-2.84)***
Statistics								
Log Likelihood	1545.874	517.968	658.376	387.695	139.335	197.852	908.834	350.445
Iteration 0: log likelihood	1522.38	542.273	634.258	353.624	127.454	183.712	891.283	317.0193
OBS	813	306	303	204	102	135	440	136
Number of groups	24	9	9	6	3	4	13	4
log likelihood Chi-square ratio test	46.988***	59.390***	48.237***	68.1404***	23.762***	28.280***	35.102***	66.851***

Source: Computed with Stata

Note: *,**,*** imply significance at 10%,5%, and 1% level. The listed countries based on commodities exports and status of export diversification are indicated in Table A1.

Also, AE represents Aggregate Estimate comprising the entire sample; OE represents the Oil exporters; ACE represents Agriculture commodity exporters; MCE represents Metals

Commodity exporters; VLDE represents Very Less Diversified Economies; LDE represents Less Diversified Economies; DE represents Diversified Economies; WDE represents Well Diversified Economies

Exchange rate (a proxy of import prices) has expected significant negative coefficients, except in the case of oil exporters[10] and primary commodity less diversified African economies with positive significant coefficients. In the latter, it means imports also have significant elements of intermediate inputs. Across all estimations, except agricultural commodity exporters, marginal propensity to export has significant positive effect on growth and the impact is huge (elastic) among the less diversified African economies. The impact of marginal propensity to import is mixed. The marginal propensity to invest has expected signs and it is found to be significantly influencing growth. The impact is huge among the less diversified economies.

The effect of population is also mixed. Overall, population has inelastic positive effects on economies of Africa. There are variations across the sampled economies, nevertheless. While increase in population has elastic negative impact on oil exporters and less diversified economies, its impact is positive on agriculture commodity exporters (inelastic) and well diversified economies (elastic). There are possible explanations for these outcomes. On one hand, most oil exporting and less diversified African economies are characterised with huge unemployment as well as dependant and aged population, hence increase in population in those economies will not be growth enhancing. On the other hand, population increase among agriculture exporters influences growth per capita positively (though in an inelastic manner) because agriculture in those economies is significantly labour intensive. In the case of well diversified primary commodity exporters, the population is characterised with huge labour force with relatively low level of unemployment. Hence, these economies are able to generate employment within their various primary commodity sectors.

The error correction mechanisms (ec) are significant with expected signs. This means that there is a long run relationship between economic growth and the explanatory variables as estimated. However, the coefficients are weak implying slow speed of adjustment of economic growth from short run to long run equilibrium. In other words, African countries converge slowly to long run equilibrium when there are discrepancies in the short-run. Besides, the values of log likelihood chi-square ratio tests indicate that the estimated models are overall significant and well fitted. Finally, there was no serious multicollinearity problem among the explanatory variables (Table A2).

6 Conclusion and Policy Lessons

This study evaluates the impact of export commodity prices on growth dynamics of selected primary commodity-based African economies. First, the conditions for different impacts of primary commodity prices on growth are explained. The patterns of impacts of commodity prices are associated with the structure of the economies and the nature of diversification in primary commodities export. The regression analyses show that primary commodity prices have inelastic positive effects on economic growth of selected African countries. Hence, increase in prices of these commodities enhances economic growth less proportionality. Besides, adjustment of African economies when there is short run disequilibrium, emanating from price changes for instance, is weak. This is due to the low level of diversification (both in terms of economic diversification and primary commodity exports diversification) among many African economies resulting in limited ability to manoeuvre in case of commodity prices crash. Some of the outcomes in this study are in line with those of previous studies such as Deaton [14], Collier and Goderis [13], Tiawara [10] and Idrisov, Kazakova and Polbin [8].

In terms of policy lessons, African countries are not only vulnerable to primary commodity prices fluctuations; they also have fewer gains from higher primary commodity export prices in the long run given the inelastic effect of export prices on growth. Besides, their ability to recover when there are unfavourable price changes is also slow. Hence, African countries need to, as a matter of urgency, mobilize domestic resources and diversified the commodity export and production base. However, this requires proactive measures by African countries at boosting supply capacity through implementation of structural reforms, especially in the oil, non-oil and power sector.

[10] It is noticed that most of the oil exporters such as Nigeria, Equatorial Guinea, and Congo Republic are also in the category of less diversified African economies.

References

1. A. Deaton, "Commodity prices and growth in Africa," Journal of Economic Perspectives, vol. 13, no. 3, pp. 23-40, 1999.
2. Central Bank, "Central bank of Nigeria Statistical Bulletin," 2015.
3. J. Bhagwati, "Immiserizing growth: a geometrical note," Review of Economic Studies, vol. 25, pp. 201-205, 1958.
4. M. Bleaney and D. Greenaway, "Long-run trends in the relative price of primary commodities and in the terms of trade of developing countries," Oxf Econ Pap, vol. 45, no. 3, pp. 349-363, 1993.
5. J. Tilton, "The terms of trade debate and the policy implications for primary product producers," Division of Economics and Business Working Paper Series, 2012. Available: http://econbus.mines.edu/working-papers/wp201211.pdf
6. S.A. Kalumbu and J. P. S. Sheefeni "Terms of trade and economic growth in Namibia," International Review of Research in Emerging Markets and the Global Economy, vol. 1, no. 3. pp. 90-101, 2014.
7. R. Arezki, K. Hadri, P. Loungani, and Y. Rao, "Testing the Prebisch-Singer hypothesis since 1650: evidence from panel techniques that allow for multiple breaks," International Monetary Fund working paper, 2013. Available: https://www.imf.org/external/pubs/ft/wp/2013/wp13180.pdf
8. G. Idrisov, M. Kazakova, and A. Polbi, "A theoretical interpretation of the oil prices impact on economic growth in contemporary Russia," Russian Journal of Economics, vol. 1, pp. 257–272, 2015.
9. Y. Kurihara, "Oil prices and economic growth in developed countries," International Journal of Business and Social Science, vol. 6, no. 11, pp. 40-46, 2015.
10. H. N. O. Tiawara, "The effect of commodity prices on african economic growth," Culminating Projects in Economics. Paper 1, 2015. Available: http://repository.stcloudstate.edu/cgi/viewcontent.cgi?article=1000&context=econ_etds
11. B. Gruss, "After the boom–commodity prices and economic growth in Latin America and the Caribbean," IMF working Paper 14/154, 2014. Available: https://www.imf.org/external/pubs/ft/wp/2014/wp14154.pdf
12. T. Cavalcanti, K. Mohaddes, and M. Raissi, "Commodity price volatility and the sources of growth," IMF working paper number WP/12/12, 2011. Available: http://www.imf.org/external/pubs/ft/wp/2012/wp1212.pdf
13. P. Collier, and B. Goderis, "Commodity prices and growth: reconciling a conundrum,". Available: http://sticerd.lse.ac.uk/seminarpapers/dg26022007.pdf.
14. P. May, H.-C. Ehrlich, and T. Steinke, "Zib structure prediction pipeline: composing a complex biological workflow through web services," in *Euro-Par 2006 Parallel Processing*. Springer, 2006, pp. 1148–1158.
15. J. Dehn, "Commodity price uncertainty and shocks: implications for economic growth," Centre for the Study of African Economies Working Paper 2000-10, 2000. https://www.csae.ox.ac.uk/workingpapers/pdfs/20-10text.pdf
16. P. Pedroni, "Critical values for cointegration tests in heterogeneous panels with multiple regressors," Oxford Bulletin of Economics and Statistics, vol. 61, pp. 653-670, 1999.
17. P. Pedroni, "Purchasing power parity tests in cointegrated panels," Review of Economics and Statistics, vol. 83, pp. 727-731, 2001.
18. K. S. Im, M. H. Pesaran and Y. Shin, "Testing for unit roots in heterogeneous panels," Journal of Econometrics vol. 115, pp. 53-74, 2003.

Appendix:

Table A1. List of countries used in estimations and their primary commodities export status

S/N	*Selected Countries*	*Major Commodity Exports*	*Primary commodities export diversification status*
1	Algeria	oil	Diversified
2	Benin	Cotton	Diversified
3	Burundi	coffee	Diversified
4	Cameroon	Oil	Diversified
5	Chad	Oil	Very less diversified

6	Congo, Dem. Rep.	Refined copper and copper alloys, unwrought	Diversified
7	Congo, Rep.	oil	Less diversified
8	Cote d'Ivoire	cocoa	Diversified
9	Egypt, Arab Rep.	oil	Well diversified
10	Equatorial Guinea	oil	Less diversified
11	Gabon	oil	Very less diversified
12	Gambia, The	Woven fabrics of synth. filam yarn (incl. hd no 54.05)	Less diversified
13	Ghana	oils	Diversified
14	Kenya	Tea	Well diversified
15	Madagascar	Unwrought nickel	Well diversified
16	Mali	Cotton	Diversified
17	Mauritania	Iron ores & concentrates; including roasted iron pyrites	Diversified
18	Mauritius	Prepared/preserved fish & caviar	Well diversified
19	Nigeria	oil	Less diversified
20	Niger	Uranium or thorium ores and concentrates	Diversified
21	Sierra Leone	Tin ores and concentrates	Very less diversified
22	Seychelles	Prepared/preserved fish & caviar	Diversified
23	South Africa	Iron ores & concentrates; including roasted iron pyrites	Well diversified
24	Uganda	Coffee	Diversified

Note: Countries that are very less diversified, less diversified, diversified and well diversified are characterised with export of major primary commodity above 75% (coded 1), 50-74% (coded 2), 25-49% (coded 3) and 0-24% (coded 4) of total exports, respectively. Some other countries were excluded because of inadequate data running from 1980 to 2014.

Table A2. Multicollinearity test

	loger	*logprice*	*logmexp*	*logmimp*	*logminvest*	*logpopu*
loger	1					
logprice	-0.0624	1				
	(0.0711)					
logmexp	0.0877	0.0305	1			
	(0.0113)	0.3793				
logmimp	0.1819	0.0423	0.6428	1		
	(0.000)	(0.2221)	(0.000)			
logminvest	0.1344	-0.2059	0.4846	0.6866	1	
	(0.0001)	(0.000)	(0.000)	(0.000)		
logpopu	-0.1236	-0.1011	-0.3269	-0.6159	-0.3373	1
	(0.0003)	(0.0034)	(0.000)	(0.000)	(0.000)	

Source: Computed with Stata
P-values are in the parenthesis

