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# Terms of Trade, Trade Openness and Economic Growth in Sub-Saharan Africa

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**Terms of Trade, Trade Openness and Economic Growth in Sub-Saharan Africa**

by

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A Thesis

Submitted to the Graduate Faculty

of

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## **Abstract**

International trade has induced important changes in the last decades. Through specialization, countries can benefit from trade and increase their national income. In fact, the current trend is that developed countries specialize in production and exports of services and manufactured products resulting in a faster and stable economic growth while developing countries specialize in production and exports of primary commodities causing lower and unstable economic growth. The present study has investigated the relationship between Terms of trade, Trade openness and economic growth in sub-Saharan African countries. The investigation aimed to see if international trade is beneficial to countries heavily dependent on primary commodities exports subject to high volatility price. Using the Fixed and Random effects models on 13 countries from 1980 to 2011, the results of this empirical analysis have led to the conclusions that Terms of trade has a positive relationship with the GDP level in SSA, therefore any improvement of it induces a better economic performance, and Trade openness has a negative relationship with the GDP level implying openness to international was not beneficial to SSA.

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## **Chapter I**

### **INTRODUCTION**

Globalization and technological progress are two important forces that have driven major changes in the last two centuries. Interdependence between countries and international trade have helped increase many countries' income and at the same time, widened the gap between developed and developing countries. The theory of comparative advantage by David Ricardo, one of the biggest revolution in international trade, has shed light on the great impact international trade can have on economic growth. A country has just to specialize in production and exports of goods in which she is more efficient to capture the benefits of international trade (Carbaugh, 2013). Today, specialization in production and exports has taken an interesting direction: developed countries specialize in and export mainly services and manufactured products while developing countries specialize in and export primary commodities.

The two kinds of products have different effects on economies: services and manufactured products since their relative price is steadier, they induce a much stable growth in exports and therefore a faster and consistent economic growth. On the other hand, the relative price of primary commodities is more volatile and leads to unstable and lower economic growth rate.

This fact was developed in the "Prebisch-Singer hypothesis" initiated by Prebisch and Singer in 1950. According to this hypothesis, the terms of trade of primary-commodities-dependent countries will deteriorate since primary commodities prices tend to decline compared to manufactured products prices in the long term (J. F. J. Toye and Richard Toye, 2003).

In the present study, we focus on developing countries from sub-Saharan Africa (SSA), hereafter examine how international trade has impacted their economic performance. Due to their low-

incomes and poor governance, most of the countries in SSA lack access to advanced technologies and are heavily dependent on primary commodities.

According to the report of United Nations Development Program (UNDP) on poverty reduction (2011), commodities exported by a country determine its vulnerability to exogenous economic shocks. The report also underlines that 95 of 141 developing countries depend on primary commodities which cover over 50% of their total exports.

Table 1 presents the share of primary commodities in total exports of SSA.

*Table 1*

Dependence on primary commodities in sub-Saharan Africa (percentage of total merchandise exports)

	<b>1995-1999</b>	<b>2000-2004</b>	<b>2005-2009</b>	<b>2010-2014</b>
<b>Primary commodities</b>	66.1	70.7	79.1	78.9
Agricultural raw materials	6.6	5.2	3.14	3.04
Food	17.8	13.6	9.4	10.2
Fuels	31.2	43.5	55.5	53.9
Ores and metals	10.5	8.4	11.1	11.6

Source: (UNCTAD, 2016)

As we can see, between 2010 and 2014, about 79% of total exports was covered by primary commodities, especially natural resources such as fuels (53.9%), and Ores and metals (11.6%).

This is interesting since the price of these resources have fluctuated a lot. Such volatility in the relative price leads to irregular changes in export revenue inducing instability in foreign exchange reserves which is significantly correlated to economic growth volatility.

Furthermore according to the UNDP report, for developing countries that depend mainly on exports of primary commodities, unstable commodity prices cause macroeconomic instabilities. Therefore, the more a country is primary commodity-dependent, the more it is vulnerable to its price shocks (UNDP, 2011).

Volatility in the commodities price is a result of a certain number of factors:

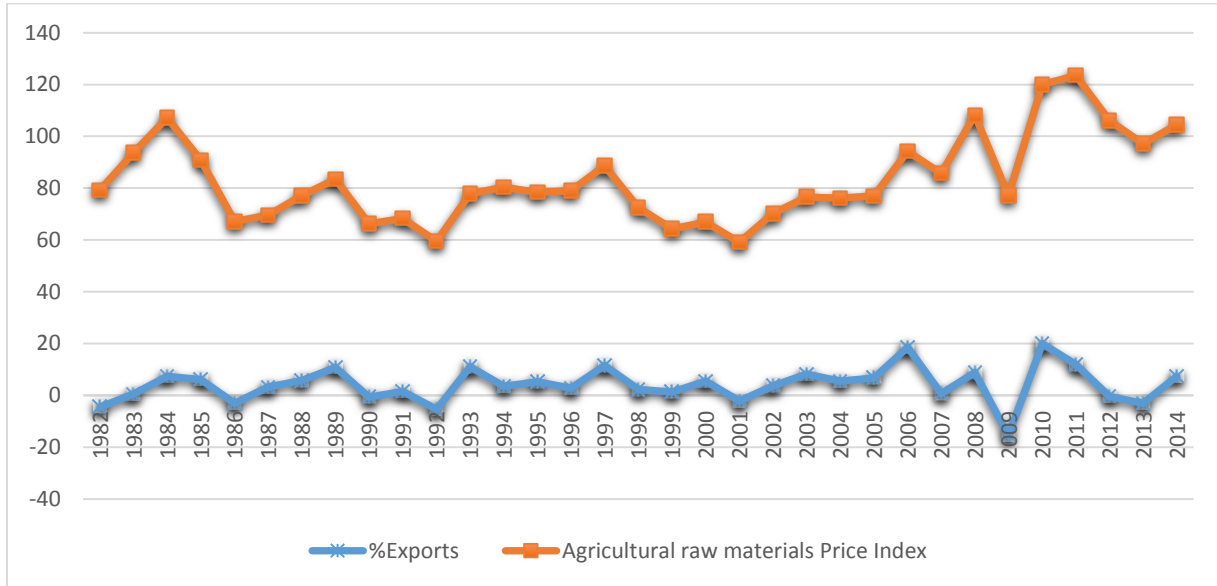


- The nature of demand and supply of primary commodities (mostly inelastic)
- The business cycle in its markets, since developed countries are the main consumers of these primary commodities, any decline or upturn in their economies decreases or increases the price of commodities
- Fluctuations in exchange rates
- Political instability in the producing country
- The weather
- Price speculation
- Export dumping

The adverse effect of primary commodities exports on economies seems well established in the literature. However, not all commodities are bad for growth. Investigating if dependence on primary commodities may be one of the causes explaining the low level of economic development in sub-Saharan African countries, Carmignani and Chowdhury (2007) showed that primary commodities negatively affect economic growth in SSA. Moreover, their analysis pointed out that not all commodities in which most SSA countries specialize induce an unsteady economic growth. In fact, only some of the primary commodities on which countries from SSA strongly depend are not favorable to growth. These commodities are for instance cotton and coffee, and Iron ores. Their negative effect will likely have a greater impact with adverse shocks in terms of trade. To show the effect of commodities price volatility on exports, we take a look at the figures below.

Figure 1

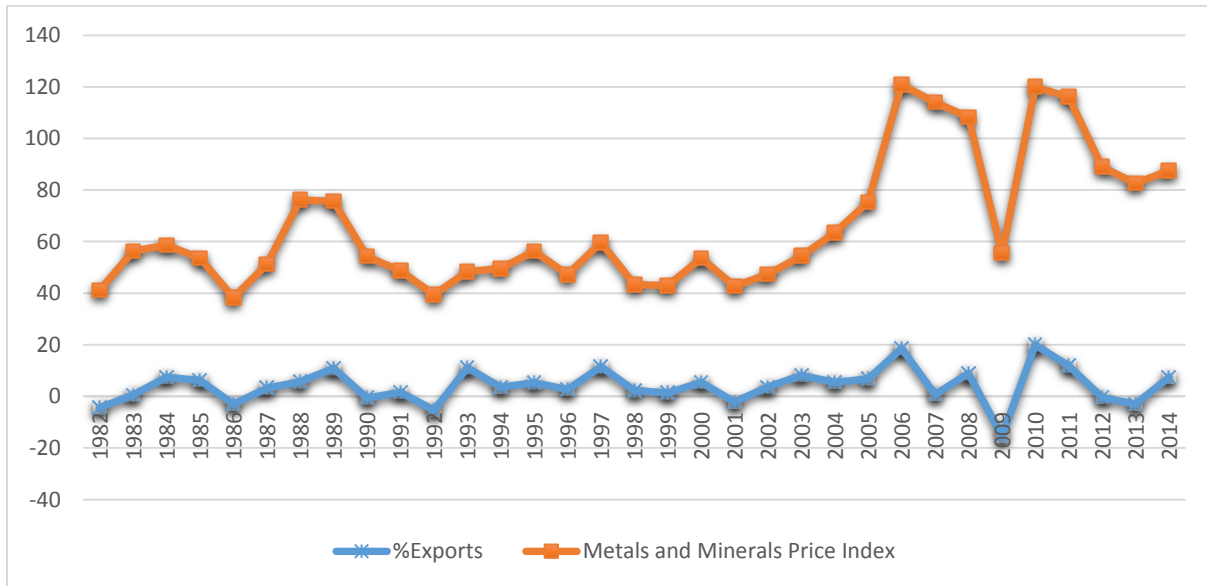
Price of Agricultural raw materials and total exports growth rate in SSA, 1982-2014



Source: Author from World Bank Data, base year=2010

Figure 2

Price of Metals and Minerals and total exports growth rate in SSA, 1982-2014



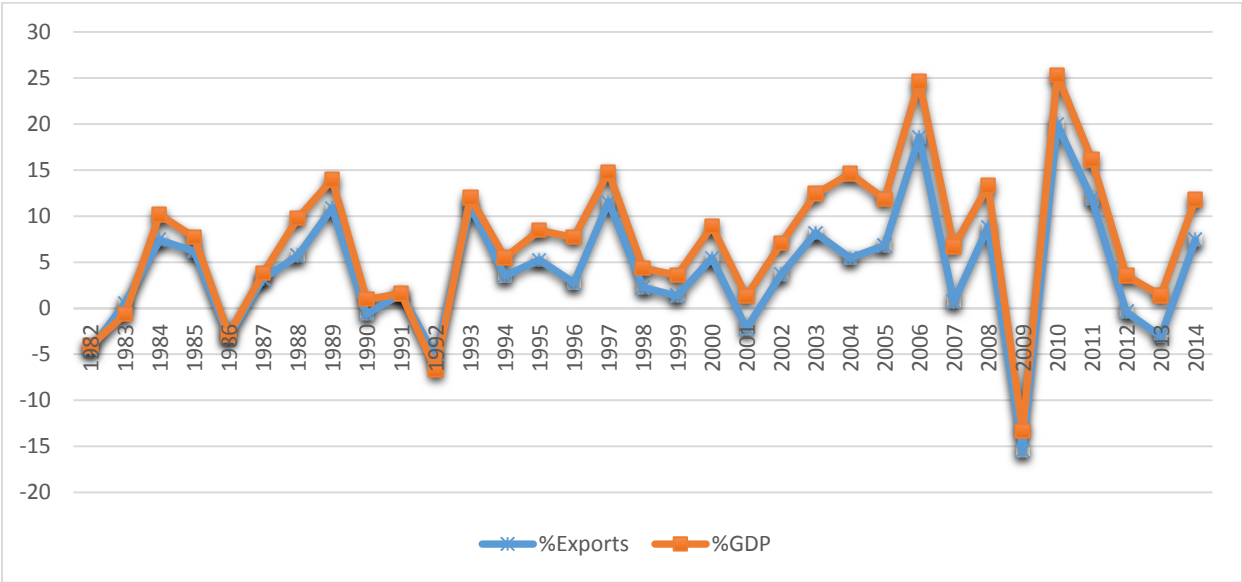
Source: Author from World Bank Data, base year=2010

As we see in the two figures, since most countries from SSA are not price-setters and receive the price of their commodities from developed economies, they are very sensitive to any change in commodities price. For given exports, a rise in price of Agricultural raw materials or Metals and

Minerals leads to an increase in exports revenue. Likewise, a fall in price of Agricultural raw materials and Metals and Minerals induces a drop in exports revenue. Also, the volume of commodities exports depend on business cycles, any downturn reduces the exports volume. The World Bank Group (2015) asserted that volatility in GDP and consumption is a result of exogenous external shocks which play a critical role in leading fluctuations in GDP. In fact, fluctuations in GDP are more volatile when there is a large change in the relative price of commodities exports. Furthermore, higher volatility in terms of trade shows that trade and production structures are not very diversified and mainly primary commodities-dependent. To assert this statement, we take a look the graph below.

Figure 3

Exports fluctuations and GDP growth rate in SSA, 1982-2014



Source: Author from World Development Indicators (WDI)

Primary commodities exports represent an important share of GDP in SSA countries and it appears that an important change in relative price of commodities not only causes exports fluctuation but also fluctuations in GDP level.

Dependence on primary commodities of SSA has many causes and consequences, some of them have been discussed by Collier (2003). He states that since most African countries are primary-commodities dependent, they face three important issues: first of all, they deal with large external shocks because of the high volatility in commodity prices which causes the output level to contract. Second, revenue generated by these commodities is associated with poor governance and last, the primary commodity-dependent countries are prone to a significant risk of civil war. Africa with its strong comparative advantage in primary commodities can escape from this pattern by diversifying her exports. In order to diversify in manufactured products and services, she has to cope first with the three severe issues: external shocks, governance and risk of civil war. Moreover, Wood (2003) points out that primary commodities will always be a large part of Africa's production and exports since she is land-abundant. As a result, her primary sector will also be more important than her manufacturing and services sector. In order for Africa to diversify her exports, she will need inter alia a faster capital accumulation, political and macroeconomic stability. Thus, the structure of trade and production of sub-Saharan African countries relies significantly on primary commodities which are highly price-elastic making them vulnerable to any exogenous economic shocks. These external shocks cause their terms of trade to deteriorate and thus, hamper their economic growth.

While diversifying their production and increasing the level of sophistication of their exports would help, Saadi (2012) found that the export sophistication does not improve the terms of trade in developing and emerging countries because the rise in sophistication in exports products has also to deal with a strong competition in international markets, which is defined as tariff escalation: the more processed the product, the higher the effective tariff.

While several studies have investigated only the impact of terms of trade of primary-commodities-dependent countries on economic growth, this study not only examines the effect of terms of trade on the GDP level but also analyzes if participation of primary-commodities dependent countries (SSA countries in this case) in international trade is benefiting or harming them. Thus, to apprehend the impact of international trade on sub-Sahara economies, the present paper investigates the relationship between terms of trade, trade openness and the GDP level. Particularly, we test the effect of terms of trade and trade openness on the GDP level of 13 SSA countries from 1980-2011. We start with a review of literature covering the subject in chapter II, then describe the methodology in chapter III. The chapter V focuses on the empirical analysis and finally, chapter V consists of conclusions.

## Chapter II

### LITERATURE REVIEW

Given the importance of terms of trade and trade openness in economic growth, a good starting point would be to define them. Terms of trade is the ratio of an index of a country's export prices to an index of her import prices. In other words, it measures the relationship between the prices a nation gets for her exports and the prices she pays for her imports (Carbaugh, 2013). Thus, an improvement of an economy's terms of trade is a result of a rise in the price of exports relative to the price of imports and a deterioration is induced by a rise of the price of imports relative to the price of exports over a given time period. For a price-taker in world markets, this implies that an improvement in the terms of trade leads to an increase of exports revenue and therefore, a rise in a country's national income. A deterioration in the terms of trade induces, likewise, a contraction of national income.

As for trade openness, it is defined as the ratio of Exports plus Imports over GDP. In other words, Trade openness measures if economic policies restrict and invite international trade. Thus, the higher is that index the larger the influence of international trade on economies and the stronger an economy is supposed to be.

The effect of terms of trade and trade openness on economic growth has been subject to many interests leading to several theoretical and empirical studies.

#### **1. Theoretical framework**

Trade openness, primary commodities, manufactured products, terms of trade and their impacts on economic development have been at the center of a lot of controversial debates. Many different views have followed over time on the matter.

The new theories of growth by Romer (1986) and Lucas (1988) presented very convincing support that openness has a positive impact on economic growth. They argued that the more countries are open to international trade, the bigger ability they have to absorb advanced technologies from developed countries. However, some authors like Krugman (1994) opponent of trade liberalization, have asserted that the effect of international trade on economic growth is uncertain.

Regarding terms of trade, according to the classical point of view, it will improve over time for primary commodities. Classical economists based their prediction on the fact that land and natural resources are limited while the level of population will always be increasing and so will be their consumption. Therefore, the relative price of primary commodities will end up rising over time. A second view regarding terms of trade and economic development is from neoclassical economists. They claim that countries' imports determine changes in the terms of trade which in turn define the ability for a country to export. They underlined the fact that this channel depends on the level of development of each country. Thus, the "rate of development" delimits changes in the terms of trade which lean on consumption and output. Terms of trade of developing countries will deteriorate if consumption of imported goods is higher their domestic production. Also, since the demand for their exports commodities is inelastic, their terms of trade will always declining. (Diakosavvas and Scandizzo, 1991).

One of the most interesting views about the terms of trade and economic development has been initiated by Prebisch and Singer in 1950. They both developed what is called the "Prebisch-Singer thesis"<sup>1</sup>. According to the analyses of the two authors, the net barter terms of trade

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<sup>1</sup> R. Prebisch, *The Economic Development of Latin America and Its Principal Problems* (New York: United Nations, 1950); also printed under the same title in *Economic Bulletin for Latin America* 7 (1962): 1–22.  
H. W. Singer, "The Distribution of Gains between Investing and Borrowing Countries," *American Economic Review* 40 (1950): 473–85.

between primary commodities and manufactured products are subject to a downward trend in the long run. That means the terms of trade of primary-commodities-dependent countries tends to deteriorate since the price of primary commodities falls relative to the price of manufactured products in the long run. This can be explained by two types of negative effects on primary commodities dependent-countries' terms of trade: The first one is a result of different institutional characteristics of products and labor markets between the two groups. The second negative effect is from technological progress since its effects are not equally distributed between the two groups and also because of its asymmetric impact on the future demand being more favorable to manufactured goods than agricultural goods. As a result, the Prebisch-Singer states that gains from international trade won't be distributed equally between primary-product-based countries and manufactured products exporting countries. That would explain why inequality of income per capita between the two groups continues to rise, (J. F. J. Toye and Richard Toye, 2003)

Pryor (1966) made an attempt to propose a framework for all the hypotheses developed regarding economic growth and the terms of trade. He used the reciprocal demand curve to represent supply and demand elasticities for imports and exports and examined the relationship between growth and the terms of trade. Unfortunately, most of the cases examined were found to be undetermined.

Kaneko (2000) has also done an interesting theoretical analysis on terms of trade and economic growth on a small open-economy case. In this study, the human capital accumulation has been introduced to investigate the relationship between the economic growth and the specialization structure of developing countries. The analysis concluded that the economic growth can definitely be affected by the terms of trade in the case of a country specialized in consumption of



primary commodities, a rise in the terms of trade leads to an increase in the economic growth and the reverse case for a fall in the terms of trade. However, the study found that economic growth is not affected by the terms of trade when a country specialized in capital-intensive goods.

## **2. Empirical evidence**

Openness to international trade has proven to benefit to countries. Several persuasive empirical analyses support this affirmation. This is the case of the one done by Edwards (1998) on 93 developed and developing countries from 1960 to 1990 suggesting that the more countries are open to international trade, the faster productivity growth they experience. Also, Chen (1999), Gundlach (1997), and Naveed and Shabbir (2006) in different investigations on both developed and developing countries ended up attesting a robust positive relationship between trade openness and economic growth. However, if in general trade liberalization benefits to countries, some authors have found out that trade openness undermines economic development in developing countries. This is the case of the study on both developed and developing countries by Dowrick and Golly (2004) who found out that since 1980 the benefits of international trade have increased more for the richer countries than less developing countries. In the same perspective, Sundaram and Arnim (2008) concluded after investigation that premature trade liberalization in sub-Saharan Africa has weakened her economic development since technology in most of her sectors is not competitive enough compared to the one in developed countries. Moreover, Huchet-Bourdon and al (2011) have found out that only countries with high exports diversification see their economic growth rise rapidly. The effect of trade openness on countries with low exports diversification is lower and even negative.

Regarding terms of trade, an important number of empirical analyses interested in its influence on countries' economic performance find that an improvement in the terms of trade has a positive impact on GDP.

This is the case of the investigation of Blattman, Hwang and Williamson (2007) who examined the impact of terms of trade growth and volatility on economic growth in 35 countries (6 from the Core and 29 from the Periphery) from 1870 to 1939. They conclude that high price volatility in primary products and volatility in the terms of trade explain the lower economic growth and performance in developing countries, or the Periphery, compared to developed countries, the Core. They also pointed out a channel through which volatility in the terms of trade could affect the GDP, Foreign Investment. In fact, high volatility in terms of trade rises uncertainty of foreign investors and therefore, decreases capital inflows to the Periphery (primary commodities-dependent countries).

Moreover, the impact of the terms of trade on economies also depends on the exchange rate regime. Broda (2004) in his analysis on 75 developing countries from 1973 to 1996 explored how the terms of trade shocks can explain the changes in output and prices in developing countries depending on flexible or fixed exchange rate regimes. He concluded that in the short run, any shock in the terms of trade affects countries with flexible or fixed exchange rates. In fact, countries with flexible exchange rate observe smaller effect on the real GDP than those with fixed exchange rate. These ones observe greater impact of the terms trade shocks on the Real GDP and consumer price. Also interested in the matter, Ghirmay, Sharma and Grabowski (1999) investigated the causal relationship between export instability, income terms of trade instability, investment and economic growth in 14 developing countries from 1960 to 1990. The concept of income terms of trade, introduced first by Graeme S. Dorrance in 1948, is the index of the value

of exports divided by the price index for imports. In other words, an increase in the income terms of trade means a rise in the potential of a country's exports of buying imports (Chauhan, 2009).

They concluded that instability in exports can affect an economy via two channels: first, it directly affects a country's income and capital formation. Second, it impacts income and capital indirectly by influencing the income terms of trade. Moreover, the study shows a negative long run relationship between income terms of trade instability and GDP.

Bleaney and Greenaway (2001) also examined the impact of terms of trade and real exchange on investment and economic growth in 14 sub-Saharan African countries. Their empirical analysis from 1980 to 1995 implied a negative relationship between specialization in primary products and GDP. Moreover, the study indicated that real exchange rate volatility has a negative effect on investment. Also, terms of trade volatility has a significant negative influence on economic growth. They concluded that when the terms of trade improve and are more favorable, economic growth is stable and high and so is Investment. Grimes (2006) analyzed the reasons for high and stable terms of trade in the beginning of 1990 in New Zealand and investigated if changes in terms of trade explain economic performance since 1960. He found out that improvement in terms of trade was a result of an increase in the real price of agricultural exports. Diversification of exports led to a reduction in terms of trade volatility. Also, the rise in economic growth in New Zealand can be explained *inter alia* by the stable terms of trade. In the same perspective, Mendoza (1996) explored the effects of terms of trade uncertainty on saving and economic growth in a stochastic endogenous growth model for 40 industrial and developing countries from 1971 to 1991. The model predicted that higher variability in terms of trade leads to lower economic growth, therefore lessens social welfare. The main finding of the study is a significant negative relationship between the terms of trade variability (or volatility) and economic growth.

In the case of Basu and McLeod (1992), the impact of terms of trade has been investigated on capital accumulation in 20 developing countries from 1950 to 1987. They concluded that volatility in export prices has a direct impact on the steady state growth rate (economic growth rate). They also indicated that higher variability in terms of trade decreases economic growth rate and that both the trend and the variability have large effects on the level of GDP and investment in small open economies.

In revisiting of Prebisch and Singer, Hadass and Williamson (2003) examined the effects of terms of trade shocks on economic growth of 19 countries from 1870-1940. They discovered that the terms of trade improved in developing countries more than they did in the Core (developed countries) until the World War I. However, the asymmetric impact of positive relative price shocks increased the economic growth in the core and reduced it in the periphery. This asymmetry may be explained by two hypotheses: the first one from Singer assumed that the long run effects of relative price shocks bolstered the comparative advantage for manufactured products in the Core, promoting sectors bearing economic growth. On the other hand, shocks in relative price strengthened the comparative advantage for primary commodities in developing countries, discouraging sectors bearing economic growth. The second hypothesis “resource curse” implied that the long run effects of relative price shocks induced capital outflows lowering the long run output.

The last study strengthening the adverse effect of terms of terms of trade shocks is done by Cashin, McDermott and Patillo (2004) who analyzed the persistence of terms of trade shocks on 42 sub-Saharan African countries from 1960 to 1996. Their study concluded that most of the countries had persistent shocks in their terms of trade consistent with long run trends. However, about half of the countries sampled experienced short-lived shocks while one-third experienced

long-lived shocks. Since these shocks have an important effect on economic performances and also, because most of the African countries don't have access to international capital markets to smooth the shocks, they resort to domestic policy such as the increase in domestic savings to raise the current and future GDP.

To sum up, after reading the literature we can conclude that openness to international trade is beneficial to countries in general. However, the countries not benefiting from it are the ones with productive abilities not competitive enough to take advantage of any improvement in markets access. This is mostly the case of countries from SSA. Moreover, all the empirical analyses mentioned attested that any improvement in the terms of trade induced an increase in the national income, therefore an improvement of economic performance.

As mentioned earlier, the distinguished element of this present study is, compared to other investigations which either examined the relationship between trade openness and economic growth or terms of trade and economic growth, we analyze the impact of both terms of trade and trade openness on economic growth of one of the regions of the world that is still economically far left behind, sub-Saharan Africa.

## Chapter III

### METHODOLOGY AND DATA

#### 1. Model

The purpose of this paper is to determine the relationship between terms of trade and economic growth in sub-Saharan African countries and then propose recommendations for economic policies.

Since terms of trade and trade openness cannot explain all the variation in the GDP level, following the literature, the model includes several other variables as well.

Solow in 1956 developed a model showing how accumulation of capital, growth in the Labor force and advances in technology interact together to determine the level of an economy's output (Mankiw, 2009). Given the importance of Capital and Labor in determining the output level, Gross Capital Formation and employment in the Labor force have been included in the model.

Thus, the estimated equation is of the form:

$$GDP = \beta_0 + \beta_1 NBTOT + \beta_2 GCF + \beta_3 Openness + \beta_4 Labor + \mu$$

The expected signs of the coefficients of the model are:

$\beta_1 > 0$ , the coefficient on Net Barter Terms of Trade is expected to be positive since most of literature attested its positive effect on GDP growth

$\beta_2 > 0$ , the coefficient on Gross Capital Formation is expected to be positive as well, since capital accumulation leads to higher national outcome

$\beta_3 > 0$  or  $\beta_3 < 0$  the coefficient on Openness is expected to be positive or negative since some of the literature has shown a negative relationship between openness to international trade and economic development in SSA

$\beta_4 > 0$ , Employment in Labor force affects the GDP positively, that is why the expected sign of its coefficient is positive.

## **2. Methodology**

To estimate the GDP regression, the panel data analysis is used. The results from both the fixed Effects model (with constant slopes but different intercepts) and Random Effects model (with a random constant term) are reported.

Moreover, in order to make sure that the error term is uncorrelated between the time series components and the cross-sectional error, the variance components or error components models will be also estimated.

## **3. Data Description**

Data collected from the present study covers annual data over 1980 to 2011. 13 sub-Saharan African countries have been investigated, therefore 416 annual observations have been collected. The countries are Cameroon, Central African Republic, Cote d'Ivoire, Gabon, Ghana, Kenya, Malawi, Mozambique, Nigeria, Senegal, South Africa, Togo and Zimbabwe.

The choice of the time period and countries completely depends on the availability of data which are collected from the World Development Indicators (WDI), World Bank's Database and the Penn World Table (only for data related to employment in the Labor force).

The different variables are presented in the table below and the descriptive statistics are presented in the Appendix in Table I.

Table 2

List of variables

Variables	Description
<b>Dependent variable</b>	
GDP	Real GDP base year=2005, rescaled GDP/USD 1 billion
<b>Independent variables</b>	
NBTOT	Net Barter Terms of Trade index (2005=100), $\frac{Px}{Pm} \times 100$ where Px= exports price index Pm= imports price index
GCF	Real Gross Capital Formation base year=2005 (current values divided by GDP deflator, rescaled GCF/USD 1 million)
Openness	$= \frac{X+M}{GDP}$ X= real Exports base year=2005 M=real Imports base year=2005 GDP= real GDP base year=2005
Labor	Number of people engaged in the Labor Force in millions, data from Penn World Table



## Chapter IV

### EMPIRICAL ANALYSIS

#### 1. Sampled Countries

This section presents a brief and short summary of sampled SSA countries and their descriptive statistics. To do this, we look at first the table below.

*Table 3*

GDP growth rate of SSA countries in the sample

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<b>Cameroon</b>	3.7	2.3	3.2	3.3	2.9	1.9	3.3	4.1	4.6	5.6	5.9
<b>Central African Republic</b>	5.9	0.9	3.6	4.6	2.1	1.7	3.0	3.3	4.1	-36.0	1.0
<b>Cote d'Ivoire</b>	1.2	1.7	1.5	1.8	2.5	3.3	2.0	-4.4	10.7	9.2	8.5
<b>Gabon</b>	0.7	3.9	-3.6	6.5	-3.0	-1.2	9.1	7.1	5.2	5.6	4.3
<b>Ghana</b>	5.6	5.9	6.4	4.3	9.1	4.8	7.9	14.0	9.3	7.3	3.9
<b>Kenya</b>	5.1	5.9	6.5	6.8	0.2	3.3	8.4	6.1	4.5	5.7	5.3
<b>Malawi</b>	4.8	2.8	2.1	9.5	8.3	9.0	6.5	4.3	1.9	5.2	5.7
<b>Mozambique</b>	7.8	8.7	9.8	7.4	6.9	6.3	6.7	7.1	7.2	7.1	7.2
<b>Nigeria</b>	33.7	3.4	8.2	6.8	6.2	6.9	7.8	4.9	4.3	5.4	6.3
<b>Senegal</b>	5.9	5.6	2.5	4.9	3.7	2.4	4.2	1.8	4.4	3.6	4.7
<b>South Africa</b>	4.5	5.3	5.6	5.4	3.2	-1.5	3.0	3.2	2.2	2.2	1.5
<b>Togo</b>	2.1	1.2	4.1	2.3	2.2	3.5	3.9	4.9	5.9	5.1	5.7
<b>Zimbabwe</b>	-5.8	-5.7	-3.5	-3.6	-17.7	5.9	11.4	11.9	10.6	4.5	3.8

Source: World Development Indicators (WDI)

Even though each country from SSA has her own economic and political context, they almost have the same characteristics.

Look at the table 3, we clearly see that the economic growth rate for most of the countries has been very unstable from 2004 to 2014. This instability can be explained by each one context. For example, Cote d'Ivoire and Central African Republic have been in the middle of conflicts and civil wars for some years over the period covered (2005-2007 for Cote d'Ivoire and since 2012 for Central African Republic). Zimbabwe is known not only known for civil wars and governance issues but also for her hyperinflation reaching the highest world records.

Although these countries face governance issues and civil wars that mainly can justify their unsteady economic growth, they all have one major common point, the primary commodities exports.

For instance, according to the International Trade Center in 2008 (N.A, 2010) , the primary products exported by Cameroon were (% of exports):

- Mineral fuels, oils, distillation products, etc. (47.2%)
- Wood, articles of wood, and wood charcoal (18.4%)
- Cocoa and cocoa preparations (10.1%)
- Edible fruit, nuts, peel of citrus fruit, and melons (9.5%)
- Aluminum and articles of aluminum (4.2%)

Gabon's main exports are petroleum products, which cover 80 percent of total exports. Other exported products include manganese, uranium and timber.

Mozambique's exports, on the other hand, are dominated by aluminum, electric energy, tobacco and also more important agricultural products as prawns, cotton, cashew nuts, sugar, citrus, copra and coconuts, and timber (N.A., Trading Economics, 2016).

South Africa, one of the richest countries in mineral resources is the biggest exporter of chromium and platinum which represent 9% of total exports, she exports manganese (9% of total exports), iron ores (14% of total exports), gold (7% of total exports), coal (6%) and diamonds (2%). This comes down to 47% of total exports covered by mineral resources. South Africa also exports motor vehicles and car parts (9%), machinery and mechanical appliances (7%) (N.A., Trading Economics, 2016).

Following the short summary, we can see that outside their governance issue, conflicts and civil wars that undermine their economic development, countries from SSA export mainly natural

resources with high volatility prices that also can be one of the major reasons of their unstable economic growth.

*Table 4*

Descriptive statistics

	<b>GDP</b>	<b>GDPREAL</b>	<b>NBTOT</b>	<b>GCF</b>	<b>GCFREAL</b>	<b>OPENNES S</b>	<b>LABOR</b>
Mean	2.84E+10	28.35807	140.4191	3.18E+08	318.4414	0.625889	7.918894
Median	8.03E+09	8.027315	105.7750	24670194	24.67019	0.600000	5.325000
Maximum	3.10E+11	310.0000	645.0900	2.84E+10	28375.00	1.220000	50.63000
Minimum	9.66E+08	0.965826	28.12000	0.000000	0.000000	0.060000	0.270000
Std. Dev.	5.79E+10	57.94938	108.5037	1.81E+09	1806.384	0.203399	9.222123
Obs.	416	416	416	416	416	416	416

GDPREAL=GDP/1 billion

GCFREAL=GCF/1 million

Look at the statistics above, the highest GDP is from South Africa which is not surprising since she has a higher level of exports diversification than most of the countries from SSA. The lowest GDP is from Central African Republic. This country has been lately in middle of an important civil war that has certainly reduced her economic performance. The highest terms of trade improvement is from Togo which has recorded a relative steady economic growth compared to the rest of the countries in the sample. The lowest terms of trade is from Nigeria in 1988. The highest capital accumulation is from Nigeria in 1980. This country has recorded a high and relatively stable economic growth since the last decade and possesses one of the highest GDP level in SSA. The highest level of trade openness is recorded by Zimbabwe in 2013. That may explain the high, although unstable, economic growth that country has registered since 2009 after the long period of hyperinflation. The lowest level trade openness in from Ghana in 1982. Ever since the country has been more open to international trade and has registered a high economic growth. The highest number of employed people in the labor is from Nigeria, what is not

surprising since she is the most populous country in Africa and the lowest number is from Gabon.

## 2. Results

The primary goal in this section is to present the results of the model estimated. The extensive form of GDP regression includes *Net Barter Terms of Trade*, *Gross Capital Formation*, *Openness* and *Labor*. An OLS time series regression has been done for each countries, the results are presented in the Appendix I Table II. The results of the estimation using Fixed Effects, Random effects and Variance Components models are also presented in the Appendix I. However, a brief summary of the estimation is presented on the table 5.

Let's recall first the model estimated:

$$\text{GDP} = \beta_0 + \beta_1 \text{NBTOT} + \beta_2 \text{GCF} + \beta_3 \text{Openness} + \beta_4 \text{Labor}$$

Table 5

Empirical Results

Dependent Variable: GDP

Observations: 416

	Fixed Effects	Random Effects	Variance Components Models			
			Fuller and Battese	Wansbeek and Kapteyn	Wallace and Hussain	Nerlove
<b>C</b>	-11.78** (3.68)	-6.01 (0.39)	-6.01 (0.39)	-6.01 (0.39)	-6.14 (0.17)	-6.02 (0.38)
<b>NBTOT</b>	0.021** (2.73)	0.021** (2.73)	0.021** (2.73)	0.021** (2.73)	0.021** (2.76)	0.021** (2.74)
<b>GCF</b>	0.0012** (3.53)	0.0012** (3.45)	0.0012** (3.45)	0.0012** (3.45)	0.0012** (3.56)	0.0012** (3.46)
<b>OPENNESS</b>	-16.73** (4.36)	-16.48** (4.30)	-16.48** (4.30)	-16.48** (4.30)	-16.69** (4.40)	-16.49** (4.31)
<b>LABOR</b>	5.27** (23.62)	5.23** (23.66)	5.23** (23.66)	5.23** (23.67)	5.26** (23.91)	5.23** (23.68)
<b>R<sup>2</sup></b>	0.9675	0.6028	0.6028	0.6030	0.6083	0.6033
<b>DW<sup>2</sup></b>	0.11	0.11	0.11	0.11	0.11	0.11
<b>F STAT</b>	720.20					

\*\* Coefficient is significant at 1% level.

\* Coefficient is significant at 5% level.

Figures in parentheses indicate absolute value of the t-statistic

<sup>2</sup> The Durbin-Watson test is low implying errors autocorrelation, even with the variance components models used to solve this problem. However, a good thing is that errors autocorrelation does not bias the estimation results.

Table 6

Summary for different methodologies (SAS, 2014)

<b>Fixed Effects method</b>	Regression with constant slopes but intercepts differ according to each cross-sectional unit (group)
<b>Random Effects method</b>	Regression with a random constant term
<b>Variance Components methods</b>	
<b>Fuller and Battese</b>	The error variance is the variance of the residual of the within estimator and also, this method is the default for estimation of one-way random-effects models with balanced panels.
<b>Wansbeek and Kapteyn</b>	Regression estimation is performed by using a quadratic unbiased estimation (QUE) method.
<b>Wallace and Hussain</b>	Regression estimation starts from OLS residuals on a data that are assumed to exhibit groupwise heteroscedasticity
<b>Nerlove</b>	This method gives estimates of the variance components that are always positive.

Given the results on the table 5, the coefficients of all the important variables are significant at 1% level, and most of them have the positive signs except for the coefficient on Openness.

Therefore, Net Barter Terms of Trade, Gross Capital formation and Labor have a significant positive impact on GDP in sub-Saharan Africa while Openness undermines it.

Using the FE, the coefficient on NBTOT is 0.021 what can be interpreted as an increase in one unit in NBTOT leads an increase in GDP of 0.021 USD billion (since GDP was rescaled). This is consistent with the results in the Random Effects models and the Variance components models.

This result matches the theory according to which any improvement of the terms of trade induce a rise in economic growth. We can therefore conclude that in sub-Saharan Africa, an improvement of Terms of trade is beneficial to economic performance. Therefore, any policy aiming to improve the terms of trade will definitely increase the economic growth rate.

The coefficient on GCF using the Fixed effects is consistent with the Random effects and the Variance components models as well. Thus, an increase of 1 USD millions in GCF (since GCF has been rescaled) induces an increase of 0.0012 USD billion in GDP. Again, this is consistent with the theory according to which capital accumulation leads to a higher economic growth in the long run.

However, the coefficient on the variable Openness is negative and statistically significant implying an increase in one unit in Openness leads to a fall in GDP of about 16 USD billions using the Fixed Effects, Random Effects and Variance Components models. This result confirms previous findings by Dowrick and Golly (2004), Sundaram and Arnim (2008) and Huchet-Bourdon and al (2011) implying that specialization in primary exports is bad for economic growth. This can be explained by different hypotheses, such as:

- Resource curse hypothesis: studied by Sachs and Warner in 1995, the hypothesis assumes a strong negative correlation between a rich endowment in natural resources and economic growth. One of the reasons that can justify this paradox is the revenue volatility. Since prices of most of those natural resources are subject to high fluctuations, that makes the revenue from their exports very volatile. Moreover, countries richly endowed with natural resources are characterized with less democracy and worse development outcomes. All the parameters potentially undermine the impact of trade openness on economic growth.
- Dutch disease: assumes that the existence of booms in natural resource sectors will lead to a decline in other sectors such as manufacturing. Consequently, this shift will affect the distribution of employment within a country and the long-term economic growth (Sachs and Warner, 1995).

- Tariff escalation: implies high import duties on semi-processed and finished products and low import duties on raw materials. If this practice protects domestic industries in developed countries, it hurts the development of processing industries in the countries producing the primary commodities. Therefore, countries richly endowed with natural resources are limited to produce only commodities that are highly volatile and discourage economic growth.

Some more reasons can also justify the harmful effects of international trade on economic growth: the inability of domestic industries in developing countries to compete multinational companies (MNCs) and the developing economies' reliance on essential imports, which can deteriorate terms of trade.

The coefficient on Labor is positive and significant implying that an increase in employment of 1 million (employment was rescaled) results in increase in GDP of about 5.27 USD billions in sub-Saharan Africa. This supports the theory, labor or accumulation in human capital induces an upturn of national income.

### **3. Policy implications**

The present study aims to investigate the relationship between terms of trade and economic growth and thereafter, propose recommendation of economic policies. In regards to the empirical results obtained, we can therefore offer the present recommendations. We found out a positive and significant relationship between terms of trade and GDP in sub-Saharan Africa implying that improvement of terms of trade is beneficial to economic growth. Therefore, we can assume any policy to enhance terms of trade improves the economic performance of a country.



Terms of trade improvement have several implications. It means among other things that for every unit of exports sold it can buy more units of imported products, thus creating an advantage in the number of products needed to be exported to buy a given amount of imports.

Generally, if a country imports more than she exports, she experiences a trade deficit. This creates a net-outflow of scarce foreign exchange leading to a depreciation of the domestic currency meaning exports become less expensive than imports. This results in deterioration in the terms trade. While it may not occur in the short run but it does in the long run.

Other factors that affect the exchange rate such as speculation, confidence and interest rates can definitely influence the terms of trade.

The negative sign of Openness suggests that the participation of sub-Saharan Africa in international trade is actually harming instead of benefiting her. Following the possible causes mentioned above (*Resource curve hypothesis, Dutch disease and Tariff escalation*), the recommendations for sub-Saharan Africa would be exports diversification. Sub-Saharan Africa has to use more of her resources in other industries than of primary commodities. Manufacturing industries and Services would certainly bring important added values to the economy of most of her countries.

Since most of sub-Saharan African countries are characterized by poor governance, less democracy and corruption, this results in poor and unfair distribution of revenue from international. In order to benefit more from international trade, countries from sub-Saharan Africa have to cope with their governance issues as mentioned by Collier. (Collier, 2003).

Diversification in exports seems to be the ideal solution for sub-Saharan Africa. However, due to Tariff escalation, this key can also face a problem. This will be one of the limitations of the present

study. With more time, we could have investigate more and propose possible solutions to cope with it.

## **Chapter V**

### **CONCLUSION**

This study investigated the relationship between terms of trade and economic growth in sub-Saharan Africa. Three other variables such as Gross Capital Formation, Openness and Labor, have been included in the model in order to capture more of the variation in GDP. After investigation, we found out that terms of trade had a positive impact on GDP. Three different models were used: Fixed Effects, Random Effects and Variance Components models and each conveyed the same message.

Gross Capital Formation and Labor have also shown a positive relationship with GDP in sub-Saharan Africa supporting therefore the theory implying that an increase in capital and labor leads to a rise in the national income.

The positive relationship between terms of trade and GDP implies an improvement of terms of trade induces an upturn of economic growth. Therefore, any policy improving the terms of trade can help GDP growth in SSA.

Two main factors that affected terms of trade have been pointed out, Trade balance and exchange rate. A deficit in trade balance suggesting a rise in imports over exports results in depreciation of the exchange rate and therefore, a deterioration of terms of trade. Exchange rate is also affected by several factors including: relative interest rates, speculation and confidence.

The negative impact of openness on economic growth in sub-Saharan Africa implies that international trade has not been beneficial. Three possible causes have been suggested such as the Resource curse hypothesis, Dutch disease and Tariff escalation. In order to solve to issue, it has been proposed that countries from sub-Saharan Africa have to specialize in production and

exports of manufacturing products and services instead of primary commodities alone. Also, they should promote a better governance and democracy in order to benefit from international trade.

The limitations of the present study are:

- The investigation of solutions to help SSA countries to cope with Tariff escalation.
- GDP is not a comprehensive measure of national output for the sample since it does not take into account some notable facts in SSA for instance, the importance of the informal sector.
- The inclusion of dummy variables representing governance, democracy, corruption and civil war to evaluate their impact on economic growth in SSA since most of the countries in this region have been exposed or are still exposed to these issues. However, by doing so we would have reduced the degrees of freedom. Also, increasing the number of observations was not possible given the data deficiency in SSA.

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## APPENDIX I

Table I

OLS Time series

Dependent variable: GDP

	<b>Independent Variables</b>						
Countries		<b>Intercept</b>	<b>NBTOT</b>	<b>GCF</b>	<b>OPEN.</b>	<b>LABOR</b>	
<b>Cameroun</b>	Coeff.	-1.39	0.004	0.088	2.93	1.86	$R^2=0.8744$
	St.error	1.90250	0.02483	0.02414	2.69326	0.36496	F Val.= 46.99
	t Value	-0.73	0.17	3.65	1.09	5.09	Pr > F=<.0001
	Pr >  t	0.4726	0.8675	0.0011	0.2864	<.0001	
<b>Central African Republic</b>	Coeff.	0.75	-0.001	0.087	0.086	0.31	$R^2=0.9247$
	St.error	0.29616	0.00039784	0.02248	0.19678	0.12016	F Val.= 82.85
	t Value	2.55	-2.62	3.88	0.44	0.6651	Pr > F=<.0001
	Pr >  t	0.0168	0.0143	0.0006	2.55	0.0166	
<b>Cote d'Ivoire</b>	Coeff.	4.21	0.0009	0.024	2.48	1.58	$R^2=0.9436$
	St.error	1.05601	0.00474	0.01016	1.52080	0.19501	F Val.= 112.9
	t Value	3.98	0.20	2.33	1.63	8.10	Pr > F=<.0001
	Pr >  t	0.0005	0.8412	0.0276	0.1146	<.0001	
<b>Gabon</b>	Coeff.	0.92	-0.006	0.003	3.02	12.34	$R^2=0.8779$
	St.error	1.37547	0.00258	0.01319	1.16423	1.09833	F Val.= 48.54

	t Value	0.67	-2.23	0.25	2.60	11.23	Pr > F=<.0001
	Pr >  t	0.5081	0.0344	0.8024	0.0150	<.0001	
<b>Ghana</b>	Coeff.	-5.5	0.012	0.0002	-3.08	1.9	R <sup>2</sup> =0.9755 F Val.= 268.38 Pr > F=<.0001
	St.error	0.55219	0.00745	0.00043761	0.76531	0.13431	
	t Value	-9.96	1.57	0.57	-4.02	14.19	
	Pr >  t	<.0001	0.1278	0.5767	0.0004	<.0001	
<b>Kenya</b>	Coeff.	-5.37	-0.023	0.023	1.59	1.88	R <sup>2</sup> =0.9828 F Val.= 384.78 Pr > F=<.0001
	St.error	1.70729	0.01128	0.00394	1.87594	0.06526	
	t Value	-3.15	-2.00	5.87	0.85	28.77	
	Pr >  t	0.0040	0.0551	<.0001	0.4028	<.0001	
<b>Malawi</b>	Coeff.	-1.19	0.003	-0.0003	-0.03	0.71	R <sup>2</sup> =0.9667 F Val.= 195.88 Pr > F=<.0001
	St.error	0.41123	0.00146	0.00041219	0.33975	0.03953	
	t Value	-2.90	1.89	-0.80	-0.09	17.93	
	Pr >  t	0.0074	0.0697	0.4300	0.9279	<.0001	
<b>Mozambique</b>	Coeff.	-10.66	0.016	0.0001	1.04	1.42	R <sup>2</sup> =0.9822 F Val.= 372.40 Pr > F=<.0001
	St.error	0.91584	0.00342	0.00020980	0.56132	0.06394	
	t Value	-11.64	5.18	0.43	1.85	22.19	
	Pr >  t	<.0001	<.0001	0.6690	0.0753	<.0001	

<b>Nigeria</b>	Coeff.	-75.22	0.41	-0.0002	-30.67	3.88	$R^2=0.9601$ F Val.= 162.48 Pr > F=<.0001
	St.error	8.14262	0.05667	0.00031916	11.73578	0.30341	
	t Value	-9.24	7.18	-0.70	-2.61	12.79	
	Pr >  t	<.0001	<.0001	0.4871	0.0145	<.0001	
<b>Senegal</b>	Coeff.	0.74	-0.002	0.05	-0.69	1.77	$R^2=0.9910$ F Val.= 745.51 Pr > F=<.0001
	St.error	0.90796	0.00272	0.00740	0.54723	0.10254	
	t Value	0.82	-0.84	6.44	-1.27	17.22	
	Pr >  t	0.4202	0.4056	<.0001	0.2156	<.0001	
<b>South Africa</b>	Coeff.	-57.89	0.67	0.004	79.7	11.9	$R^2=0.9400$ F Val.= 105.71 Pr > F=<.0001
	St.error	46.47623	0.46736	0.00466	45.44693	1.19403	
	t Value	-1.25	1.43	0.92	1.75	9.97	
	Pr >  t	0.2236	0.1645	0.3663	0.0906	<.0001	
<b>Togo</b>	Coeff.	-0.39	0.0007	0.02	0.28	0.84	$R^2=0.9656$ F Val.= 189.68 Pr > F=<.0001
	St.error	0.22299	0.00016602	0.00815	0.11014	0.05766	
	t Value	-1.77	4.12	2.40	2.56	14.51	
	Pr >  t	0.0883	0.0003	0.0233	0.0163	<.0001	
<b>Zimbabwe</b>	Coeff.	5.94	-0.05	0.30	-4.62	1.13	$R^2=0.5312$ F Val.= 7.65 Pr > F=0.0003
	St.error	2.17642	0.02821	0.05635	1.82065	0.32416	
	t Value	2.73	-1.75	5.27	-2.54	3.49	

	Pr >  t	0.0110	0.0923	<.0001	0.0173	0.0017	
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Table II  
Fixed Effects Model

Dependent Variable: GDP

<b>Model Description</b>	
<b>Estimation Method</b>	FixOne
<b>Number of Cross Sections</b>	13
<b>Time Series Length</b>	32

<b>Fit Statistics</b>			
<b>SSE</b>	45298.2875	<b>DFE</b>	399
<b>MSE</b>	113.5295	<b>Root MSE</b>	10.6550
<b>R-Square</b>	0.9675		

<b>F Test for No Fixed Effects</b>			
<b>Num DF</b>	<b>Den DF</b>	<b>F Value</b>	<b>Pr &gt; F</b>
<b>12</b>	399	720.20	<.0001

<b>Parameter Estimates</b>						
<b>Variable</b>	<b>DF</b>	<b>Estimate</b>	<b>Standard Error</b>	<b>t Value</b>	<b>Pr &gt;  t </b>	<b>Label</b>
<b>Intercept</b>	1	-11.7794	3.2024	-3.68	0.0003	Intercept
<b>NBTOT</b>	1	0.020623	0.00755	2.73	0.0066	

<b>GCF</b>	1	0.001203	0.000341	3.53	0.0005	
<b>OPENNESS</b>	1	-16.734	3.8384	-4.36	<.0001	
<b>LABOR</b>	1	5.269974	0.2231	23.62	<.0001	

Table III

Random Effects Model

Dependent Variable: GDP

<b>Model Description</b>	
<b>Estimation Method</b>	RanOne
<b>Number of Cross Sections</b>	13
<b>Time Series Length</b>	32

<b>Fit Statistics</b>			
<b>SSE</b>	46691.3803	<b>DFE</b>	411
<b>MSE</b>	113.6043	<b>Root MSE</b>	10.6585
<b>R-Square</b>	0.6028		

<b>Variance Component Estimates</b>	
<b>Variance Component for Cross Sections</b>	2909.632
<b>Variance Component for Error</b>	113.5295

<b>Hausman Test for Random Effects</b>		
<b>DF</b>	<b>m Value</b>	<b>Pr &gt; m</b>
2	2.11	0.3488

<b>Parameter Estimates</b>

<b>Variable</b>	<b>DF</b>	<b>Estimate</b>	<b>Standard Error</b>	<b>t Value</b>	<b>Pr &gt;  t </b>
<b>Intercept</b>	1	-6.00899	15.2282	-0.39	0.6933
<b>NBTOT</b>	1	0.020633	0.00755	2.73	0.0066
<b>GCF</b>	1	0.001175	0.000341	3.45	0.0006
<b>OPENNESS</b>	1	-16.4773	3.8311	-4.30	<.0001
<b>LABOR</b>	1	5.229094	0.2210	23.66	<.0001



Table IV

Variance Components Model

1. Fuller and Battese Method

The PANEL Procedure

Fuller and Battese Variance Components (RanOne)

Dependent Variable: GDP

<b>Model Description</b>	
<b>Estimation Method</b>	RanOne
<b>Number of Cross Sections</b>	13
<b>Time Series Length</b>	32

<b>Fit Statistics</b>			
<b>SSE</b>	46691.3803	<b>DFE</b>	411
<b>MSE</b>	113.6043	<b>Root MSE</b>	10.6585
<b>R-Square</b>	0.6028		

<b>Variance Component Estimates</b>	
<b>Variance Component for Cross Sections</b>	2909.632
<b>Variance Component for Error</b>	113.5295

<b>Hausman Test for Random Effects</b>		
<b>DF</b>	<b>m Value</b>	<b>Pr &gt; m</b>
2	2.11	0.3488

<b>Parameter Estimates</b>					
<b>Variable</b>	<b>DF</b>	<b>Estimate</b>	<b>Standard Error</b>	<b>t Value</b>	<b>Pr &gt;  t </b>
<b>Intercept</b>	1	-6.00899	15.2282	-0.39	0.6933
<b>NBTOT</b>	1	0.020633	0.00755	2.73	0.0066
<b>GCF</b>	1	0.001175	0.000341	3.45	0.0006
<b>OPENNESS</b>	1	-16.4773	3.8311	-4.30	<.0001
<b>LABOR</b>	1	5.229094	0.2210	23.66	<.0001

## 2. Wansbeek and Kapteyn Method

The PANEL Procedure

Wansbeek and Kapteyn Variance Components (RanOne)

Dependent Variable: GDP

<b>Model Description</b>	
<b>Estimation Method</b>	RanOne
<b>Number of Cross Sections</b>	13
<b>Time Series Length</b>	32

<b>Fit Statistics</b>			
<b>SSE</b>	46659.4578	<b>DFE</b>	411
<b>MSE</b>	113.5267	<b>Root MSE</b>	10.6549
<b>R-Square</b>	0.6030		

<b>Variance Component Estimates</b>	
<b>Variance Component for Cross Sections</b>	2978.141
<b>Variance Component for Error</b>	113.5295

<b>Hausman Test for Random Effects</b>		
<b>DF</b>	<b>m Value</b>	<b>Pr &gt; m</b>
4	2.94	0.5684

<b>Parameter Estimates</b>					
<b>Variable</b>	<b>DF</b>	<b>Estimate</b>	<b>Standard Error</b>	<b>t Value</b>	<b>Pr &gt;  t </b>
<b>Intercept</b>	1	-6.01286	15.3951	-0.39	0.6963
<b>NBTOT</b>	1	0.020633	0.00755	2.73	0.0065
<b>GCF</b>	1	0.001176	0.000340	3.45	0.0006
<b>OPENNESS</b>	1	-16.4831	3.8300	-4.30	<.0001
<b>LABOR</b>	1	5.230015	0.2210	23.67	<.0001

### 3. Wallace and Hussain

The PANEL Procedure

Wallace and Hussain Variance Components (RanOne)

Dependent Variable: GDP

<b>Model Description</b>	
<b>Estimation Method</b>	RanOne
<b>Number of Cross Sections</b>	13
<b>Time Series Length</b>	32

<b>Fit Statistics</b>			
<b>SSE</b>	45544.7167	<b>DFE</b>	411
<b>MSE</b>	110.8144	<b>Root MSE</b>	10.5268
<b>R-Square</b>	0.6083		

<b>Variance Component Estimates</b>	
<b>Variance Component for Cross Sections</b>	3150.491
<b>Variance Component for Error</b>	21.67335

<b>Hausman Test for Random Effects</b>		
<b>DF</b>	<b>m Value</b>	<b>Pr &gt; m</b>
4	0.04	0.9998

<b>Parameter Estimates</b>					
<b>Variable</b>	<b>DF</b>	<b>Estimate</b>	<b>Standard Error</b>	<b>t Value</b>	<b>Pr &gt;  t </b>
<b>Intercept</b>	1	-6.14915	35.3107	-0.17	0.8618
<b>NBTOT</b>	1	0.020625	0.00746	2.76	0.0060
<b>GCF</b>	1	0.001198	0.000337	3.56	0.0004
<b>OPENNESS</b>	1	-16.6878	3.7907	-4.40	<.0001
<b>LABOR</b>	1	5.26264	0.2201	23.91	<.0001

#### 4. Nerlove Method

The PANEL Procedure

Nerlove Variance Components (RanOne)

Dependent Variable: GDP

<b>Model Description</b>	
<b>Estimation Method</b>	RanOne
<b>Number of Cross Sections</b>	13
<b>Time Series Length</b>	32

<b>Fit Statistics</b>			
<b>SSE</b>	46600.0628	<b>DFE</b>	411
<b>MSE</b>	113.3821	<b>Root MSE</b>	10.6481
<b>R-Square</b>	0.6033		

<b>Variance Component Estimates</b>	
<b>Variance Component for Cross Sections</b>	2987.274
<b>Variance Component for Error</b>	108.8901

<b>Hausman Test for Random Effects</b>		
<b>DF</b>	<b>m Value</b>	<b>Pr &gt; m</b>
4	1.61	0.8067

<b>Parameter Estimates</b>					
<b>Variable</b>	<b>DF</b>	<b>Estimate</b>	<b>Standard Error</b>	<b>t Value</b>	<b>Pr &gt;  t </b>
<b>Intercept</b>	1	-6.02005	15.7222	-0.38	0.7020
<b>NBTOT</b>	1	0.020632	0.00754	2.74	0.0065
<b>GCF</b>	1	0.001177	0.000340	3.46	0.0006
<b>OPENNESS</b>	1	-16.4938	3.8279	-4.31	<.0001
<b>LABOR</b>	1	5.231731	0.2210	23.68	<.0001



## APPENDIX II

### Review of Empirical Literature

Paper	Countries Studied, Time Period	Methodology (Times Series, Cross-Section, Panel)	Dependent Variable	Independent Variables	Main Findings
Winners and losers in the commodity lottery: the impact of terms of trade growth and volatility in the Periphery 1870-1939 Christopher Blattman and al.	35 countries among what 6 core countries (price-setters) and 29 periphery countries (price-takers), 8 Europeans, 3 Oceanians, 8 Latin America, 10 Asians and Middle East.	OLS method with Cross sectional panel data	Average annual Growth rate per capita	1. Growth in terms of trade 2. volatility in terms of trade 3. vector of controls 4. country dummy 5. time dummy 6. Foreign investment (Capital inflows)	1. High price commodity volatility explains poor economic performance in the Periphery compared to the Core and also poor relative performance within the commodity-specialized Periphery. 2. Volatility reduces capital

					flows to the commodity-dependent, price-taking countries ( even though slightly less statistically robust compared to income growth)
Terms of trade and exchange rate regimes in developing countries By Christian Broda	75 countries from developing and non-oil countries 1973-1996	Cross sectional panel unit roots Granger Causality tests	1. Real GDP 2. Real exchange rate 3. Terms of trade 4. Consumer Price	1. Fixed exchange rate 2. Float exchange rate	With fixed exchange rate, a permanent change in terms of trade with value equals -10% have an effect on Real GDP, Real exchange rate and

					Consumer price.
The impact of terms of trade and real exchange rate volatility on investment and growth in sub-Saharan Africa By Michael Bleaney and David Greenaway	14 sub-Saharan African countries 1980-1995	OLS method with Cross sectional panel data with fixed effects	The ratio of Investment to GDP (for the investment equation)  The GDP (for the GDP equation)	1. Two lags of the dependent variables 2. Two lags of GDP 3. real exchange rate 4. real inflation rate 5. terms of trade 6. one lag of terms of trade 7. Volatility in terms of trade 8. Volatility in real exchange rate	For the first regression with Investment, the lagged terms of trade have a positive influence, volatility of terms of trade does not influence Investment. Real exchange and the volatility in real exchange rate have a considerable

				<p>9. Real exchange rate misalignment</p> <p>10. one lag of real exchange rate misalignment</p>	<p>negative effect on Investment.</p> <p>For the GDP equation, the current terms of trade has a positive influence and the lagged of terms of trade has negative influence.</p> <p>Also, there is a negative effect of terms of trade instability.</p> <p>Therefore, the research suggests a negative correlation between</p>
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					specialization in primary product exports and growth.
A smooth ride: Terms of trade, volatility and GDP growth By Arthur Grimes	New Zealand 1960-2004	OLS time series	Annual GDP Growth rate	1. Ln of Terms of trade 2. Ln Real Exports Price 3. Ln Real Imports Price 4. 10-year moving standard deviation of the Terms of trade 5. 10-year moving standard deviation of	The increase in the commodity terms of trade of New Zealand since 1990 is a result of a rise in real price in key agricultural commodity exports. Also, diversification of the export has resulted in reducing

				Real Exports Price 6. 10-year moving standard deviation of Real Imports Price	volatility in the overall terms of trade. A reduced volatility in individual commodity prices had some effects on reducing terms of trade volatility
Terms of terms uncertainty and economic growth By Enrique Mendoza	9 industrial countries (G7 plus Australia and Spain) and 31 developing countries 1971-1991	Cross- country panel	Real per- capita consumption growth	1.Import prices 2. Rate of change of terms of trade	The research suggests a considerable negative effect of the variability of terms of trade on economic growth.

Export sophistication and the terms of trade of the developing and emerging countries By Mohamed Saadi	36 Developing countries (balanced panel) 1990-2006	Cross country OLS estimation	1.Log terms of trade 2.Change in log terms of trade ( for a second regression)	1. log exports sophistication (exports productivity) 2. Imports 3. Change in log exports sophistication (for a second regression) 4. change in imports	The level of productivity of the developing countries' exports did not stop the fall in terms of trade of commodities. The level of sophistication of exports of developing countries diversification in traded goods) did not improve the terms of trade.
Export instability, income terms of trade	14 developing countries 1960-1990	Cross-country cointegration analysis and	Real GDP	1.Investment 2. Export instability	Income terms of trade causes Investment in 10 countries

instability and growth: causal analyses Teame Ghirmay and al.		multivariate error correction model		3. Instability of income terms of trade	and also causes real GDP or investment in 12 of 14 countries
Terms of trade fluctuations and economic growth in developing countries By Parantap Basu and Daryl McLeod	20 developing countries 1950-1987	Cross-country unit root tests	GDP	Terms of trade	Transitional terms of trade shocks have negative persistent effects on output level
Terms of trade shocks in Africa: are they short-	42 sub-Saharan African countries 1960-1996	Biased least squares, median-unbiased Dickey-Fuller	Terms of trade	1. Trend 2. Terms of trade one year lagged	Most of countries are found to have persistent shocks to their



lived or long-lived? By Paul Cashin and al.		and Augmented Dickey-Fuller regressions			terms of trade what lower the output level
Terms of trade shocks and economic performance, 1870-1940: Prebisch and Singer revisited By Yael S. Hadass and Jeffrey G. Williamson	19 countries with 7 European, 5 from the New World Argentina, Australia, Canada, USA, Uruguay and 7 from Asia and Africa 1870-1940	OLS time series	1. Real wage growth 2. GDP per capita	1. ln purchasing-power-parity adjusted real wage 2. ln GDP per capita 3. External terms of trade 4. Land-labor ratio growth	Terms of trade improved in developing countries more than they did in the Core until the World War I. The positive relative price shocks increased the economic growth in the core and reduced it in the periphery