EXPORT INSTABILITY AND ECONOMIC GROWTH IN SUB SAHARA AFRICAN COUNTRIES

BY PAULOS GUTEMA

A thesis submitted to the School of Graduate Studies of Addis Ababa University in partial fulfilment of the requirements for Degree of Master of Science in Economics (Economic Policy Analysis)

June, 1999
Addis Ababa.

ADDIS ABABA UNIVERSITY
School of Graduate Studies

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By
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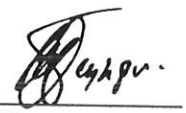
Dr. Alemayehu Geda Examiner	 Signature
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Acronyms

ADF	Augmented Dickey Fuller
AEPRP	African Economic Policy Reform program
CC	Cross Country
CRS	Constant Returns to Scale
EEI	Export Earnings Instability
EG	Engle-Granger
EP	Export promotion
FPD	Factor Productivity Differential
GDP	Gross Domestic Product
IMF	International Monetary Fund
ISI	Import Substituting Industrialization
LDC	Least Developing Countries
OLS	Ordinary Least Square
OOEP	Outward Oriented Economic Policy
SAF	Structural Adjustment Facility
SAP	Structural Adjustment Program
SRS	Spearman Rank correlation
SSA	Sub Sahara Africa
SUR	Seemingly Unrelated Regression
TOT	Terms of Trade
TS	Time Series
UNCTAD	United Nations Conference on Trade and Development
USAID	United States Agency for International development

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ABSTRACTS

The study attempts to investigate the impact of uncertainty generated by export earning instability on economic growth. Through this investigation the degree to which outward oriented economic policy will be reliable for the purpose of accelerating economic growth is also be examined.

After detail review of theoretical and empirical foundation of the policy, a model that links variable of uncertainty to economic performance is developed. Moreover, from the model, the condition under which outward oriented economic policy contributes favourably, to economic growth is set theoretically. Furthermore, the model and the conditions were estimated based on available statistical data.

From the estimates, it can be inferred that, to benefit from outward oriented economic policy in terms of economic growth, the stable component of export revenue of the region has to grow substantially. If this condition is not satisfied the policy acts adversely on economic performance. Lastly, if the condition cannot be met and the adverse effect is not affordable, the estimates indicate that there should exist an external mechanism that absorbs the growth of uncertainty coming from international trade.

1. Introduction

Sub-Saharan African (SSA) economies have been experiencing a very slow growth for the last three and a half decades. According to Sachs and Warner's (1997) estimate the regions annual average change in GDP per capita was only 0.8% per year over the period 1965 - 1990. By contrast growth in some of South East Asian Countries was 5.8% and that of the rest of the less developed countries (LDCs) is 1.8%. Expressing the same issue in another way, in 1965 GDP per capita in SSA was 60% of the average of the rest of developing world, but in 1990 this figure had fallen to 35%. The regions', poor performance has been reflected not only in static income per head, but also in a rapidly declining share of world commerce. Ng and Yeats (1996) showed that the decline in SSA share of world exports between 1962-1964 and 1991 - 1993 has reduced the absolute value of exports by over $11 billions per year.

Such slow or stagnant growth of SSA have been point of much concern for African specialists, development economists and other scholars as the prevalence and severity of the problems seem different from that of another regions of developing countries. While searching for the cause of such problem, some of them consider poor policy as the primary causes while others emphasize on the underlying growth conditions - like colonial history, ethnic diversity and tribal divisions, tropical climate, geographical factors e.g. access to sea etc.

From the latter group, Easterly and Levin (1997), for example, besides producing evidence for strong relationship between the underlying growth conditions and growth, they described how these conditions themselves contribute to poor public policy choices. That is poor policy it self is not a self-standing cause, but rather a consequence of other adverse factors. Galup and Sachs'

(1998) work, for example, indicate protectionist policies in SSA (considering it to be inappropriate) could be the result of adverse underlying growth conditions.

Based on these and other similar studies and the fact that these adverse factors' uniqueness, to some extent to Africa, as Cuddling et al. (1996) notes, one often hears the argument that there is no presumption that the usual economic prescriptions should apply in addressing Africa's economic problems. Other scholars like Sachs and Warner (1997) prefer to argue the other way round. They find that poor economic policies, most importantly Africa's lack of openness to international markets have played a particularly important role in the slow growth than the underlying growth factors. As a result these group of specialists prefer to stress that there is no need for a special theory for Africa with regard to economic growth. As a reconciliatory idea but inclined towards the latter view, UNCTAD (1998a) suggest that care must be taken not to neglect the structural factors underlying growth conditions and not to over state the role of policy variables in economic growth.

By considering the overstated role of internationally open economic policy in African context, this study departs from this point of debate by asking the following question: Even if the underlying growth conditions in Africa are considered to be similar to that of the other developing countries is policy of openness to international market truly suitable for accelerating SSA economic growth? Thus the whole content of this thesis revolves around this question.

After describing the hypothesis and objective of the study in second and third section, the fourth and fifth section attempts to review the role of different policies implemented in the past three decades. The subsequent sections deal with describing the basic foundation of outward oriented economic policy, framework of the analysis and econometric analysis.

2. The Hypothesis

This study hypothesizes that the effectiveness of outward oriented economic policy depends on the fulfillment of some economic conditions, and if such condition are not fulfilled the policy acts adversely in the attempts made to accelerate economic growth. This hypothesis is formulated on the ground of three basic points as outlined hereafter.

First, beginning from the early 1980's a large number of policy makers, development economists and international organizations like IMF, World Bank and western aid organization like USAID have been emphasizing the appropriateness of Outward Oriented Economic Policy(OOEP) for promoting economic growth of LDCs. Be it willingly or unwillingly, this policy was implemented in most of SSA countries. The basic foundation for such recommendation was the result obtained by empirical studies regarding the relationship of export and economic performances that concluded the existence of positive and strong association between the two variables. Despite the strong belief held by the above bodies, the policy couldn't give the expected results in some of the LDCs specially in the SSA countries, even to the extent of import substitution industrialization policy that was widely used in SSA during the second half of the 1960s and early 1970s. But it is claimed to be successful in some South East Asian countries. This dissimilar result casts strong doubt on the universal applicability of the OOEP.

Second the advocates of the policy claim the prediction of neo-classical trade model as theoretical justification of the OOEP. However, the claimed model relies heavily on a dozen of heroic assumptions that can't be valid in LDCs context. Some of the assumptions will be reviewed in section 5.1 thoroughly, but for our purpose here, looking at the assumption of

absence of uncertainty is enough. Nowadays we can find a number of theoretical researches that indicate the fact that the prediction of the model can not hold true when this assumption is removed. On the other hand we can find a large number of evidences indicating the volatility of revenue of primary commodities. This volatility, indeed, generates uncertainty in the system in general. From these two points it seems reasonable to suspect the attainability of dynamic gains of trade by primary commodity exporters.

Thirdly, most of the empirical evidences forwarded by the advocates of the policy relies heavily on the cross-sectional data set that over smoothes the fluctuations of export revenues, and deals only with the stable components. That means it makes an implicit assumption of absence of uncertainty. Consequently, the result to be found from such approach may not have relevance to the primary commodity exporters. Here too, one can have a good reason to suspect the relevance of policy implication of the findings for those countries not in accordance with the implied assumption. This issue will be discussed in detail in section 5.2.

In short, the ineffectiveness of the policy in SSA countries, the breaking down of the neo-classical model under uncertainty and the methodological problem appearing in the empirical studies made on the area, leads one to formulate a hypothesis that OOEP requires some economic preconditions to be effective in line of the purpose it is designed to serve.

3. Objective and Methodology

3.1. Objective

The primary objective of the study is to develop a model that links uncertainty variable with economic growth. Developing such a model is believed to enable one to tell the condition under which the outward oriented economic policy results in accelerating growth.

The intended model may require measuring uncertainty and using the measurement as a variable. In the literature, most often we find export earnings instability (EEI) index being considered as a suitable measure of uncertainty generated there from. However, most of the indices were developed in a way that they can generate uncertainty data of cross-sectional data set. Hence developing an index that is suitable for generating time series data of uncertainty will be the second objective of the study. Besides developing the model, confirming the consistency of the index to be developed with that of the cross-sectional data will be a supplementary objective.

The third objective of the study will be confronting the model to be developed with statistical data from SSA countries. The analysis is expected to give information about a specific country as well as the region as a whole.

3.2. Methodology.

To hit the intended target, i.e. investigate the coditionality of OOEP, the study follow two main routes. The first one is analytical approach without the use of statistical evidences. Beginning from endogenous growth model and passing through including the variable that captures export oriented economic policy and arriving at incorporation of uncertainty variable. After developing the intended model this way the approach tries to drive a prerequisite for a positive contribution of export promoting policy to economic growth. This approach makes some behavioral assumptions of the involved economic agents. In addition to the behavioral assumption, the approach also assumes that the underlying economy is bi-sectoral: export sector and non-export sector, which may have total factor productivity differential as well as some externality between the sectors.

The second approach attempts to estimate the entire model by the help of statistical data. Time series analysis and panel data analysis will be employed. Based on the estimated parameters the requirement from the region to have effective OOEP will be set down. To pave the way taking to this end, lets review some policies and performances seen in the region in the last three decades and a half.

4. Post Independence SSA's Economic Policies and Performances

After independence according to World Bank (1989) Africans had high hopes of rapid development. The leaders, being motivated by the end of colonialism, were determined that their countries should catch-up with the developed countries. There was a widely prevailing saying like "we must run while they walk" to express their intention. To achieve their goal in most of newly formed SSA states import substituting industrialization was considered to be the engine of growth as well as for transforming traditional agricultural economies to modern industrial ones. Indeed this policy choice was not an arbitrary one, but has got two basic reasons. The first was the prospect for commodity exports in the world market were poor, and the second was for strong desire to reduce dependence on manufactured imports that was linked to their prior colonialists. To implement such strategy governments were believed to play a dominant role, as the market forces weren't trusted.

Overall SSA growth performance was quite strong from the mid 1960s until the first oil Shock, 1973. GDP growth in the region was faster than in the 1950s or under colonial rule, averaging an annual rate of 4.5% or more than 1% per capita. During this time GDP was observed to grow faster than the population. During this period the study indicates, some countries like Botswana, Burundi, Kenya Nigeria, Zimbabwe, Cote'd Ivore were showing growth performance comparable to the best performing economies elsewhere in the developing world. Moreover the earlier trend of falling terms of trade came to its inflection point in 1965 and the period 1965-1973 is characterized by fast growth of export revenues, averaging over 15%. However, as UNCTAD (1998a) noted, the export expansion at that time were in most cases based on very traditional commodities with little diversities either vertically to wards processed commodities and manufactures or horizontally within the primary sector.

In line with the chosen growth strategy, industry was the fastest growing sector; manufacturing activity grew by 7.3% per year during 1965-73. Indeed, growth of agricultural value added in SSA was generally weak averaging only 2.5% per year.

Other development indicators also confirm the fact that performance was strong during this period. World Bank (1989, p. 16) describes that life expectancy, literate number of people, investment in infrastructure and health care was raised fastly in this period.

To expand the small domestic markets and avoid restrictive colonial trading legacy, great endeavors were made to create new sub regional trade arrangements and to strengthen the existing ones. In this line the industrialization strategy was reshaped in such a way that it fits in to the target of collective self-reliance. Even though the achievements in economic progress were very appreciable, there was a lot to be done to achieve the goal of self-reliance. In actual fact, in early 1970s there was strong dependence of SSA countries on developed countries. Such dependence has made them special victim of the 1973 oil price rise, except for a few oil exporters. As a result pattern of economic growth was altered. A number of SSA countries registered an unusual decline in their economic performance between 1973 and 1980 than in other developing countries. With population growing at a previous rate, this led to a very significant fall in per capita growth rates. World Bank (1989) estimates such changes in growth from 1.2% per annum in period before the oil shock to 0.7% in the period there after. Moreover the study notes that almost half of the region's countries showed negative per-capita growth in the period 1973-80.

Sector wise, agriculture continued to deteriorate where the average growth in SSA as a whole fell from 2.5% in previous to below 2% during 1973-80, falling still far below the population growth. Industrial growth was stagnated compared with 1965-1973, and there was a sharp deceleration on manufacturing growth, which fell to 3% per annum for the region.

Export volumes, which had been increasing almost constantly for the previous periods peaked in 1973 and showed a slight downward trend during the rest of 1970s. Despite rising domestic nominal prices of the number of non-oil commodities, export earnings slowed down, growing at an average rate of 4% per annum during 1973-80. During this period, borrowing by SSA from all sources rose from $3 billion in 1976 to $11.5 billion in 1980. Short term lending to SSA also rose from $2.5 billion in 1976 to 22.6 billion in 1980. The debt in general both public and private rose from 18% of GDP in 1976 to 40% in 1980. Thus as UNCTAD(op.cit.) concludes many SSA end the decade with increased external indebtedness, greater macroeconomic imbalances and instability, a lagging agricultural sector and a weak and incompetitive industrial base.

A very surprising fact is that despite such tremendous increase in borrowing, return on investment was declining sharply. For evidences of the adverse effect of the debt on investment and growth in the region see for example UNCTAD (1998b). Such declines were not generally experienced elsewhere in developing regions. If that is the case, is it a mistake to require "special theory" for SSA, then?

At the beginning of 1980s, we observe two conflicting policy directives coming from two different sources to solve the region's problem. African head of states and governments, may be initiated by the debt crises, in a conference held at Lagos in April 1980, adopted a Plan of

Action for economic development of Africa. This plan was based on the principle of collective self-reliance to be implemented through progressive harmonization of national development policies, a promotion of joint regional and sub-regional projects and encouraging intra regional trade and economic change.

On the other side, the Bretton wood institutions argued that assistance is vital for changing the direction of economic performance and to make effective assistance, they underlined that the assistance has to be coordinated with major economic policy reforms, that exposes African economies to a market discipline, and that firmly contradicts the successful policy the Africans have been using since independence.

These institutions, in line with their argument, put their proposed policies into practice in different and yet having common target programs, like Structural Adjustment Programs (SAPs) of World Bank, Structural Adjustment facility (SAF) of IMF, and African Economic Policy reform program (AEPRP) of USAID.

In its program, according to Williams (1994) World Bank proposed four major and basic policy changes, which it viewed as critical. First correcting the exchange rate of over valued currencies second improving price incentives for exports and agriculture, thirdly protecting industry in a more uniform and less direct way. Last, reducing direct governmental controls. The aim of these all changes is one and clear: Exposing African economies with out any reservation to world market.

However, such basic policy changes were not considered at their face values, rather there were strong doubts about the effectiveness of the policy from the beginning. The ground for the

doubts, according to Luckham (1987, P. 47), was both policy prescription and evidence on which they were based were not convincing. The Banks own data do not suggest that the public sector is only larger relative to GDP in Africa than else where, nor do they show that the size and increase of public sector expenditure has any effect, negative or positive on growth. To open up African economies, to international economy any further, it is argued by critics of the policy, would reduce their self-reliance and expose them to unnecessary risk in a period of global excess productive capacity.

As the assistance is at the door of every indebted country as far as the required conditionalities are fulfilled many African states were tempted to contrast the Lagos Plan of Action and inclined to open their economies internationally. That is from the early 1980s and on, dropping the economic strategy of industrialization and collective self-reliance, SSA leaders started to pursue SAPs with the 'help' of Bretton wood institutions. Hence in many SSA countries the period of 1980s (specially early 1980s is characterized by economic reformation, even though it is difficult to perceive it as a self initiative reformation. However, after this reformation, the face value of reformation wasn't achieved. The economic performance continued to deteriorate. During 1980-94, in the region, there were only nine countries that had positive per capita growth. In many countries growth was faster in Agriculture than industry, about 2% in the former sector and somewhat below 2% in the latter, UNCTAD (1998a).

World price of manufactures was seen to rise and that of commodities were falling, which leads to a further worsening of Terms of Trade (TOT). Timberlake (1985) as coated in Sparks (1987, P. 22) for example expressed the deterioration of terms of trade in SSA as follows. In 1971 the beef from one Sahelian cow could pay for a barrel of petroleum. In 1981 the beef from nine cows was needed for the same volume of petroleum. In general, TOT fell by more than 1/3

between 1977 and 1993 compared with a decline of about 20% for other non-oil exporting developing countries. Thus according to some studies estimate by 1993 SSA countries would have needed to increase the value of their exports by more than 50% above 1977 level in order to be able to import the same volume of goods as in that year. Countries relying heavily on exports of tropical beverages were hit the hardest with TOT loses of between 50% and 77%.

On the other hand the impact of the worsened TOT on import compression was particularly severe. UNCTAD (1998a) estimates that if TOT remained at 1976-78 levels, SSA imports could have been higher by one quarter of their actual value in every year between 1981 and 1983; even without any increase in export value. Obviously, such import compression in its turn has suppressed investment. For the period 1980-1994, the average decline amounted to 0.5% per year. The share of investment in GDP, which had averaged around 26% in the 1970s, fell below 20% in the 1980s and to 16% in the first half of 1990s. Generally during this period the region seems to be caught in a vicious circle where by the existing deteriorating terms of trade compressed import that suppresses investment. The suppressed investment in its turn retards economic growth that pulls back export.

In short, despite the strong "effort" made by Bretton wood institutions and some developed countries to prove the suitability of more international openness, the SAP didn't result to the intended target. UNCTAD (1998a P. 24) States "...despite a decade long adjustment hardly any country had successfully completed its SAP with return to sustained growth. The high frequency and persistence of SAPs suggested that SSA countries were locked into adjustment programs, unable to restore self sustained growth".

The period 1995 is believed to be period of recovery for most countries of the region. For the years 1996, 1997 positive per capita income was seen in the whole of African countries. The export earnings of SSA rose by 16% in 1995 and 10% in 1996, which resulted from improvement of non-oil commodity prices. From 1993 to 1996 the price were found to rise by 25% and TOT showed 13% improvement in this period. However, some writers underline the necessity of further investigation concerning whether this recovery is attributed to decade long SAP or not.

From the above overview of SSA policies and performances, we understand that there can exist four major category of growth history after the time of independence. We noted that in the immediate post independence period the prevailing policy was industrialisation on the base of self-reliance. This strategy had worked well in improving the economy. The second half of 1970s were characterised with strong external shock that left African countries in dilemma by devoiding them of their self-confidence. The 1980s and early 1990s are characterised as period of adjustment. The economies operated in a more internally open fashion insisted by SAPs. The sought result was not achieved. In periods of 1994 and there after, economic recovery have been observed though it is argued to have a weak link with the SAPs. So, the very basic question requiring due attention, from the economic history prospective, is whether internationally open economic policy or OOEP is truly reliable for the purpose of accelerating economic growth for SSA countries or not. To analyse the question to a suitable depth lets have a clear insight of the policy itself i.e. its essence, its theoretical foundation and its empirical foundation.

5. Outward Oriented Economic Policy and Economic Growth

Over the last 15 or so years, the outward oriented approach has gained strong dominance among academic economists and those in international organizations concerned with development. Many national aid agencies in the North have been convinced of the suitability of outward approach for the purpose of economic growth. A number of countries have made strong effort to shift from an essentially import substitution to a more outwarded approach, other countries are still trying to do so, and virtually all countries are being urged to take similar measures by aid donors and external economic advisors. But a very basic question demanding earnest considerations is whether these all reformations are based on belief or fact. To shed some light on this point, let's try to see the theoretical and empirical foundations of the policy one by one.

5.1. Theoretical Foundations of the Policy.

Even if the justification of OOEP relies heavily on findings of empirical studies made in 1970s, the advocates of the policy claim the suitability of Neo-classical trade model for explaining the availability of static and dynamic gains from the policy. See for example Haberler (1988), Ram (1985) and Dornbush (1992). Lets try to review some of recent views on the validity of the predictions of the model regarding static and dynamic gains.

5.1.1. Availability of Static Gains

According neo-classical trade model, countries benefit more from free trade than autarky, and the benefits exists as a result of production specialization. Moreover they demonstrate, by their model, that countries with cheap labor will have a relative cost and price advantage over other

countries with relatively expensive labor in commodities, like primary products, that make abundant use of labor. As a consequence, the model indicates these countries should focus on producing labor intensive products and export the surplus in return for imports of capital intensive goods, to be guaranteed the gains from trade. By the same hand, the model implies, countries with capital abundant will have a relative cost and price advantage in the production of manufactured goods, which tend to require relatively large capital inputs, such countries have to specialize in production and export of capital intensive manufacturing in return for imports of labor intensive products.

One point stands quite clear from the prediction of this model. That is, it leads less developing countries which are usually well endowed with labor to specialize in a very risky sector-primary products, where as on the other hand it leads the developed countries to specialize in relatively less risky sector - manufactured products. But the effect of such risk is not incorporated in the model. Besides this point, whether the risky gain it self is available for sure for less developing countries or not is another point of question on the prediction of the model.

In fact the prediction of availability of potential gains from trade heavily relies upon a dozen of heroic assumptions which may not hold true in the real economic life of LDCs. On this point Strydam (1995) states that neoclassical trade theory provides us with the most unqualified support for international trade as a growth factor, based on a very restrictive assumptions. Among the assumptions used by the model that called attentions of recent researchers, perfect competition in the international trade, constant returns to scale, rational behavior of agents that works as utility maximization, free factor mobility, full employment of resources, absence of uncertainty in the trade system are the major ones. Lets try to review some of the recent finding,

that indicate the extent of the validity of the prediction when the assumption are removed in accordance with the actual economic phenomenon.

The work done by Brander and Krugman (1983), Brander and Spencer (1985), Eaton and Grossman (1986), and Markusen and Venabel (1988) have explored the attainability of the economic gains from free trade when the model that incorporates imperfect competitions and economies of scale. Even if they claim desirability of free trade at global level in general, they cast strong doubt as to whether rival firms from different countries gain with a move from autarky to free trade. Anderson et al (1989) show that firms of at least one country lose with international free trade competition in an environment of no uncertainty. Moreover, Rafael (1998) examined the model under homogenous goods case, and demonstrated that trade liberalization is unfavorable for firms of at least one country for the homogenous goods case in an environment of certainty. He concluded that for a particular case of symmetry both demand and industry sizes, the firms of at least one country prefer to operate under autarky rather than under free trade. While noting on the guarantee of the gain from free trade under imperfect competition he says neither an oligopoly model with asymmetric cost and complete information nor a model with demand uncertainty leads to gains for every body in a free trade situation. From these works, too we observe very clearly that the attainability of prediction of neoclassical trade model is conditional.

Another key assumption that has got unique relevance to developing countries like SSA is the case of free factor mobility. The model assumes price driven, but without cost, free factor mobility. The validity of this assumption is very unlikely in the developing countries context. For instance the immobility usually results from the nature of employment and business contract and etc. Moreover even if some mobility is there, it can't be without cost. Some theoretical

researches have discovered the fact that under such circumstances neoclassical model prediction fails down. Mankiw and Romer (1991) clearly explain this issue.

Furthermore, the model rests on one of its sides on the assumption of full employment before entering international trade. This assumption, too, is quite far from the truth of developing countries or an assumption that a country can not fulfill when it plans to embark on international trade from the status of autarky. Such dimension of the model was well explored in the work of Layard et al (1991), and they concluded the invalidity of the model's prediction when the assumption of full employment is removed. Here one point is worth noting. The classical trade model that allows unemployment of resources, in contrast to neoclassical model, doesn't deny the importance of import substitution or an inward oriented economic policy. That is the arguments of Agosin (1993) and Bell (1993), that will be seen in section 5.2, based on empirical work has got a theoretical foundation that fits to the nature of developing countries. In line with this view, Myirt (1977) argues that Adam Smith's analysis emphasis the complementary nature of these two polices. Indeed this, fact based, argument forms a strong and yet convincing ground for an LDC to be reluctant to choose a sole outward oriented economic policy which is built solely on neoclassical trade theory. The last major assumption of neoclassical trade theory, which lies theoretical ground for this study, is its assumption of absence of uncertainty.

There exist a large volume of theoretical literature that examines what happens to the prediction of the neoclassical trade model when the model is exposed to the world of uncertainty. Some of these studies tried to mimify the assumption of no uncertainty by saying there exist a complete risk market that serves any form of risk generated in the process of trade and production. Under such situation they managed to prove the validity of the model. For such types of works see Helpman and Razin (1978), Dumas (1980) and Helpman (1988). But a very simple question to

be raised here is whether really LDCs have risk market for any forms of risk that exists in the process of international trade? In actual fact the assumption about the existence complete risk market may hold to some extent for developed countries.

Other studies made on this area build their model without complete risk market but assumed that firms have fixed levels of utility (e.g. Mayer, 1976). This study was able to prove the validity of neoclassical trade model prediction within such circumstance. Here, too, one may ask questions like 'is a firm's utility truly fixed or can policy makers limit firms utility to a fixed level?' The most suitable answer, to my view to such question is negative.

Still another group of researcher made their study on the issue of uncertainty assuming that the number of firms involved in international trade is fixed. For such studies see Batra 1975, Sakai (1978), Pomery (1984). Even if the assumption is unrealistic like the preceding ones, they end up with the result contrasting the model's prediction. That is the model of neoclassical trade breaks down under uncertainty.

Before we leave this section, one point is worth questioning. How do we associate the breaking down of the model's prediction or even its validity to economic growth? Do we have a theoretical model of economic growth that captures the problem of uncertainty that arises from international trade, to be able to understand the extent of its impact on growth? Even though there exist a large volume of literature that confirms the breaking down of the model under uncertainty, it difficult to find studies made on how and the degree to which such uncertainty affects growth. Savvidis (1984) states that there is no satisfactory theoretical model of how uncertainty affects economic growth. But for sure, the existence of such model enables a given country analyze its actual cost-benefit based on its own economic realities in terms of economic

growth. That is such models helps one to know the extent to which uncertainty hampers economic growth and hence help to decide the extent of relying on economic polices that involve uncertainty for the purpose of accelerating economic growth. In other explicit words, having such model enable a given country to choose between outward oriented policy and import substitution or their mixture and how to form a proper mixture of both policies. This issue is a particular point of concern for this study. However, before we attempt to trace the way uncertainty is related to growth, it will be a wise approach to move from the static gain point to what is argued about the availability of dynamic gains of international trade, as it is more relevant to our purpose here.

5.1.2. Availability of Dynamic Gains

So far we have seen what neoclassical trade theory claims about the availability of potential economic gains from international trade, with emphasis on the static dimension, and what happens to this claims when the restrictive assumptions are relaxed in a way that captures realities of less developed countries. In the next part we try to see what happens to the claim of dynamic benefits of the theory under relatively actual phenomenon.

Even though some scholars and international institutions argue firmly the availability of dynamic effects-economic growth from trade, the issue is still under much debate, see for example Berg and Schmidt (1994). At a very extreme side, some economists argue that let alone the availability of such gains, the model it self is not suitable to trace dynamic issues or to solve growth problems. Indeed the consensus among trade economists is that the neoclassical theory of trade can be used to address problems of economic growth. Among theoretical works who claim the availability of dynamic gains Haberler (1988) have emphasized that both static

and dynamic gains are available for trade participants. From relatively recent work, Dornbush (1992) also argues that increased competition could result in both static and dynamic benefits. Ram (1985) also notes that the standard neoclassical trade argument postulates a substantial positive impact of exports and trade on economic performance due to better allocation of resources.

To make their claim valid for long run and plausible in a theoretical sense, the advocates of international trade try to show how economic integration in the world market, compared to isolation, helps long run growth by avoiding unnecessary duplication of research and thus increases aggregate productivity of resources employed in research and development sectors. In this line, River-Batiz and Romer (1991) argue that world competition gives incentives to these countries to incline to wards producing products that are unique in the world economy. Besides inducing countries to produce unique items, they argue, trade helps transmission of useful ideas in production engineering and information about changing product patterns. On such argument a point that require due attention is whether developing economies like SSA, whose exports are dominated by primary products, truly gain the claimed benefits or not, i.e. whether international trade help them invent new products or not, or whether trade help them accumulate human capital or not.

This point of doubt arises from the structure of economy and the commodity characteristics itself. On this issue Bardhan (1995, p. 2986) states that the presumption in many of the models of a common pool of knowledge capital created by international spillover of technical information is sometimes not relevant to a poor country. While elaborating this argument Fenstra (1990) and Grossman and Helpman (1991, Ch.9) note the fact that rich country enjoy a growing market share in the total number of differentiated varieties and the entrepreneurs where

as in the poor country due to capital loses they may innovate less rapidly in long run equilibrium with international trade than it does under autarky.

Further more, the claim made concerning dynamic aspect of trade, according to Bardhan (op.cit.) they lack rigorous empirical demonstrations of causal relationships between some satisfactory measure of outwardedness and rate of growth. Moreover, the models employed for the investigation are criticized for their being partial and static in nature and for their inability of describing long run effects. Regarding this point Salvadore and Hatcher (1991) say there is today, no acceptable general model that captures the long run dynamic aspects of international trade and economic development. Authors like Bardhan (op.cit.) also state the fact that standard neoclassical growth theory does not provide any general theorem on the effect of trade on the long run growth rate.

In short, from this theoretical argument perspective, its possible to argue that the claimed dynamic gain is uncertain particularly for developing countries like SSA.

5.2. Empirical Foundation of the Policy.

The justification given for suitability of OOEP for the purpose of accelerating economic growth are mainly the findings of the numerous and yet similar empirical studies made in 1970s. In fact such views have been appearing in the economic literature since the late 1930s. See for example the conclusion of Robertson (1938). Most of the 1970s studies were made to investigate the direction and strength of the relationship between economic growth and export and almost all of

them concluded that there is strong and positive relationship between the two variables. Some of the major studies that lay ground for the policy were given in table 5.1 below.

Table 5.1. Previous Empirical Studies of Exports and growth

No.	Study	Data Set Used			Estimation Technique	Result
		Type	Time range	# of coun.		
1	Emery(1967)	CC	1953-63	50	OLS	EP
2	Maizels(1968)	TS	1950-62	9	OLS	EP
3	Voivodas(1973)	CC	1956-67	22	OLS	EP
4	Michaely(1977)	CC	1950-73	41	SRC	EP
5	Balassa(1978)	CC	1960-66, & 1967-73	10	OLS	EP
6	Williams(1978)	TS	1960-74	22	OLS	EP
7	Fajana(1979)	CC	1954-74	20	OLS	EP
8	Tyler(1981)	CC	1960-77	55	OLS	EP
9	Feder(1982)	CC	1964-73	31	OLS	EP
10	Schenzler(1982)	TS	1950-79	30	OLS	EP

CC- cross-country; TS- time series; SRC- spearman rank correlation;
EP. Finding in favor of export oriented policy. OLS – Ordinary least square;
Source: Jung and Marshal(1985)

A common characteristic of most of studies listed in table 5.1 is the use of cross-sectional data. In such approach, values of the variables are averaged overtime for each country. Models are then estimated with the resulting cross-section of time wise averages to test the effect of trade on economic growth. If difference exists, among the studies, then it is the period over which the averages are taken and number of countries included. Berg and Schmidt (1994) claim that results from such analysis do not describe the behavior of any particular country in the cross-section. Such approach, in fact, implicitly assumes that EEI plays no role in economic growth, as it over smoothes the fluctuations and only deals with the stable component of export, which most often be positively associated with growth. Nevertheless, it is clear that EEI is the major

source of uncertainty, the higher EEI the higher the concerned agents be came uncertain about their future revenue, and hence the more reluctant they be for their decision of investment which deters output. Moreover, it is a common argument that EEI makes development planning more complicated and affects economic growth adversely. Unless and otherwise there is a valid reason to reject these arguments over smoothing EEI in the estimation of the relationship of export and economic growth can lead to an over stated results under the conventional view of EEI. In short, it is possible to say that the empirical studies made on the base of cross-sectional data are in line with neo-classical trade model that assumes absence of uncertainty, and hence concluded similar results- positive and strong relationships. However, the economic reality especially of LDCs like SSA doesn't agree with such assumption, which make it difficult to achieve the prediction of the above empirical works in realty.

The rest of the studies were made on the base of time series data set. Even if the problem of over smoothing is avoided in this case, there may exist a problem of using inappropriate estimation technique. They used ordinary least square (OLS) that gives spurious result. That is, in general, application of OLS to time series data can lead to over stated relations among variables if some of the variables are non stationary, which in this case might have given them distorted results.

Moreover, recent empirical studies on the success of OOEP by Linnemann (1992) and Edwards (1993) have casted strong doubt as to whether the policy resolves growth problems of LDCs. Linnemann (op.cit.) emphasized the ambiguity of the growth effect in general, and the absence of the positive effect in some countries. Moreover he stated that the success of the policy appear to be dependent on certain conditions or supportive actions. Edwards (1993) indicated very clearly the role of exchange rate policy in the reform. Furthermore, the export promotion seems

to be successful in countries that have reached a minimal level of development, see Mickaely (1977). This means that the OOEP may not give the expected results for a lot of African countries that doesn't attain that minimal level.

Agosin (1993) also share the view of Linneman and Edwards and says although there is some evidence for the 1980s that OOEP is positively associated with economic growth, the extent of relationship vary from country to country widely, and there is no enough reason to regard import substitution as an inferior option. Bell (1993) confirmed this Agosin's position based on South African experience over the period 1970-1990. He demonstrated that import substitution could have played a better, role in accelerating economic growth during the given period.

On the other hand, countries which experienced sustained export expansion and economic growth such as South East Asian countries, it is argued, had substantial resources in terms of social capital and others, which were described as initial conditions by a number of researchers. Such initial conditions, developed more by heavy investment in human resources, facilitated the process of transferring labor into export-oriented manufactures as well as high value added product manufactures. On the issue of examining external trade alone and disregarding initial conditions, Strydom and Fiser (1995) and Strydom (1995) concluded that foreign trade hasn't been an unambiguous growth factor over 1960-1993 in South African economy. The later study says, "The opening up of an economy to international trade is a complicated process implying important qualifications as well as certain conditions which are to be met ".

6. Uncertain Export Earnings

In the preceding section we have reviewed some of the theoretical works done to analyze what happens to the prediction of neo-classical trade model under uncertainty from static point of view. Never the less, dynamic issue requires some more investigation to argue for or against the prediction of neo-classical model. To move a step towards filling this gap lets consider uncertain export earnings.

Generally speaking, the uncertainty in international trade emanates either from supply side or from demand side or from both at a time. The effects of the factors influencing demand side can be reflected through international price, while that of the supply side will be reflected through quantity supplied to international market. On the other hand, level of export earnings is determined by the supply quantity and the price. Hence, the uncertainty existing in the international trade can be well represented by the uncertainty observed in export earnings, which is manifested through and measured by export earnings instability. However, it is difficult to find a well established and satisfactory theoretical framework work that reveals the impact of such uncertainty on the dynamic benefit of international trade, specially in the long run context. As a consequence of absence of such established theoretical framework one may observe some limitations on some of the existing empirical works. Some of these limitations are outlined as follows.

The first is the ambiguity of the results obtained on the relationship between trade and economic growth under uncertainty. In general we can find two groups of opposing views

derived from such empirical studies. The "positive view" for example, resting mainly on empirical evidence holds a view that Export Earnings Instability (EEI), which is considered as a manifestation and a measure of uncertainty, is not detrimental to economic growth. From this group some extremists like Hirschman (1958) has argued that the growth of industries may be encouraged more by fluctuations than by stable exports proceeds. Copppock (1962) and Michaly (1962) have published a study that casts strong doubt on the negative association of EEI and growth. MacBean (1966) have claimed that there is no statistical evidence to support the hypothesis that EEI brings damage on economic growth.

An opposing view refereed to as "traditional view" resting also mainly on causal empiricism believes that EEI is detrimental to economic growth. Glezakos (1973), for example, argued strongly that EEI have an adverse effect on economic growth. Maizels (1968) also, while criticising MacBean (1966) for some statistical weaknesses, presents a strong supportive evidence for traditional view. For more supportive evidences on such views see Cairncros (1962), Myrdal (1956), and Maizels (1968).

There is also some disagreement concerning the association of severity of EEI with level of development. Some researchers like Glezakos (1973, 1984), Savvides (1984), Naya (1973), Erb and Compo (1969), Massel (1970), and Stein (1977) argued that less developed countries suffer more from EEI than developed countries. Contrary to this view, other writers argue that there is no association between level of development and EEI. In its extensive work MacBean (1966), for example, argues that the difference in EEI between LDCs and developed countries is a fairly weak tendency. However, today it seems an acceptable argument that export earnings of LDCs is more unstable than that of developed countries.

The second common, limitation of the studies is that they lack a satisfactory theoretical estimating equation that links EEI with economic growth. That is most of the estimating equations used in the studies have not been derived systematically starting from a valid growth models, in a way that are consistent with the hypothesis they are supposed to be testing. In the absence of a theoretical foundation regressing different variables is likely to lead to inconsistent and contradictory results like that of a "positive view" and "traditional view" above. Glezakos (1973) work, for example, work was criticised by Lim (1976) for its lack of derivational procedure even if the setting of the functional form is logically consistent with the hypothesis to be tested. MacBean's (1966) study is also criticised for lacking explanations or theoretical ground for choice of the determining variables other than EEI. Moreover, Kenen and Voivodas (1972) study, even though it is implicitly understandable that it adopted a Harrod-Domar growth framework, also criticised for the absence of derivation procedure for the estimating equation. Usually, the derivational procedure is expected to start from one of the valid growth models. Some studies that are based on systematically derived estimating equation are also criticised for missing the intended target i.e. lacking consistency with the hypothesis to verify. For example Voivodas (1974), is one of the articles that was criticised by Lim (1976) for such weakness.

The third common limitation on the studies made to examine the relation of EEI and growth is that they are based on aggregate cross-sectional evidences. That is values of variables are averaged overtime for each country, and then models are estimated with the resulting cross-section of time wise averages to test the effect of EEI on growth. However, there is no doubt that cross-section studies obscure inter-country differences and hides information about dynamic behaviours with in countries. Concerning the problem incurred with cross-section data

Berg and Schmidt (1994) say, "models based on aggregate cross-sectional data obscure important inter-country differences and leads to results that are not representative of any particular country in the group". Besides that the non-stationary nature of many time series makes the use of period averages inappropriate. In fact, the use of time series data introduces other difficulties like spurious results, arising from non-stationary nature of the data, unless suitable estimating mechanism is employed. Still another problem associated with the use of cross-sectional estimates, is that it carries an implicit assumption that estimating functions are identical across countries with similar parameters. If the equations are different, which is more likely, then the equation is not properly estimated. Moreover there are many unmeasurable factors (like initial conditions stated in the introductory part) that vary across countries and have an influence on economic growth. Such factors are assumed, implicitly, to be similar across countries which is of course untrue.

The fourth limitation observable on some of the empirical studies is the usage of dissimilar instability indices. There exist more than five formulations for measurement of instability. For a partial survey of these formulations see Cuddy and Valley (1978). In fact, choice of different instability indices leads to generation of different variable (measure of EEI) which in turn distorts the estimated results. Hence as Glezakos (1984) notes the choice, with respect to index formula as well as a the trend estimating equation, made for the estimation of unpredictable variability in export proceeds should not be an arbitrary one, but which is concise and that reveals the actual behaviour of each countries time series of export.

As a consequence of these limitations the policy recommendation suggested by the findings are not clear cut and leads one to suspect their reliability to solve the respective economic problems.

This study attempts to overcome some of the limitations out lined above. To avoid arbitrary selection of estimating equations and fill the gap of absence of systematically derived framework, estimating equation will be derived analytically by making point of departure endogenous growth model. Concerning methodological problem, the estimating equation will be derived in a way that enables each country to estimate its equation separately using its own time series data. Moreover, the framework to be developed attempts to avoid the problem of arbitrary choice of instability index formula. The type of index to be employed is determined within the process of driving the estimating equation. Moreover, the consistency of the index with other formula that is claimed to be concise will be shown in analytical way. Accordingly, the next section attempts to overcome this task.

7. A Framework for Export Earnings Instability and Economic Growth Relationship

7.1. Derivation of the Model and Uncertainty Index

7.1.1. The Model

As mentioned above our point of departure in deriving our model is endogenous growth model. The basic reason to choose this model as a starting point is, so far, there is no generally acceptable international trade model that captures the long rum dynamic aspect of international trade and economic development, Salvatore and Hatcher (1991). As a consequence, usually, advocates of international trade use growth model, mainly endogenous growth model to confirm the availability of dynamic benefits from trade in the long run. Hence I follow the same routine. The endogenous growth models are preferred to its counterpart (exogenous growth model) since they allow possible linkage between public policies and growth in the long run in contrast to the other models, e.g. exogenous growth models. In actual sense, endogenizing technical progress was clearly observed in the growth models of the 1950s and the 1960s. [Arrow (1962), Uzawa (1965) and Kaldor-Mirrlees (1962) are some of the prominent ones]. In our case here the public policy that is supposed to influence growth is trade policy, more specifically Outward Oriented Economic Policy (OOEP).

The growth equation from this model takes the form of

$$\frac{dY}{Y} = \rho + \alpha\frac{dK}{K} + (1-\alpha)\frac{dL}{L} \quad \text{.....(7.1)}$$

Where dY/Y, dK/K, and dL/L are growth rates of out put, capital and labor respectively, ρ is an endogenously determined total factor productivity. The parameters α and $(1-\alpha)$ implicitly imposes the assumption of constant returns to scale (CRS), which is not basic, as recent influential works like Lucas (1988) assume increasing returns to scale. Trade economists in general argue that opening an economy to international market will influence the economy positively in the form of improvement in factor productivity. In deed, the way it results to the supposed improvement varies from one research to another. Krueger (1980) claims that free trade brings productivity gains from increasing returns to scale, minimum efficient size of plant, indivisibility and the effect of market size on competition. Cottani et al (1990) suggest that productivity improvement tend to concentrate in export or import competing industries. Dollar (1992) argues that there are externalities associated with export industries, in addition he says export earnings allow a country to use external capital without running into difficulties servicing foreign debt. Others like Grossman and Helpman (1989a, 1989b, and 1991), Khan (1987), Lucas (1988) and Romer (1990) emphasize the fact that international trade improves productivity as it promote competition, encourage learning by doing, raise the efficiency of resource allocation.

Based on such arguments, we can say that some parts of total factor productivity can be influenced by trade or trade policies but not all. Let's split ρ into ρ_o and ρ_1, the trade policy insensitive and policy sensitive component respectively.

That is

$$\rho = \rho_0 + \rho_1(\tau) \quad \text{.....(7.2)}$$

Where τ is a variable that captures trade policy.

According to the above listed arguments we expect $d\rho_1 / d\tau > 0$. But there is some counter argument, particularly for poor countries cases. Bardhan (1995, p. 2988) emphasise the possibility of trade, in poorer countries, accelerating market failure in a sense of under investment in research in the initial situations, by allocating resources further away from research which hampers production, as it contradicts indiginization of creativity and creates reliance on the external one. In this circumstance we expect $d\rho_1/d\tau < 0$. Substituting (7.2) in (7.1) we get

$$\frac{dY}{Y} = \rho_0 + \rho_1(\tau) + \alpha\frac{dK}{K} + (1-\alpha)\frac{dL}{L} \quad \text{.....(7.3)}$$

Moreover, in literature it is a generally accepted approach to take the growth rate of real exports dX/X as a representative of the influence of international trade on the economic growth (see, for example, Feder (1982)) and to assume a linear relation between trade and productivity improvement.

Accordingly, (7.3) can be rewritten, by avoiding the assumption of constant returns to scale, as

$$\frac{dY}{Y} = \beta_0 + \beta_k \frac{dK}{K} + \beta_2 \frac{dL}{L} + \beta_3 \frac{dX}{X} \quad \text{.....(7.4)}$$

Where β_k, β_2, β_3 are the out put elasticities of capital, labour and export, β_o autonomous total factor productivity. Authors like Lucas (1988) give valid reasons for abandoning assumption of CRS, however, since it is not our focal area here we by pass it. Usually, there are no data on capital for most developing countries, following researchers like Salvatore and Hatcher (1991), Ram (1985) and others, we can reformulate (7.4) by replacing dK/K by dK/Y which approximates investment-income ratio, I /Y as follows

$$\frac{dY}{Y} = \beta_0 + \beta_1 \frac{I}{Y} + \beta_2 \frac{dL}{L} + \beta_3 \frac{dX}{X} \quad \text{.....(7.5)}$$

Where I/Y stands for the share of investment from output (GDP) and β_1 is the marginal physical product of capital. Equation (7.5) resembles a very traditional model that was used by a number of researchers, except for special emphasis made at the initial steps on its derivation from growth model as well as rationalisation of inclusion of export growth. The equation now appears in the spirit of endogenous growth model in a sense that it allows trade policies to influence growth through factor productivity improvement.

So far, we are treating our economy of study as a uni-sectoral or as if factor productivity differential doesn't exist between export and non-export sectors. But one of the arguments in favour of trade given above is that the productivity is higher in export sector and as well there is positive externality from this sector on non-export sector. To capture this issue we need to divide the underlying economy in these two sectors. Indeed such approach is not the new one as it was done by Feder (1982), Keesing (1967, p. 311) and others. To this effect lets switch to two sector model from (7.5) as follows. Lets suppose that the marginal factor productivity in export sector exceeds that of non-export by δ% i.e.

$$\delta = \frac{(f_L - g_L)}{g_L} \times 100\% = \frac{(f_K - g_K)}{g_K} \times 100\%$$

Where f_L and g_L stand for marginal labour product in export and non-export sectors respectively f_K, g_K stand for marginal capital product in non-export sectors respectively.

When the economy embarks on export promoting policy, or dismantles trade barriers, according to advocates of international trade, competition and resource reallocation will make the non-export sector gain some components of δ through externality but not all since we are still assuming factor productivity differential, lets denote the gain by non-export sector by θ, ($\theta < \delta$). This parameter can be considered as non-export output elasticity of export output. Under this condition growth in export dX/X, achieved as a result of the new trade policy, contributes to economic growth in three forms. The first is the part that comes from non-export sector [θ.(ΔX/X).(N/Y)], as a result of externality; the second part that comes from export sector, coming from factor productivity equivalent to the other sector [θ.(ΔX/X).(X/Y)] and the third, from export sector coming from the factor productivity differential [(δ - θ).(ΔX/X).(X/Y)].

That is the total growth in output as a result of trade will be

$$\theta\left(\frac{dX}{X}\right)\left(\frac{N}{Y}\right) + \theta\left(\frac{dX}{X}\right)\left(\frac{X}{Y}\right) + (\delta - \theta)\left(\frac{dX}{X}\right)\left(\frac{X}{Y}\right) \quad \text{.....(7.6)}$$

Substituting (7.6) in (7.5) our growth equation will be

$$\frac{dY}{Y} = \beta_0 + \beta_1 \frac{I}{Y} + \beta_2 \frac{dL}{L} + \theta\left(\frac{dX}{X}\right)\left(\frac{N}{Y}\right) + \theta\left(\frac{dX}{X}\right)\left(\frac{X}{Y}\right) + (\delta - \theta)\left(\frac{dX}{X}\right)\left(\frac{X}{Y}\right)$$

$$\frac{dY}{Y} = \beta_0 + \beta_1 \frac{I}{Y} + \beta_2 \frac{dL}{L} + \theta\left(\frac{dX}{X}\right)\left(\frac{N}{Y} + \frac{X}{Y}\right) + (\delta - \theta)\left(\frac{dX}{X}\right)\left(\frac{X}{Y}\right)$$

$$\frac{dY}{Y} = \beta_0 + \beta_1 \frac{I}{Y} + \beta_2 \frac{dL}{L} + \theta\left(\frac{dX}{X}\right) + (\delta - \theta)\left(\frac{dX}{X}\right)\left(\frac{X}{Y}\right) \quad \text{.....(7.7)}$$

Equation (7.7) is exactly the same with one of the Feder's equations except for the latter starts from expressing factor productivity differential (FPD) as ratio, and (7.7) starts from expressing FPD as percentages.

Even if it is possible to extend (7.7) to in away that it accommodates uncertainty, our primary objective, for the sake of simplicity we will compress it a little bit by collecting export terms together as follows

$$\frac{dY}{Y} = \beta_0 + \beta_1 \frac{I}{Y} + \beta_2 \frac{dL}{L} + \theta\left(\frac{dX}{X}\right) + \delta\left(\frac{dX}{X}\right)\left(\frac{X}{Y}\right) - \theta\left(\frac{dX}{X}\right)\left(\frac{X}{Y}\right)$$

$$\frac{dY}{Y} = \beta_0 + \beta_1 \frac{I}{Y} + \beta_2 \frac{dL}{L} + \theta\left(1 - \frac{X}{Y}\right)\left(\frac{dX}{X}\right) + \delta\left(\frac{dX}{X}\right)\left(\frac{X}{Y}\right)$$

$$\frac{dY}{Y} = \beta_0 + \beta_1 \frac{I}{Y} + \beta_2 \frac{dL}{L} + \theta\left(\frac{dX}{X}\right)\left(\frac{N}{Y}\right) + \delta\left(\frac{dX}{X}\right)\left(\frac{X}{Y}\right) \quad \text{.....(7.8)}$$

Assuming constant elasticity,

$$\frac{\partial N}{\partial X} = \theta \frac{N}{X} = \theta \frac{N}{Y} \cdot \frac{Y}{X} \quad \text{.....(7.9)}$$

$$\frac{dY}{Y} = \beta_0 + \beta_1 \frac{I}{Y} + \beta_2 \frac{dL}{L} + \lambda\left(\frac{dX}{X}\right)\left(\frac{X}{Y}\right) + \delta\left(\frac{dX}{X}\right)\left(\frac{X}{Y}\right)$$

and denoting $\partial N/\partial X$ by λ; and substituting (7.9) in (7.8)

$$\frac{dY}{Y} = \beta_0 + \beta_1 \frac{I}{Y} + \beta_2 \frac{dL}{L} + (\delta + \lambda)\left(\frac{dX}{X}\right)\left(\frac{X}{Y}\right) \quad \text{.....(7.10)}$$

$$\frac{dY}{Y} = \beta_0 + \beta_1 \frac{I}{Y} + \beta_2 \frac{dL}{L} + \beta_9 \left(\frac{dX}{X}\right)\left(\frac{X}{Y}\right) \quad \text{.....(7.10')}$$

Where $\beta_9 = \delta + \lambda$ .....(7.11)

Equation (7.10) expresses growth as a function of trade, labour and investment-GDP ratio. It says trade affects growth only if there is FPD and positive externality of export sector on non-export sector. In the extreme case, if the sum of FPD and the externality is negative, trade has got a deterring effect on growth.

After we expressed the coefficient of [dX/X . X/Y] as a sum of externality effect and FPD, we can proceed to arrive at our ultimate goal, that is to extend this model in such away that it comprises uncertainty or export earnings instability, so that the explicit effects of the components can be seen. The need for such model arises from two basic facts. First, export revenue at a given time comprises two variables, the certain(stable) component of X and the uncertain components of X which act in opposing direction on economic growth, on the ground of traditional view about EEI. Having export as the sum total of the two components in our model makes the model unable to indicate which component acted in which direction to what extent. The second fact is just calculating EEI and inserting it in the model is subject to a number of criticisms like miss-specification.

The inclusion of EEI in the growth model relies on the assumptions that EEI is transmitted to the rest of the economy and such economic instability is detrimental to economic growth. In fact, this argument depends on the assumption of the behaviour agents i.e. whether they are risk averse or not. Moreover, change in export proceeds will affect the economy, especially of the

LDCs through direct effect on incomes of producers in the export sectors changing domestic expenditure for consumption and investment and through multiplier and accelerator effects Lim (1976). Furthermore, the adversity of EEI can be seen as deterring factor of level of investment as a result of business miscalculations and speculational behaviour it encourages Myrdal (1956). A lower level of investment, obviously, means lower economic growth. Besides this, instability is believed to result in a discontinuous flow of imports of intermediate and capital goods that are crucial to the implementation of development plans. While stating the link between instability and growth Barro (1976 and 1980) says that lack of stability, by creating an atmosphere of uncertainty, makes it difficult for economic agents to extract the correct signals from relative prices, such as real returns to investment, and thus leads to inefficient allocation of resources.

On the ground of this argument we will split the export earnings X into its reliable or certain component, x, and unreliable or uncertain component u as

$$X = x + u.$$

Fluctuations of revenue is undesirable only in so far they don't serve as a guide on the allocation of resources to bring about appropriate long run adjustment in supply and demand. Hence in using the term instability to refer to such undesirable revenue fluctuations, there is a problem in distinguishing between those, which are excessive or misleading. In this sense, then to proceed in getting the components exports apart, in deed, we have to get some concise definition of export instability. Lancier (1978) defined EEI in line with MacBean and others as the residual variability of export values after correcting for trend. Charette (1985) uses EEI to denote unexpected fluctuation in export markets, which agrees conceptually with that of

Glezakos (1983). It is possible to consider both definitions by assuming that the agents' expected value of export corresponds to the mathematically derived trend value. In fact, this assumption is not an arbitrary one, rather it is in line with the theory of rational expectation that considers agents as rational thinkers in their decision making. Having EEI defined that way, way of measuring it will be our next consideration. It is usually measured as the short term or yearly fluctuations of export proceeds around the growth trend of exports (Naya (1973)). Nguyen (1980) also state that trend value is likely to be the best estimator of long run revenue so that the term instability should refer only to the short term export earnings fluctuations around its trend.

Accordingly, (10') become a time series equation by taking a subscript t and becomes

$$\frac{dY_t}{Y_t} = \beta_0 + \beta_1 \frac{I_t}{Y_t} + \beta_2 \frac{dL_t}{L_t} + \beta_9 \left(\frac{dX_t}{X_t}\right)\left(\frac{X_t}{Y_t}\right) \quad \text{.....(7.12)}$$

and x and u will be x_t and u_t respectively.

Assuming constant output elasticity export, ε, we get

$$\varepsilon.\partial Y_t/\partial X_t = X_t/Y_t$$

and substituting it in (7.12), we get

$$\frac{dY_t}{Y_t} = \beta_0 + \beta_1 \frac{I_t}{Y_t} + \beta_2 \frac{dL_t}{L_t} + \beta_9 \left(\frac{dX_t}{X_t}\right)\left(\varepsilon.\frac{\partial Y_t}{\partial X_t}\right)$$

Let's denote $\beta_9.\ \varepsilon.\partial Y_t/\partial X_t$ by μ

$$\frac{dY_t}{Y_t} = \beta_0 + \beta_1 \frac{I_t}{Y_t} + \beta_2 \frac{dL_t}{L_t} + \mu.\left(\frac{dX_t}{X_t}\right)$$

$$\frac{dY_t}{Y_t} = \beta_0 + \beta_1 \frac{I_t}{Y_t} + \beta_2 \frac{dL_t}{L_t} + \mu\left(\frac{d(x_t + u_t)}{(x_t + u_t}\right)$$

Where x_t and u_t are the trend value and unstable components of export revenue.

$$\frac{dY_t}{Y_t} = \beta_0 + \beta_1 \frac{I_t}{Y_t} + \beta_2 \frac{dL_t}{L_t} + \mu\left(\frac{dx_t}{(x_t + u_t}\right) + \mu\left(\frac{du_t}{(x_t + u_t}\right)$$

$$\frac{dY_t}{Y_t} = \beta_0 + \beta_1 \frac{I_t}{Y_t} + \beta_2 \frac{dL_t}{L_t} + \mu\left(\frac{dx_t}{x_t}\right)\left\{\frac{1}{\left(1+\frac{u_t}{x_t}\right)}\right\} + \mu\left(\frac{du_t}{u_t}\right)\left\{\frac{1}{\left(1+\frac{x_t}{u_t}\right)}\right\}$$

$$Lets..denote...\left\{\frac{1}{\left(1+\frac{u_t}{x_t}\right)}\right\}..by.\psi_{1t};....and\left\{\frac{1}{\left(1+\frac{x_t}{u_t}\right)}\right\}..by.\psi_{2t}$$

$$\frac{dY_t}{Y_t} = \beta_0 + \beta_1 \frac{I_t}{Y_t} + \beta_2 \frac{dL_t}{L_t} + \mu.\psi_{1t}\left(\frac{dx_t}{x_t}\right) + \mu.\psi_{2t}\left(\frac{du_t}{u_t}\right) \quad \text{.....(7.13)}$$

Here, we are concerned with the long run effect of uncertainty and export, and not with the one time effect like Ψ_{1t} and Ψ_{2t}. In other words our interest doesn't lie with what has happened but also what could have happened but did not and what will happen. For this purpose Ψ_{1t} and Ψ_{2t} have to be substituted with their long run expected values Ψ_1 and Ψ_2 respectively. By representing Ψ_{1t} and Ψ_{2t} by their long run expected values denoted by parameter Ψ_1 and Ψ_2 respectively,

our growth estimating equation will be

$$\frac{dY_t}{Y_t} = \beta_0 + \beta_1 \frac{I_t}{Y_t} + \beta_2 \frac{dL_t}{L_t} + \mu.\psi_1\left(\frac{dx_t}{x_t}\right) + \mu.\psi_2\left(\frac{du_t}{u_t}\right) \quad \text{.....(7.14)}$$

7.1.2. Uncertainty Index Construction

In equation (7.14) the last term in the right hand side is a representative of the effect of uncertainty. However, considering u_t as a measure of instability has got some limitations, that require some corrections (with out affecting the entire model) before its application. The first problem is when we compare u_t values obtained from different economies, since u_t is expressed at levels, it overstates the degree of uncertainty generated in economies that have got large value of exports. The mechanism that amends this limitation is to weight the deviation with the mean value of the revenue. Accordingly we divide the numerator and denominator by a constant mean of export earnings $\bar{X}$

$$\frac{du_t}{u_t} = \frac{\left(du_t / \bar{X}\right)}{\left(u_t / \bar{X}\right)} = \frac{di_t}{i_t} \quad \text{.....where...} i_t = \frac{u_t}{\bar{X}} \quad \text{.....(7.15)}$$

$$\Rightarrow \frac{du_t}{u_t} = \frac{di_t}{i_t} \quad \text{.....(7.16)}$$

The second limitation associated with u_t, with in a given economy, is it gives equal weight to large deviations and small but frequent deviations. But in reality, occasional and sporadic deviations from trend are believed to generate more uncertainty and bring more damage than small but frequent deviations (See Nguyen (1980)). The solution to this problem is to square

deviations. Squaring the deviation would automatically give greater weight to such large deviations. Thus,

Let $Z = i_t^2$; then $dZ/di_t = 2i_t$, $dZ = 2i_t . di_t$

$$\frac{dZ}{Z} = 2i_t \frac{di_t}{i_t^2} \qquad \Rightarrow \tfrac{1}{2}\frac{di_t^2}{i_t^2} = \frac{di_t}{i_t} \quad \text{.....(7.17)}$$

Substituting (7.17) in to (7.16)

$$\frac{du_t}{u_t} = \frac{1}{2}\frac{di_t^2}{i_t^2} \quad \text{.....(7.18)}$$

Lastly, from statistical point of view, (7.18) is unadjusted for small sample bias as well as uncorrected for degree of freedom. That is it assumes agents with long time series information and with a very limited information develop similar uncertainty when they face similar u_t. But in actual sense, when information is limited it creates more uncertainty than hand full information. That is i^2_t is more appropriate for large sample size and for one degree of freedom. Hence it requires adjustment for small sample bias as well as correcting for degree of freedom. Accordingly,

$$i_t^2 = \frac{u_t^{\,2}}{\bar{X}^2}\frac{N}{N-K} \quad \text{.....(7.19)}$$

Where N is size of sample included in the study, K is number of explanatory variables used to estimate trend values.

After substitution (7.19) in (7.18) and the result in (7.14), we get

$$\frac{dY_t}{Y_t} = \beta_0 + \beta_1 \frac{I_t}{Y_t} + \beta_2 \frac{dL_t}{L_t} + \beta_3\left(\frac{dx_t}{x_t}\right) + \beta_4\left(\frac{di_t^2}{i_t^2}\right) \quad \text{.....(7.20)}$$

Where $\beta_3 = \mu\Psi_1$, $\beta_4 = \tfrac{1}{2}\mu\Psi_2$ and i_t^2 = is Export Earnings Instability Index or uncertainty index.

Equation (7.20) relates change in stable components of export revenue and change in export instability or measure of uncertainty to economic growth.

7. 2. Consistency of the Instability Index with Other Indices

The adjusted instability index developed in (7.19) is claimed here to be consistent with a formula used in cross-sectional data developed by Cuddy and Valle (1978). The later index is claimed by a number of researchers to be concise and universally acceptable. It was derived from definition of multiple determination combined with the sample coefficient of variation and is adjusted for the degree of freedom used in any particular regression model.

The instability index formula developed by these authors is given as

$$i = \sqrt{C.V^2(1-\bar{R}^2)} \quad \text{.....(7.2.1)}$$

Where C.V is coefficient of variation, R^{-2} is adjusted coefficient of determination. To show the consistency of (7.19) with the cross-sectional data instability index, it is suffice to show that the arithmetic mean of the (7.19) is equal to that of Cuddy and Valle's index(7.2.1). Accordingly,

$$\frac{\sum_{t=1}^{N} i_t^2}{N} = \frac{\sum_{t=1}^{N}(X_t - x_t)^2}{\bar{X}^2}\frac{N}{N-K}\frac{1}{N}$$

$$\frac{\sum_{1}^{N} i_t^2}{N} = \frac{\sum_{1}^{N}(X_t - x_t)^2}{\bar{X}^2}\frac{1}{N-K} = \frac{SEE^2}{\bar{X}^2} \quad \text{.....(7.2.2)}$$

But

$$SEE^2 = \frac{Sd^2}{\bar{X}^2}\left(1-R^2\right)\frac{N-1}{N-K}$$

Where SEE is the standard error of regression estimate. On the other hand,

we know that the common way of correcting R^2 is

$$\bar{R}^2 = 1-\left[\left(1-R^2\right)\frac{N-1}{N-K}\right]$$

Solving for R^2 and substituting its value in (7.2.2)

$$\frac{\sum_1^N i_t^2}{N} = \frac{Sd^2}{\bar{X}^2}\frac{N-1}{N-K}\left(1-\bar{R}^2\right)\frac{N-K}{N-1}$$

$$\bar{i}^2 = \frac{Sd^2}{\bar{X}^2}\left(1-\bar{R}^2\right) = C.V^2\left(1-\bar{R}^2\right)$$

Thus the arithmetic mean of the instability index (7.2.1) is equal to the index of Cuddy and Valle.

7. 3. Expected Signs of the Parameters.

7.3.1. The expected Sign of β_o,β_1 and β_2

β_o, β_1 and β_2 are expected to have positive signs on the ground of economic growth theories. Since our basic interest lies out side this set we don't go into detail about their expected signs.

7.3.2. The Expected Sign of Ψ_1

The sign of Ψ_1 is expected to be positive i.e. $\Psi_1 = E(\Psi_1 t) > 0$.

Proof:

Expected utility analysis indicates that uncertainty hampers output level if the agents are risk averters.

$$\sum_{t=1}^{N} X_t < \sum_{t=1}^{N} x_t \quad \text{.....(7.3.1)}$$

Where X_t – is export earnings at period t, and x_t- the trend value of export earnings at period t.

Inequality of (7.3.1) implies $\sum X_t - \sum x_t < 0$

$\Rightarrow \quad \sum(X_t - x_t) < 0 ; \qquad \Rightarrow \quad \sum(1 - x_t/X_t) < 0$

$\Rightarrow \quad n - \sum(x_t/X_t) < 0 \qquad \Rightarrow \quad \sum(x_t/X_t) \cdot 1/n > 1$

Accordingly, lets consider the probability density function f(.) of x_t/X_t assume uniform distribution in discrete form i.e. f(.) = 1/n and "E"denote the mathematical expectation, then

$\sum(xt/Xt) \cdot 1/n > 1 \quad \Leftrightarrow \quad E(x_t/X_t) > 1$ .....(7.3.2)

$$\Rightarrow E\left[\frac{x_t}{(X_t - x_t) + x_t}\right] > 1$$

$$\Rightarrow E\left[\frac{1}{[(X_t - x_t) + x_t]/x_t}\right] > 1 \text{.....} i.e. \psi_1 = E(\psi_{1t}) > 1$$

This proof proposes that if a) all agents are risk averse b) export sector has relatively higher factor productivity and positive externality on non-export sector then expected export growth could promote economic growth keeping other factors unchanging.

7.3.3. The Expected Sign Ψ_2

The of sign of Ψ_2 is expected to be negative. i.e. $\Psi_2 = E(\Psi_{2t}) < 0$.

Proof:

From (7.3.2) above

$E(x_t/X_t) > E(1) \quad \Rightarrow \quad E((x_t/X_t)-1) > 0$

$\Rightarrow \quad E[x_t - X_t)/X_t] > 0 \quad \Rightarrow \quad E[(X_t-x_t)/X_t]<0$

$E[u_t/X_t]<0 \; E[u_t/(u_t+x_t]<0$

$$\Rightarrow E\left[\frac{1}{[u_t + x_t]/u_t}\right] < 0 \ldots\ldots\ldots\ldots i.e. \psi_2 = E(\psi_{2t}) < 0$$

This proof, on the other hand, proposes if assumption associated with (7.3.2) holds true, then growth in export earnings instability can deter economic growth keeping other factors constant.

7.4. Policy Implications of the Model

We can arrive at the policy implication of the model after some mathematical manipulations as follows. To have a positive contribution of trade to economic growth the sum of the fourth and

$$\beta_3 \frac{dx_t}{x_t} + \beta_4 \frac{di_t^2}{i_t^2} > 0$$

fifth components of the model (7.20) has to be positive that is

$$\Rightarrow (\delta + \lambda)\frac{\mu}{\beta_9}\psi_1 \frac{dx_t}{x_t} + (\delta + \lambda)\frac{\mu}{\beta_9}\psi_2 . \tfrac{1}{2} . \frac{di_t^2}{i_t^2} > 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7.4.1)$$

$$\Rightarrow (\delta + \lambda)\left(\frac{\mu}{\beta_9}\psi_1 \frac{dx_t}{x_t} + \frac{\mu}{\beta_9}\psi_2 . \tfrac{1}{2} . \frac{di_t^2}{i_t^2}\right) > 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7.4.2)$$

Conditionality (7.4.2) can be satisfied if both items in the bracket are positive or if both are negative. Lets consider it case by case.

Case 1. $(\delta + \lambda) > 0$

Under this case,

$$\frac{\mu}{\beta_9}\psi_1 \frac{dx_t}{x_t} + \frac{\mu}{\beta_9}\psi_2 \tfrac{1}{2}\frac{di_t^2}{i_t^2} > 0$$

Now from the variables di_t^2 / i_t^2 and dx_t/x_t , we understand that the former is more or less exogenous to public policies. Hence we solve for dx_t/x_t, and we get

$$\frac{dx_t}{x_t} > -\tfrac{1}{2}\frac{\psi_2}{\psi_1}\frac{di_t^2}{i_t^2} \quad \text{.....(7.4.3)}$$

If EEI is exhibiting growth over time since Ψ_1 and Ψ_2 is expected to be positive and negative respectively, the coefficient of di_t^2 / i_t^2 is expected to be positive. The policy implication of the model according to (7.4.3) is then, if factor productivity differential and export externality is positive, $((\delta + \lambda) > 0)$, then to have growth promoting trade the growth of stable component of export has to be kept above some level where the level is determined by growth of EEI. In this case if EEI is unchanging overtime, then having positive growth of exports is a guaranteeing situation for economic growth promoting trade. The implication agrees with the idea of efficient resource allocation.

Case 2. $(\delta + \lambda) < 0$;

In this case to have a positive contribution of trade to economic growth, the item in the second bracket of conditionality (7.4. 2) has to be negative. i.e.

$$\frac{\mu}{\beta_9}\psi_1\frac{dx_t}{x_t} + \frac{\mu}{\beta_9}\psi_2 \tfrac{1}{2}\frac{di_t^2}{i_t^2} < 0$$

$$\frac{dx_t}{x_t} < -\tfrac{1}{2}\frac{\psi_2}{\psi_1}\frac{di_t^2}{i_t^2} \quad \text{.....(7.4.4)}$$

The policy implication of the model based on (7.4.4) is that if $(\delta + \lambda) < 0$), then to have growth promoting trade, the growth of stable component of export has to be kept below some level where the level is determined by change in EEI. Here, too, to if EEI is unchanging having a negative growth in the stable components of export is a guaranteeing condition for the contribution of trade to economic growth. Here too, the implication agrees with idea of efficient resource allocation. Under such situation, doubtlessly, Import Substitution Industrialisation (ISI) serves well than export promoting polices.

Finally, economic conditionality (7.4.3) tells us that there is some level below which export-promoting policy can't contribute to economic growth. If the option of raising growth rate of stable components of export above that level, then to fulfil the conditionality, the policy has to be backed up by mechanisms that limits or suppresses di^2/i^2 or change in EEI to some minimum possible level. There then we don't face resource miss-allocation by the suggested policy. If such mechanisms are not available, be it from inside or outside, ISI serves better the purpose of accelerating economic growth.

We can associate our conditionality of Outward Oriented Economic Policy (OOEP) here with some studies made before. Michaely (1977) suggest, based on empirical evidence, that OOEP helps " only once countries achieved some minimum level of development." On the other hand studies listed in section-6 paragraph 5 of this study indicate that EEI is inversely related to economic level except that of Macbean. From the two findings, one can deduce the fact that OOEP serves the purpose of economic growth only for those countries that show low level of EEI, which agrees with our OOEP coditionality given above. The agreement of the two conditionality, indeed, depends on the ground that more advanced economies export manufacturing, whose earnings is less volatile.

Strydom (1995) as coated in the last paragraph of section 5 of this study also underlines the conditionality of the policy. Furthermore, Cline (1982) also describes the fact that the effectiveness of the policy depends on the number of trading developing countries. He argues the more the number of trading countries, the less the effectiveness is.

Most often, it is required to support results of theoretical analysis by empirical results. The following section deals with fulfilling this requirement.

8. Econometric Analysis

8.1. The data

The statistical data used for the estimation of model (7.20) and conditionality (7.4.3) or (7.4.4) was taken from Financial Statistics Yearbook – 1997, published by IMF (cf. IMF (1997)). This source is particularly preferred to other sources to increase the degree of comparability of the results obtained from this study with that of the others as most of the studies done so far on the area made use of this source. There are four basic variables that were used by the model, Gross Domestic Product (GDP), Investment to GDP ratio, Population, and Exports.

The time series data for the first variable was given in the yearbook as a percentage increase of GDP at constant price over the previous year. The investment to GDP ratio data, as described in the yearbook, is the percentage share of investment in GDP. Investment comprises gross fixed capital formation and increase or decrease in the stocks. The population data was given as a midyear population estimate of each country. Lastly, export data are value of exports from each country expressed in USD. Moreover, the export data were decomposed in to its stable and unstable components to generate uncertainty variable that was used as a fifth variable.

The length of the series obtained for each variable varies from country to country and those countries whose data series length are below 20 were omitted from the analysis to refrain

from committing small sample bias. Accordingly, from SSA countries 20 countries were selected as a representative of the region. Namely, Benin, Botswana, Burundi, Cameroon, Congo, Ethiopia, Ghana, Kenya, Liberia, Madagascar, Mauritius, Nigeria, South Africa, Sierra Leone, Swaziland, Tanzania, Togo, Zambia, Zimbabwe and Rwanda. For the panel data analysis, Rwanda, Tanzania and Zimbabwe were omitted to make the results of time series analysis and panel analysis comparable. Moreover, to make the panel data set balanced type, Madagascar and Liberia were omitted from the data set for their data series lengths do not correspond to the remaining countries. The length of the time series data was determined in such a way that it maximizes the number of sample countries as well as the number of observations, while being balanced type. Accordingly, 1971-1990 was chosen for the panel data set.

To decompose export data in to its components suitable trend that fits the data properly was needed. Generally one can expect three types of trends. Trends exhibiting declining growth, constant growth and increasing growth. The values of the selected type of trend were considered to be a measure of stable components where as its residuals were taken to represent the unstable components. The choice among the three types of trends was made on the grounds of cointegration tests coupled with explanatory power of the curve fitted to the export data. That is, if the growth of stable and unstable components of the data cointegrate with the other variables (GDP growth, Investment to GDP ratio, Population growth) then it is considered to be a representative trend, and if there exist two or more of such curves then the decision was made on the ground of their explanatory power, R^2. Using data generated this way, in subsequent sections attempt is made to estimate our analytical model derived in section-7 as well as its degenerates.

8.2. Analysis and Estimation

The model is estimated using two estimation approaches: Time series approach - that gives information about a specific country, and panel data analysis approach- that gives general conclusion about our region of study, SSA.

8.2.1. Time series Analysis

Switching from usual cross-sectional data analysis approach to time series analysis avoids a number of problems associated with averaging data. However, there exist some analytical problems that are associated with time series analysis, too. The basic one is non-stationarity of the variables under study. To ignore this problem and to proceed estimating a regression model containing non-stationary variables means to ignore important information about the underlying economic processes generating the data, and it leads to spurious results. That is conventional tests are biased towards finding a significant relationship among variables in levels when in fact non exists. This problem was popularised and studied extensively by Grange and Newbold (1974). For this reason it seems necessary to test for the presence of unit roots on the series before estimation.

Unit Root Analysis

To examine whether a variable has got a unit root or not, there exist a variety of tests like that of Sargan and Bhargava (1983), Dickey and Fuller (1979), Khan and Ogaki (1992), Phillips and Perron (1988), and others. From these testing techniques, for our purpose here Augmented Dickey Fuller (ADF) test was selected for its relative popularity and its availability on software at hand. Conducting unit root test using ADF may require, solving some problems ahead. The

first problem is the proper assumption to be made about the most appropriate data generating process for the variable being tested. That is the problem associated with a decision to be made on inclusion or exclusion of trend and constant in the test.

Harris (1995, p. 7) suggest that it is necessary to allow both an intercept and a time trend to enter the regression model used to test for unit root, in order to test what probably the data generating process contains. The rationale behind this suggestion is that if the data generating process does not contain the intercept and trend, then the regression assigns them zero values. Following this suggestion, in each country case the presence of unit root in the variable was tested by including both constant and trend.

The second basic problem associated with ADF, is decision to be made on appropriate lag length. In the literature there exist two approaches of deciding on lag length. The first is the decision made based on R^2, i.e. if an additional lag is significant in a sense of increasing R^2, and the second is using formula developed by Schwert (1989), that sets the lag length as a function of sample size as L = int {12 (T/100)¼} where L is appropriate lag length and T is sample size. Even if the latter is suggested to be more appropriate by some authors like Harris (1995) it may not be applicable to samples with a limited sizes as it may reduce the power of the test. Thus for countries having relatively long data series, the latter approach was adopted and for those having limited sample size the former procedure was adopted. In both cases a lag length of not less than four were used through out the test. The results of ADF test for unit roots for our variable under study for the sample countries obtained from PcGive(ver.8) are given in table- 8.1. below. The test for export variable was not given, as it has no stochastic property. The values for this variable were generated by fitting a curve to the data of export.

Table 8.1 ADF Test for Unit Root

No.	Country	GDPg	INV/GDPr	POPg	EEIg
1	Benin	I(1)	I(1)	I(1)	I(2)
2	Botswana	I(1)	I(2)	I(1)	I(0)
3	Burundi	I(0)	I(2)	I(0)	I(1)
4	Cameroon	I(1)	I(1)	I(2)	I(1)
5	Congo	I(1)	I(2)	I(2)	I(1)
6	Ethiopia	I(1)	I(2)	I(1)	I(1)
7	Ghana	I(0)	I(1)	I(2)	I(1)
8	Kenya	I(1)	I(1)	I(2)	I(1)
9	Liberia	I(1)	I(2)	I(2)	I(1)
10	Madagascar	I(1)	I(2)	I(2)	I(1)
11	Mauritius	I(1)	I(2)	I(1)	I(0)
12	Nigeria	I(1)	I(2)	I(1)	I(1)
13	S.Africa	I(0)	I(2)	I(1)	I(2)
14	Sierra Leone	I(0)	I(2)	I(0)	I(2)
15	Swaziland	I(1)	I(2)	I(0)	I(2)
16	Tanzania	I(1)	I(1)	I(0)	I(2)
17	Togo	I(1)	I(2)	I(1)	I(1)
18	Zambia	I(1)	I(1)	I(2)	I(1)
19	Zimbabwe	I(0)	I(2)	I(2)	I(1)
20	Rwanda	I(1)	I(2)	I(1)	I(1)

I(i)= integration of order i=0,1,2. Subscript g, r = growth and ratio respectively

Table 8.1. reports that non of the sample countries have got a balanced variables with I(0) that rules out application of OLS at levels. Moreover, in the region GDP growth and EEI growth tend to be I(1) variables as there are 15, and 13 such cases out of 20 respectively. On the other hand, Investment to GDP ratio tends to be I(2) as there are 14 such cases out of 20. Population growth shows I(2) properties in 8 of the 20 countries and I(1) property in other 8 of the 20 countries. The general implication of the test analysis is that application of ordinary least square estimation technique at levels is not appropriate to estimate equation (7.20) since the estimate of the parameters will be affected by non stationarity of the variables. As a result the

next step will be to examine whether the variables cointegrate or not before model estimation. In fact this step requires a careful way of selecting the test procedure.

Cointegration Analysis

The usual approach used to handle unit root problem is to difference all non-stationary variable used in regression. However, while the use of differenced variables will avoid the spurious regression problem, it will also remove any long run information that may be of interest. While emphasising the in appropriateness of differencing Enders (1995, p. 355) says that the approach entails a miss-specification error. On the other hand, our basic purpose here is to investigate if there is comovement of variables due to underlying equilibrating economic forces, and hence we need to retain the long run information in such circumstance. To be more specific, our point of interest here is to investigate if EEI growth and growth of stable export have a significant role in determining the long run path of GDP Growth. Hence differencing the non-stationary variables will be in appropriate. Hence the only option is to test if the variables cointegrate at levels, and if they really do, estimating the model with suitable technique.

Generally there are two approaches to test for cointegration and estimate a given model; sing equation and systems equation approaches. Regarding the former type of equation, some writers argue that it has got some disadvantages mainly associated with its assumption of weak exogenity of regressors. As a result of this assumption, the parameter estimates are given as a linear combination of vectors of parameter estimates.

Systems approach, on the other hand, is believed to avoid some of the disadvantages of the former methods. It doesn't make a priori assumption about weak exogenity of the explanatory variables, and hence it allows the possibility of having multiple cointegrating vectors rather than a linear combination of them. From this approach Johansen method of testing for cointegration and model estimation is becoming an essential tool in handling time series models.

However, reviews of literature on the area shows there are some issues that are not yet resolved. We know that if our sole objective is point estimation of the parameters of a given model like equation (7.20), then the vectors obtained by Johansen approach, which doesn't make any assumption about the probability distribution of the disturbance terms and estimator will suffice. But if our objective is estimation as well as inference about the population from which the sample observation are taken, which is the actual objective here, then we have to get some probability distribution that the estimators and disturbance term follow. If the estimators are normally distributed then the standard inference is possible.

But in the case of systems approach, particularly in Johansen approach, the estimators obtained as cointegrating vectors do not fulfil the basic standard Gausian assumption even asymptotically, and hence the standard statistical inferences are not possible with a good level of reliability. Johansen (1996 p.93) as edited in Cox (1996) says, " the reason why inference for non-stationary processes is interesting and why so many people now work on it is that it is non-standard, in the sense that estimators are not asymptotically Gausian and test statistic are not asymptotically Chi-square". As a consequence we may require an extremely very large sample size to acquire Gausian type estimators that enable us making statistical inferences. In practice working with very large sample may be economically meaningless especially if the observation

is from annual data. Hence, Johansen (op.cit.p. 97) points out the necessity of deriving better approximation for the distribution rather than making unqualified assumption. He says " the most important problem for further studies, in my opinion, the problem of deriving better approximations for the distributions than those given by the asymptotic results. It often turns out that with, say 100 observations the tables provided give very poor approximations to the actual distributions...." While making statistical inferences is our basic task here, besides the impossibility of deriving economically meaningful results from long annual data series, availability of data is also a problem. Let alone having 100 observations of annual data series, having half of that is hardly possible in LDCs.

Another strong problem associated with systems approach is the problem of I(2) variables. The usual technique used to handle the case of mixture of I(0) and I(1) are not suitable for handling models containing I(2) variables. Thus it is argued that before using Johansen's approach, it is important to check whether the multivariate model contains I(0) and I(1) variables alone in which case the modelling is simpler, or whether I(2) variables are also present. In deed Harris (op.cit.) suggests that the problem can be handled by the technique developed by Johansen (1994), but Johansen (1996) indicates the insufficiency of the previous work done in this regard. He writes, " Another important area of research is to extend these methods of processes that are better described as integrated of order 2. For these models the asymptotic theory becomes more difficult, although some results have been found...).

Another associated problem is even if we consider the technique developed in Johansen (1994 and 1995) as adequate it doesn't appear in currently available software packages like PCFIML, CATS and MICROFIT. These software packages are said to be suitable to handle the cases of unbalanced variables only if the mix is from I(0) and I(1) variables (See Harris (1995, p.91 -

95). From table 8.1, we observe that some of our variables are unbalanced type containing I(2) variables in most of the sample countries, hence the available software are not suitable for applying Johansen approach for cointegration tests and model estimations.

On the other hand, Haldrup (1994) indicates that we can conduct residual based ADF test for cointegration, in single equation models containing I(2) variables with special critical value given by him. The critical value for ADF test in this case will depend on the number of I(1) and I(2) regressors in the equation.

For our purpose here, this Haldrup approach is adopted. Results of residual based ADF test for cointegration from PcGive (ver.8) are given in Table 8.2. That is the t-ADF value is taken from the output of the software and the critical values were taken from the table provided by Haldrup (op.cit.). The third column of table 8.2 reports the suitable type of curve selected in decomposing export revenue in to its stable and unstable components. For the majority of the cases we observe linear and quadratic curves are suitable, and only for a few of them (20% of the cases) does quadratic exponential served the purpose well. This condition reveals the fact that most countries' export exhibits either declining (decelerating) growth rate or constant growth, which in turn implies the necessity of structural changes in the traded commodities to fulfil the condition of (7.4.3.) from most of SSA countries.

The test results indicate that for majority (17 out of 20) of the countries the null hypothesis that states residuals are non-stationary was rejected at 5% level of significance, which means that variables understudy cointegrate in these countries, which in turn implies there exist a true long run relationship among these variables. The test accepts the null hypothesis for Rwanda, Tanzania and Zimbabwe at 5% level of significance. In these countries the test indicates the

absence of long run relationship, hence they were omitted. Acceptance of the null hypothesis in the case of these three countries might have arisen from poor data quality, other wise there is no enough reason to have a different result from the other similar countries. Our next task will be model estimation for countries having cointegrated variables. Regarding model estimation, even though Engle-Granger (EG) is most popular, it is argued, due to its small sample bias and inability to test statistical hypothesis it can not be appropriate here. Instead, dynamic Auto regressive Distributed Lag (ADL) is suggested to be more suitable. It is superior to EG for its ability to improve the weakness of EG and, is considered as comparable to error correction model. Moreover it is known that it provides unbiased estimates of the long run model and valid t-statistics even when some of the regressors in the model are endogenous.

Table 8. 2. Residual based ADF Test for Cointegration

	Country	Type of Curve	t -ADF	5% C.V.#	1% C.V.#	(m1,m2)
1	Benin	Linear	-5.7494	-5.09	-6.02	(3,1)
2	Botswana	Expon.	-4.83	-4.64	-5.50	(2,1)
3	Burundi	Expon.	-6.1891	-4.21	-5.10	(1,1)
4	Cameroon	Q.Expon.	-6.7877	-5.09	-6.02	(3,1)
5	Congo	Linear	-6.000	-5.22	-6.15	(2,2)
6	Ethiopia	Expon.	-5.0974	-5.09	-6.02	(3,1)
7	Ghana	Expon.	-5.9022	-4.64	-5.50	(2,1)
8	Kenya	Linear	-5.784	-5.09	-6.02	(3,1)
9	Liberia	Q.Expo.	-6.015	-5.22	-6.15	(2,2)
10	Madagascar	Q.Expo.	-5.2653	-5.22	-6.15	(2,2)
11	Mauritius	Expon.	-6.6798	-4.64	-5.50	(2,1)
12	Nigeria	Linear	-5.528	-5.09	-6.02	(3,1)
13	South Africa	Q. Expo.	-5.7035	-4.79	-5.73	(1,2)
14	Sierra Leone	Linear	-4.936	-4.32	-5.21	(0,2)
15	Swaziland	Expon	-5.207	-4.79	-5.73	(1,2)
16	Tanzania*	Linear+	-3.265	-4.64	-5.5	(2,1)
17	Togo	Expon.	-5.821	-5.09	-6.02	(3,1)
18	Zambia	Linear	-5.416	-5.09	-6.02	(3,1)
19	Zimbabwe*	Linear+	-3.117	-4.79	-5.73	(1,2)
20	Rwanda	Expon+.	-3.016	5.09	-6.02	(3,1)

(m1,m2) denotes the number of I(1) and I(2) regressors respectively.
* Non-stationary at any lag. + curve with largest r^2
Expon.=exponential curve; Q.Expo.= Quadratic Exponential Curve
# -Haldrup critical values , source Haldrup(1994), table 1

On this issue Inder (1993) states that it gives precise estimates of long run parameters and valid t-statistics, even in the "presence of endogenous explanatory variables".

On the ground of these arguments the method of ADL was selected for our model estimation.

The unrestricted ADL model takes the form of

$$A(L)Y_t = B(L)X_t + U_t \text{ .... } (8.1)$$

where A(L) is the polynomial lag operator $1 - \alpha_1 L - \alpha_2 L^2 \ldots \alpha_p L^p$; B(L) is the polynomial Lag operator $\gamma_0 + \gamma_1 L + \gamma_2 L^2 \ldots\ldots + \gamma_q L^q$; $L^r X_t = X_{t-r}$; and Y_t in our case here stands for GDP growth and X_t stands for vector of regressors:(investment to GDP ratio, labour growth, growth of stable component of export and growth of EEI.) The long run parameters will be obtained by estimating (8.1) and then solving for ß^ as

$$\hat{\beta} = \frac{\sum_{i=0}^{q} \gamma_i}{1 - \sum_{i=1}^{p} \alpha_i} \text{ .... } 8.2$$

In estimating the above equation there is a problem associated with deciding upon appropriate lag lengths. Even though no clear-cut rule for the lag length selection is available, Banerjee et al (1993) and Inder(op.cit) suggest generous size of lag length in order to avoid estimation bias. Harris (op.cit, p.61) also comments " it is preferable to over parameterise the dynamic model since this reduces any bias when compared to under-parameterised model even when the "true" model involves a simple data generating process with few dynamic terms". Nevertheless since there is loss of degree of freedom, here insignificant lags were not considered. Accordingly, the

PcGive(ver8) output for estimates of longrun equasion for countries of our study are given in table 8.3.

Table 8.3 Estimates of Long Run Relationship

No.	Country	Constant	Inv/GDP	DL/L	Dx/x	di^2/i^2	Wald Test
1	Benin	-0.9962 (-0.6456)	0.4852 (0.1987)	-0.962 (-0.39)	3.604 (1.27)	-0.00149 (-2.16)*	12.977 {0.0114}*
2	Botswana		0.2576 (1.31)	-1.238 (-1.24)	0.4617 (3.101)**	-0.000114 (-2.740)*	75.061 {0.0000}**
3	Burundi		-1.434 (-2.142)*	1.051 (0.45)	4.301 (3.02)**	-0.0218 (-2.48)*	70.464 {0.0000}**
4	Cameroon	4.247 (2.07)	3.456 (2.193)*	-0.0527 (-0.34)	-3.962 (-2.065)	0.0000092 (0.82)	12.539 {0.04963}*
5	Congo	-3.39 (-1.98)	0.3267 (2.911)**	0.7801 (0.74)	2.494 (2.31)*	-0.01079 (-4.01)**	257.9 {0.0000}**
6	Ethiopia		0.9336 (2.351)*	-0.1791 (-0.19)	-1.405 (-0.83)	-0.00254 (-2.411)*	93.865 {0.0000}**
7	Ghana		0.693 (3.240)**	2.329 (2.10)*	-2.688 (-3.18)**	0.0000227 (0.19)	39.464 {0.0000}**
8	Kenya	1.626 (1.57)	0.4019 (0.99)	0.6464 (2.541)*	-4.273 (-0.91)	0.00095 (1.72)	34.7304 {0.0061}**
9	Liberia	-6.128 (-1.32)	0.4292 (2.750)*	12.61 (3.15)**	1.448 (2.343)*	-0.0155 (-2.771)*	16.641 {0.0023}**
10	Madagascar	-3.314 (-1.33)	0.1955 (0.170)	-0.5084 (-0.06)	7.475 (0.13)	-0.0194 (-2.162)*	0.3748 {0.9845}
11	Mauritius		0.182 (2.937)**	-3.049 (-1.51)	0.3225 (0.84)	0.0000336 (0.67)	92.84 {0.0000}**
12	Nigeria	4.108 (0.97)	0.01856 (0.03)	0.6426 (1.55)	-2.963 (-0.83)	-0.00345 (-2.95)**	26.587 {0.0000}**
13	S.Africa	3.658 (2.36)*	-0.02929 (-0.241)	0.3397 (0.95)	-4.365 (-2.38)*	-0.001063 (-1.25)	28.093 {0.0000}**
14	Sierra Leone	2.975 (0.825)	-0.0385 (-0.04)	-0.4281 (-0.1283)	1.617 (0.847)	-0.05239 (-3.186)**	9.3204 {0.0536}
15	Swaziland		-0.3789 (-1.873)	-0.459 (-0.137)	1.981 (2.212)*	-0.0132 (-3.133)**	67.739 {0.0000}**
16	Togo		-0.288 (-0.795)	5.548 (0.848)	-1.663 (-0.484)	0.000148 (1.345)	5.1307 {0.2741}
17	Zambia	-7.325 (-1.97)	0.9069 (2.634)*	-2.345 (-1.132)	7.767 (3.210)**	0.004186 (1.24)	34.7238 {0.0000}**

Note -1. * - significant at 5% level; **- significant at 1% level of significance. 2.Countries where exponential curve was found to be more suitable, the model was estimated with out intercept to avoid the problem of multi- collinearity. 3.Figures in the parenthesis stand for t-ratio. 4. Figures in curly bracket stand for probability of type I error.

Table 8.3 reports estimates of long run relationship between economic growth on one hand and investment to GDP ratio, population growth, growth of stable component of export and growth

of EEI on the other hand. The theoretical relationship was derived in section 7, and the technique of estimation is the one that was given in equation (8.1) and (8.2). From the 17 countries in 14 of them, Wald test rejects the null hypothesis that states all long run coefficients (except the constant term) are zero at 5% level of significance. If 10% level of significance is used the number of countries will be 15. The test accepts the null only in Madagascar, Sierra Leone and Togo at 5% level of significance. This statistical test indicates the possibility of using the estimated equation to describe the underlying economic relationship among the variables.

Unlike the case of systems equation, the estimates of the parameters and their standard error given in table 8.3 are claimed to be Gausian type and unbiased. This behaviour of estimator allows us to make reliable statistical inferences. Inder (op.cit.) shows that t-tests using critical values from standard normal distributions have good size and power properties even when the regressors are endogenous. Hence, it is legitimate to make inference about the economy from which the sample elements were drawn.

According to our derived equation (7.20) the constant term represents part of the total factor productivity that can not be influenced by trade policy. The term can be purely a function of time and hence exogenous to the economic system (as argued in exogenous growth model), or can be influenced by other public policies like education policy and the like.

Investment to GDP ratio was found to have unexpected negative sign in five of the seventeen countries but not statistically significant. On the other hand, we find the expected positive sign in 12 of the 17 countries and statistically significant estimate in 7 of them. The estimates suggest that for a 1% increase (decrease) in investment from GDP share there will be at least

0.02% and at most 3.4% increase (decrease) in the GDP growth in SSA region where the expected sign were obtained.

Likewise, for coefficient of population growth we find unexpected sign in nine of the seventeen countries but non-of them are statistically significant at 5% level of significance. This unexpected sign can occur as a consequence of unemployment and under employment. Berg and Schmidt (1994) for example, have explained the occurrence of such negative sign as a consequence of high rates of unemployment and under employment in their study of Latin American countries. Here too, the same argument can hold true as the region generally suffers from the same problem. From the remaining 8 countries where the expected positive sign was observed in three of them the estimates were found to be statistically significant at 5% level of significance.

Obviously our special interest will be in the remaining two variables. On the ground of assumption of risk aversity of agents and the existence of positive externality of export sector on non-export sector as well as positive factor productivity differential we expect a positive association between growth of stable component of exports and GDP growth. In ten of the seventeen (59%) countries this expected sign was observed. From seven countries where negative sign was observed in three of them namely, in Cameroon, Ghana and South Africa the coefficients were found to be statistically significant at 5% level. The implication of the results for these three countries is that export-promoting policies may not serve the purpose of accelerating economic growth.

From our derived model we can understand that one of the cases that makes the sign of β_3 negative is when a country is having negative total factor productivity differential (i.e. when

factors are more productive in non export sector than export sector) and negative export sector externality on non-export sector. If this is the case, certainly the resource reallocation away from non-export sector can hurt the growth since the reallocation is not optimal. In case of South Africa, the implication of our study here agrees with findings of Strydom (1995) that argued against the suitability of export promoting policies for economic growth and favours import substitution industrialisation. But for the rest, where the expected sign was observed, we understand that growth of stable components of export contributes to the economic growth.

Finally, if agents exhibit risk averse behaviour in their economic activities and there exist positive externality of export sector on non-export sector and there exist positive factor productivity differential we expect growth of EEI to affect GDP growth adversely. This expected sign was
observed in eleven of the seventeen (65%) of countries.

We find unexpected signs, under our assumption, in Cameroon, Ghana, Kenya, Mauritius, Togo and Zambia. Except Mauritius and Zambia, the positive sign of β_4 can be explained as the inappropriate behavioural assumption we made i.e. they may exhibit risk neutral or risk loving behaviour, or as a result of the absence of positive externality as well as absence of positive factor productivity differential. In the case of Ghana this may possibly be due to strong effort made to effectuate the SAP, which might have made the agents to behave like risk neutral or risk loving. When we look at significance of the parameters in ten of the sample countries (59%) where negative sign were observed, the estimates are found to be significant at 5% level of significance; indicating the strong deterrence of economic growth by uncertainty generated by EEI growth.

Thus the estimates of Table 8.3 indicates that in our region of study by moving towards OOEP, unlike the conventional wisdom, there is a cost to be born by implementing country in terms of loss of economic growth. The cost can exceed the benefit available there from. Thus we are not always guaranteed to achieve economic growth through export promoting policies unless there exist a mechanism that freezes export volatility, be it from inside or out side. Even if we don't have a mechanism that avoids EEI growth, to get some benefits from OOEP, there must exist some mechanisms that controls EEI growth not to exceed above some fixed level. If such mechanism is not available for the region at all, countries of the region has to be able to keep the growth of stable component of export above some level so that it will out way the cost incurred from implementing OOEP. The required growth in this regard will be analysed in more detail in panel data in the following sub section. But if these two options are not possible our result here suggest that a country has to look for an alternative policies that keeps resource allocation at optimal level.

8.2.2. Panel Data Analysis

Conventionally, a panel data set (also called longitudinal survey) is one in which a given set of individuals or units is repeatedly sampled at different points in time. Never the less, in applied research it is common to use time series data from different units as a panel data set. The approach of the modeling time series data with cross-sectional data set have become increasingly popular in economic researches, its is argued, over the last 30 years following the work of Zellner (1962) on seemingly unrelated regressions (SUR). According to Hsiao (1985) modeling a panel data set offers a number of advantages over traditional pure cross-sectional or pure time service data set. The most obvious advantage is that the number of observations is typically much larger in panel data. This quality is likely to produce more

reliable parameter estimates, and most importantly enables one to specify and test more sophisticated models, which incorporates less restrictive behavioral assumptions. A related advantage is that panel data sets may alleviate the problem of multi collinearity. When the explanatory variables vary in two dimensions they are less likely to be highly correlated. Still another advantage is that these data sets make it possible to identify and measure effects that are simply not detectable in pure cross-section or pure time series data. Finally it is sometimes argued that cross-section data reflects long run behavior, while time series data emphasize short run effects. By combining the two sorts of information, a more general and comprehensive dynamic structure can be formulated and estimated.

To gain these advantages for our study and be able to drive a conclusive result for our region of study, in subsequent subsections attempt is made to employ this approach of analysis.

Model Specification

Under the panel data analysis there exist a variety of model specifications. From these specifications ordinary regression model, individual regression model, seemingly unrelated progression model, covariance model, error component model and random coefficient model are the major ones. (for more detail see Matyas and Seustre (1996 p. 26)). Thus application of panel data analysis requires decision making on one of these and other model specification based on the nature of data and purpose of analysis. To start with we specify equation (7.20) as ordinary regression model and confront the assumptions with statistical test of validation.

Ordinary regression model takes the form of

$$Y_{it} = B_{1it}X_{1it} + B_{2it}X_{2it}\ldots+B_{kit}X_{kit} + U_{it}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(8.3)$$

$B_{kit}= B_k$ for all i and t.....Assumtion-1

$U_{it} \sim$ i.i.d $(0,\sigma^2)$.....Assumtion-2. Where $i = 1 \ldots N$, $t = 1 \ldots T$; N and T being number of units and time length included in the study.

If inclusion of constant term is required X_{1it} will be equal to one and there will be K-1 regressors.

In actual fact the latter two assumptions are specific to ordinary regression model and different from assumptions made under the other models listed above. The implication of the assumptions under this model specification is that it considers the uniformity of behavior across units and in time, and that the observations are homogeneous or drawn from the same population.

If the assumption is valid, this form of model specification is said to have some advantages over the others. Firstly it is said to be very parsimonious (only k coefficients will be estimated by NT observation). Secondary, it is computationally simple. Some of the other models like individual regression model and SUR are said to give unreliable estimates when N is large in relation to T. Moreover, they are criticized for not being parsimonious. Indeed if the model can't pass the uniformity assumption test, the next suitable model will be covariance model. The latter assumes that $\beta_{1it}X_{1it}$ for $(X_{1it}=1)$ are random variables rather than being fixed. Besides that the model assumes that U_{it} and the parameters as well as U_{it} and U_{jt} for $j \neq i$ are also independent.

Accordingly the ordinary regression model specification of equation (7.20) will take the form

$$\left(\frac{dY}{Y}\right)_{it} = \beta_{0it} + \beta_{1it}\left(\frac{I}{Y}\right)_{it} + \beta_{2it}\left(\frac{dL}{L}\right)_{it} + \beta_{3it}\left(\frac{dx}{x}\right)_{it} + \beta_{4it}\left(\frac{di^2}{i^2}\right)_{it} + U_{it} \quad \text{.....(8.4)}$$

$B_{kit} = B_k$ for all i and t.....Assumtion-1

$U_{it} \sim$ i.i.d $(0, \sigma^2)$.....Assumtion-2

Where $i = 1 \ldots N$, $t = 1 \ldots T$; (N=15) and (T =20 years) being number of countries and time length included in the study respectively.

Model Estimation

Under model estimation the first task to be performed is testing the validity of the assumption imposed on the model. This test tells us whether or not the specification is adequate. The suitable test statistics for this purpose and that is available on many software packages is F – test. It compares the unrestricted residual sum of squares i.e. model (8.4) with out assumption 1 with the restricted residual sum of squares. The restrictions being the first assumption given in the model above. In our case, the test was conducted using TSP (ver. 4.3A) and the test result is given in table 8.4. The result indicates that the null hypothesis that states the parameters are similar across the countries can't be rejected at 5% level of significance (P=0.0693). This result implies that there exists a uniformity of behavior of countries in their economic performance. Though the null is weakly accepted (i.e. can be rejected at 10%) the uniformity assumption or homogeneity of countries could be supported by the fact that most of SSA countries are agricultural economies or from the pool of LDC's. Acceptance of the

null hypothesis on the other hand gives us the permission of pooling the data set to estimate a single equation. This in turn implies that we can use the total or (plain OLS) estimate as a parameter estimates of (7.20). The estimate obtained from TSP is given in table 8.4 below.

Table 8.4 Regression Estimates Using Panel data Set.

TOTAL (plain OLS) Estimates

Variable	Estimated Coefficient	Standard Error	t-statistic
INVGDPR	.099494	.033277	2.98990**
POPG	-.021615	.040537	-.533202
EXPOG	.402179	.062763	6.40790**
EEIG	-.38286E-03	.154312E-03	-2.48107*
C	-1.16177	.693724	-1.67468

F test of A,B=Ai,Bi: F(65,230) = 1.2143, P-value = [.06931]
Critical F value for diffuse prior (Leamer, p.114) = 8.6381

BETWEEN (OLS on means) Estimates:

Variable	Estimated Coefficient	Standard Error	t-statistic
INVGDPR	-.063468	.099728	-.636413
POPG	.316805	.395557	.800908
EXPOG	.623974	.138863	4.49345**
EEIG	-.396823E-04	.821141E-04	-.483258
C	-.740459	2.00773	-.368804

Table 8.4 also reports that investment to GDP ratio has got the expected positive sign. Besides that the t-ratio indicates that the variable is strong determinant of GDP growth which agrees with the generally accepted economic theory. The coefficient is significantly different from zero at 1% level of significance. The estimate tells us that in the region, a 1% increase (decrease) in the share of investment from GDP (that approximate capital growth) can increase (decrease) the GDP growth by 0.09%. This estimate, actually, lies in the estimated range of the region given by time series analysis.

In the case of population growth variable like in the most cases of the time series analysis results, we find unexpected sign. From economic theory we know that the more the labor grows the more economic performance will be. However, here the estimate indicates the reverse relation. But since the estimate couldn't pass test of significance at 5% level of significance, we can't conclude strongly that we are having a result differing from prediction of economic theory. Even if it passes the test such result can occur due to excessive unemployment and under employment. Feder (1982) for example emphasize on some exception of the general prediction by saying that the coefficient of labor growth should be significantly more than zero if labor surplus wasn't the prevalent situation in sample countries during the period covered.

The last two variables are the basic area of attention for this study. The sign of the stable component of export certainly agrees with the clams of OOEP advocates, or with our expectation under the assumption of risk aversity and positive factor differential in export sector. Moreover the estimate is significantly different from zero at 1% level of significance. The estimate found here doesn't vary from the estimates reported by different researchers. Feder (op.cit.) for example based on his cross-sectional study of semi industrialized LDC's reports the estimate to vary from 0.39 to 0.422. Berg and Schmidt (1994), based on time series study of Latin American Countries, report the parameter estimate to vary from 0.051 to 0.332 which slightly less than our estimate.

The estimate obtained here suggests that a 1% increase (decrease) in stable component of export can bring 0.4% increase (decrease) in GDP growth of the region. In fact the elasticity here can not be directly compared with the estimate cited above for we are dealing with the stable component of the variable alone. But the above results may give a rough estimate of

the elasticity over here. The result obtained here supports the claim of OOEP advocates if we could get enough reason to assume absence of uncertainty. However, since, we are aiming at examining the its absence it seems illegitimate to make a priori assumption, hence we have to consider the presence of uncertainty initially and the regression assigns zero coefficient if it is not really there. Based on the underlying assumptions we made about the agents and the sectors of the economy, we expect the coefficient of variable of uncertainty (β_4) to have negative sign. The estimated model shows that the coefficient has got a sign that agrees with this expectation. Moreover, the coefficient was found to be statistically significant at 5% level of significance. At first glance, the estimate seems infinitesimal but since the growth invariable of uncertainty i.e. growth of EEI is a very large number, its impact on growth can not be neglected. From the sign and statistical significance of this estimate we can argue that uncertainty has been one of the factors that have been deterring the economic growth of the region. Furthermore, we can infer that if the structure of traded commodities remain unchanging (i.e. if not vertically diversified) uncertainty is one of the factors that deter economic growth of SSA region.

The estimated model from the mean data has got additional information concerning the methodological problem incurred in estimating the effect of OOEP in 1970s based on cross-sectional data. The between (OLS on means) estimate is similar to cross-section analysis as it runs OLS on the time wise averages. Two basic points stand clear from this estimate. First we observe that the coefficient of dx/x is greater in this case than the proceeding one (0.6239 in the latter approach and 0.4021 in the former case). That is the cross-sectional analysis has got an exaggerating effect on the parameter estimate. Such results of cross-sectional data have induced empirical researchers of 1970s to conclude their studies in strong favor of OOEP.

The second interesting result is the variable of uncertainty (di^2/i^2) has got extremely insignificant coefficients. That is when we take the time wise average of uncertainty the impact of uncertainty impact on GDP growth or economic performance will be unobservable. Thus the - OLS on mean – result, being set in accordance with neo-classical assumption (absence of uncertainty), gives the over-stated effect of OOEP on economic growth.

Next it may be of interest to estimate the long run cost/benefit of OOEP on the region by considering the mean of export growth over the twenty years and the mean of variable of uncertainty. By taking the parameter estimates of the fourth and fifth components of the model, and average values of the variables in the period study. The analytic result leads one to conclude that the region has been loosing 0.153% growth of GDP per year (see Annex-3) due to export. That is the estimate here indicates that, as far as the structure of traded commodities is unchanging, the net effect of OOEP in the region in the long run is deterring economic performance rather than what is argued conventionally.

Lastly, as we have seen in section-5 policy choice in the region is not purely made internally. Be it willingly or unwillingly there are external influences. Hence one may ask questions like for the region, under what condition will OOEP be effective to serve its face value? Answering such questions demands solving some minimum requirements for stable export growth given by conditionality (7. 4.3). Assuming that the pattern of uncertainty generated from export volatility that has prevailed in the past will repeat its self in the future, we can estimate the minimum growth required in stable component of export that could overcome the adverse effect of uncertainty in the long run. Accordingly, the minimum growth required in stable component of export for the region is 7.1874% per year (see Annex-4). Thus, to be

benefited from the policy, the region has to be able to keep its stable export growth above this critical point. Indeed, fulfillment of such condition can be met if there is enough external demand for SSA product and as well as if there is production capacity improvement. On the other hand, the deteriorating nature demand for primary products have been emphasized by a number of researchers, which makes the attainment of such target very unlikely. Under this circumstance, there should exist a trade agreements between the region and other trading partners that absorbs some part of volatility, say like export earnings stabilization scheme, as far as there is external instance for OOEP. Otherwise SSA better refer to their post independence economic history that gives a better hint for accelerating economic growth of the region.

9. Summary and Conclusion

9.1 Summary

SSA countries have been experiencing a very slow growth for the last three and a half decades. Some studies estimate annual GDP per capital growth for this period to be not more than 0.8%. This rate is exceptionally below the rate observed in some other developing regions.

Regarding the real cause of such retarded growth, so far, there is no general consensus among development specialists. One group attributes the problem to unfavourable initial conditions like colonial history, ethnic diversity and tribal division, tropical climate and geographical factors. This group of specialists requires special development theory, as they regard the usual economic prescriptions not applicable in addressing Africa's economic problems. An opposing view, considers lack of openness to international competition as the real cause of the problem, and hence does not agree with the requirement of a special theory. Despite the argument given by the latter, review of the growth history of the region, does not give enough support for the suitability of internationally open Economic Policies.

Nevertheless, advocates of the policy try to justify the advantageousness of the policy both theoretically and empirically. In their theoretical justification they stick to the prediction of neo-classical trade model that states there is both static and dynamic benefits to trading partners when they move from autarky to internationally free trade. Actually, this prediction hinges on a number of assumptions that may not be valid in the context of LDCs. Recently, there are

many theoretical works examining the validity of the prediction when these assumptions are removed. Most of the studies in this line end up by concluding the breaking down of the model when the corner stones of the model are removed.

A key assumption having special relevance to the LDCs and to this study is the absence of uncertainty. Indeed, it is difficult to assume absence of uncertainty in primary products trading country cases, because earnings from international trade is highly uncertain. Like the other assumptions, it was discovered by theoretical research that when uncertainty is introduced into the model, the usual predictions would not hold true.

The empirical foundation of internationally open economic policy is the empirical research of the 1970s, which tried to find the direction and extent of the relationship between economic growth and export. Almost all of them arrived at the same conclusion stating there exist strong and positive relationship between the two variables. However, a close look at some of the studies indicates that there was methodological problem in their estimation. Majority of the studies used cross-sectional data for the purpose of estimation. The approach uses time wise averages to test the effect of trade on economic growth. However, this approach makes some implicit assumption of the absence of uncertainty, as it smoothes out the volatility of export earnings. Hence it is in accordance with neo-classical model is this respect. Other studies used time series data, but used OLS technique for estimation. Recent econometric studies indicate that application of OLS to time series data may lead to exaggerated results. Specially, it the variables are non-stationary, the technique leads one to infer the existence of strong relationships between variables when indeed non exists. Hence the latter approach also has some methodological shortcomings

To amend these methodological problems a model that captures uncertainty is required. To fulfil the requirement, making the point of departure endogenous growth model, and considering a two-sector economy (export and non-export sectors) the usual equation relating export and growth was derived. From this equation, by decomposing export variable into its stable and unstable components, an equation that links uncertainty to economic growth was developed.

From this derivation, it is possible to conclude that uncertainty deters economic growth if the agents are of risk averse type, there is a positive factor differential in expert sector and there is a positive externality of the export sector on the non-export sector. Similarly, if these three assumptions hold, the growth of stable component of export contributes positively to economic growth. Under this circumstance the point requiring due attention is whether or not the cost incurred by uncertainty from export instability is compensated by the benefit there from. The analysis implies if the growth of stable component is very low and the volatility is very high there is a risk of loss in terms of economic growth. This situation resembles the case of agricultural commodity exports, since the demand for these commodities is deteriorating overtime and the supply side depends on uncontrollable and unpredictable factors. That is the prevailing situation on the demand side limits the growth of the stable component of export while the situation on the supply side coupled to some adverse factors from the demand side promotes the volatility of export through time. Hence it is difficult to rely on outward oriented economic policy for the purpose of accelerating economic growth.

The econometric analysis gives empirical evidences supporting the argument given above. The analysis was made using time series as well as panel data to derive country specific and regional conclusions. In most countries, the results from time series data indicate a positive

relation between the stable component of export and economic performance. Similarly, the strong negative relation between uncertainty variable and economic growth was observed. This result indicates the possibility of risk of loss in terms of economic growth from implementing outward oriented economic policy.

From panel data similar conclusion to that of time series was derived. Based on analysis of this data set, to benefit from implementing the policy, the structure of the traded commodities of the region has to allow an annual growth rate of at least 7.5% in its stable component of export.

9.2. Conclusion

Despite the conventionally held view about the outward oriented policy, the analytical results obtained here indicate that the policy is effective in terms of accelerating economic growth only if some economic conditions are fulfilled. These conditions are specified in terms of growth stable components of export. To benefit from the policy the required level of export growth may lie above the reach of some countries since the growth will not be determined solely by internal factors. Even if the growth is determined by internal factors alone these factors may not purely be in the hands of economic agents especially in the case of production of agricultural commodities. Hence the option of raising growth of stable component of export may not always be practical. An alternative, for those who could not fulfil the condition is to suppress volatility of export earnings.

As far as there exist foreign insistence for choosing the outward oriented policy, there has to exist some external mechanism that covers the risk of loss emerged from the policy. Otherwise,

it is better if SSA countries refer to their post independent growth history that gives a good hint for solving the growth problems of the region.

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Note to the Annex-1

* - Represents the first three letters from a country's name,
e.g. ben-bennin, Saf- S.Africa

*1- GDP growth of country *

*2- Investment to GDP ratio of country *

*3- Population growth of country *

*4- growth of stable component of export of country * as derived by linear curve

*5- growth of stable component of export of country * as derived by exponential curve

*6- growth of stable component of export of country * as derived by quadratic exponential curve

*7- growth of unstable component of export of country * as derived by linear curve

*8- growth of unstable component of export of country * as derived by exponential curve

*9- growth of unstable component of export of country * as derived by quadratic exponential curve

*ecm residual from the long run static model estimate

ANNEX-1 Solved Static Long Run Equation

BENIN

```
LINEAR
  Solved Static Long Run equation
       ben1 =    -0.9962              +0.4852 ben2          -0.962 ben3
 (SE)         (    1.543)           (   0.4064)          (    2.451)
                  +3.604 ben4       -0.001494 ben7
               (    2.839)          (0.00069)
```

```
WALD test Chiý(4) = 12.977 [0.0114]
AR 1- 1F( 1,  4) =      3.726 [0.1258]
ARCH 1 F( 1,  3) =    0.34741 [0.5970]
Normality Chiý(2)=     3.6498 [0.1612]
RESET  F( 1,  4) =    0.48362 [0.5251]

BENECM1    t-adf = -5.7494  lag = 4
```

BOTSWANA

```
EXPONENTIAL
  Solved Static Long Run equation
       bot1 =   +0.2576 bot2          -1.238 bot3          +0.4617 bot5
 (SE)         (   0.1968)          (   0.9991)          (   0.1488)
               -0.000114 bot8
               (4.169e-005)
```

```
WALD test Chiý(4) = 75.061 [0.0000] **
AR 1- 1F( 1,  7) =    0.26506 [0.6225]
ARCH 1 F( 1,  6) =    0.49936 [0.5063]
Normality Chiý(2)=      2.493 [0.2875]
RESET  F( 1,  7) =     2.1607 [0.1850]

BOTECM2  t-adf = -4.83  lag = 5
```

BURUNDI

EXPONENTIAL

Solved Static Long Run equation

```
      bur1 =    -1.434 bur2          +1.051 bur3          +4.301 bur5
(SE)          (   0.6694)          (    2.322)          (    1.423)
                 -0.0218 bur8
              ( 0.008804)
```

```
WALD test Chiý(4) =    70.464 [0.0000] **
AR 1- 1F( 1,  5) =    0.23787 [0.6464]
ARCH 1 F( 1,  4) =   0.065032 [0.8113]
Normality Chiý(2)=     8.9873 [0.0112] *
RESET  F( 1,  5) =   0.081418 [0.7868]
```

BURECM2 t-adf = -6.1891 lag = 5

CAMEROON

QUADRATIC EXPONENTIAL

Solved Static Long Run equation

```
      cam1 =     +4.247               +3.456 cam2        -0.05278 cam3
(SE)         (     2.050)             ( 1.575)          (  0.1566)
                  -3.962 cam6        +9.092e-006 cam9
               (     1.918)           (1.123e-005)
```

```
WALD test Chiý(4) =    5.5396 [0.2363]
AR 1- 1F( 1,  5) =    0.89455 [0.3877]
ARCH 1 F( 1,  4) =    0.11916 [0.7473]
Normality Chiý(2)=     0.3566 [0.8367]
RESET  F( 1,  5) =     2.4423 [0.1789]
```

CAMECM3 t-adf = -6.1891 lag = 4

ANNEX-1 (cont...)

CONGO

LINEAR

Solved Static Long Run equation

con1 = -3.99 +0.3267 con2 +0.7801 con3

(SE) (1.714) (0.1122) (1.058)

+2.494 con4 -0.01079 con7

(1.079) (0.00269)

WALD test Chiý(4) = 257.9 [0.0000] **

Normality Chiý(2)= 0.66582 [0.7168]

CONECM1 t-adf = -6.000 lag = 4

ETHIOPIA

EXPONENTIAL

Solved Static Long Run equation

eth1 = +0.9336 eth2 -0.1791 eth3 -1.405 eth5

(SE) (0.3971) (0.9468) (1.688)

-0.00254 eth8

(0.00105)

WALD test Chiý(4) = 93.865 [0.0000] **

AR 1- 1F(1, 5) = 0.60173 [0.4730]

ARCH 1 F(1, 4) = 0.032556 [0.8656]

Normality Chiý(2)= 2.8617 [0.2391]

RESET F(1, 5) = 1.1097 [0.3404]

ETHECM2 t-adf = -5.0974 lag = 5

ANNEX-1 (cont...)

GHANA

```
EXPONENTIAL
  Solved Static Long Run equation
       gha1 =   +0.6931 gha2          +2.329 gha3          -2.688 gha5
(SE)          (   0.2135)          (    1.107)          (   0.8462)
               +2.271e-005 gha8
               (0.0001213)


WALD test Chiý(4) = 39.464 [0.0000] **
AR 1- 1F( 1,  7) =     1.1402 [0.3210]
ARCH 1 F( 1,  6) =    0.42522 [0.5385]
Normality Chiý(2)=   0.046632 [0.9770]
RESET  F( 1,  7) =    0.16735 [0.6947]

GHAECM2  t-adf = -5.9022  lag = 5
```

KENYA

```
LINEAR
  Solved Static Long Run equation
       ken1 =    +1.626             +0.4019 ken2          +0.6464 ken3
(SE)          (    1.032)          (    0.405)          (   0.2543)
               -4.273 ken4        +0.0009515 ken7
              (    4.699)          (0.0005537)

WALD test Chiý(4) = 4.7304 [0.3161]
AR 1- 1F( 1,  9) =  0.0020176 [0.9652]
ARCH 1 F( 1,  8) =  0.0016544 [0.9686]
Normality Chiý(2)=    0.10816 [0.9474]
RESET  F( 1,  9) =    0.89153 [0.3697]

KENECM1  t-adf = -5.784  lag = 5
```

ANNEX-1 (cont...)

LIBERIA

```
QUADRATIC EXPONENTIAL
  Solved Static Long Run equation
       lib1 =    -6.128              +0.4292 lib2          +12.61 lib3
(SE)         (    4.646)          (   0.1556)          (    3.999)
                 +1.448 lib6        -0.01552 lib9
              (    0.618)          (  0.0056)

 WALD test Chiý(4) = 16.641 [0.0023] **
 AR 1- 1F( 1,  2) =    0.90716 [0.4414]
 Normality Chiý(2)=    0.30239 [0.8597]
 RESET  F( 1,  2) =     1.7339 [0.3186]

 LIBECM3  t-adf = -6.015  lag = 4
```

MADAGASCAR

```
QUADRATIC EXPONENTIAL
  Solved Static Long Run equation
       mad1 =    -3.314              +0.1955 mad2         -0.5084 mad3
(SE)         (     2.491)          (    1.118)          (    8.211)
                 +7.475 mad6       -0.01942 mad9
              (    5.642)          ( 0.00897)


 WALD test Chiý(4) = 0.37483 [0.9845]
 AR 1- 1F( 1,  2) =     0.2472 [0.6683]
 Normality Chiý(2)=    0.22523 [0.8935]
 RESET  F( 1,  2) =    0.66315 [0.5010]

 MADECM3  t-adf = -5.2653  lag = 4
```

ANNEX-1 (cont...)

MAURITIUS

EXPONENTIAL

Solved Static Long Run equation

mau1 = +0.1821 mau2 -3.049 mau3 +0.3225 mau5

(SE) (0.0620) (2.009) (0.3821)

+3.368e-005 mau8

(5.059e-005)

WALD test Chiý(4) = 92.84 [0.0000] **

MAUECM2 t-adf = -6.6798 lag = 6

NIGERIA

LINEAR

Solved Static Long Run equation

nig1 = +4.108 +0.01856 nig2 +0.6426 nig3

(SE) (4.166) (0.4785) (0.415)

-2.963 nig4 -0.003452 nig7

(3.554) (0.001171)

WALD test Chiý(4) = 26.587 [0.0000] **

AR 1- 1F(1, 2) = 0.012036 [0.9227]

Normality Chiý(2)= 2.3513 [0.3086]

RESET F(1, 2) = 0.76997 [0.4728]

NIGECM1 t-adf = -5.528 lag = 4

ANNEX-1 (cont...)

SOUTH AFRICA

QUADRATIC EXPONENTIAL

Solved Static Long Run equation

	saf1 =	+3.658	-0.02927 saf2		+0.3397 saf3
(SE)	(	1.55)	(0.1233)	(	0.356)
		-43.65 saf6	-0.001063 saf9		
	(	18.33)	(0.0008544)		

WALD test Chiý(4) = 28.093 [0.0000] **
AR 1- 1F(1, 10) = 0.010893 [0.9189]
ARCH 1 F(1, 9) = 0.22127 [0.6493]
Normality Chiý(2)= 5.8969 [0.0524]
RESET F(1, 10) = 0.53459 [0.4815]

SAFECM3 t-adf = -5.7.035 lad = 5

SIERA LEONE

LINEAR

Solved Static Long Run equation

	sie1 =	+2.975	-0.0385 sie2		-0.4281 sie3
(SE)	(	3.609)	(0.9583)	(	3.336)
		+1.617 sie4	-0.05239 sie7		
	(	1.908)	(0.01644)		

WALD test Chiý(4) = 9.3204 [0.0536]
AR 1- 1F(1, 6) = 0.34818 [0.5767]
ARCH 1 F(1, 5) = 0.14305 [0.7208]
Normality Chiý(2)= 10.298 [0.0058] **
RESET F(1, 6) = 0.14606 [0.7155]

SIEECM1 t-adf = -4.936 lad =4

ANNEX-1 (cont...)

SWAZILAND

EXPONENTIAL

Solved Static Long Run equation

```
       swa1 =   -0.3789 swa2          -0.459 swa3          +1.981 swa5
(SE)          (   0.2023)          (    3.339)          (    0.895)
                -0.01328 swa8
              ( 0.00423)
```

```
WALD test Chiý(4) = 67.739 [0.0000] **
AR 1- 1F( 1,  3) =     7.6312 [0.0700]
ARCH 1 F( 1,  2) =   0.074606 [0.8104]
Normality Chiý(2)=     1.7549 [0.4158]
RESET  F( 1,  3) =    0.39433 [0.5746]
SWAECM2  t-adf = -5.207 lag = 4
```

TANZANIA

LINEAR

Solved Static Long Run equation

```
       tan1 =    -334.5            +0.007826 tan2          +0.7631 tan3
(SE)          (    458.9)          (  0.04318)          (    4.807)
                  +611.7 tan4        +0.001863 tan7
              (    761.6)          (  0.01006)
```

```
WALD test Chiý(4) = 2.3715 [0.6678]
AR 1- 1F( 1,  7) =   0.095024 [0.7669]
ARCH 1 F( 1,  6) =   0.027636 [0.8734]
Normality Chiý(2)=     5.2524 [0.0724]
RESET  F( 1,  7) =    0.11193 [0.7478]

TANECM1  t-adf = -3.265  lag = 5
```

ANNEX-1 (cont...)

TOGO

EXPONENTIAL

Solved Static Long Run equation

```
       tog1 =   -0.2888 tog2          +5.548 tog3          -1.663 tog5
(SE)          (   0.3632)          (    6.538)          (    3.435)
               +0.0001483 tog8
               (0.0001123)
```

```
WALD test Chiý(4) = 5.1307 [0.2741]
AR 1- 1F( 1,  3) =    0.26839 [0.6402]
ARCH 1 F( 1,  2) =   0.076299 [0.8083]
Normality Chiý(2)=     4.3833 [0.1117]
RESET  F( 1,  3) =     1.3438 [0.3302]
```

TOGECM2 t-adf = -5.821 lag = 5

ZAMBIA

LINEAR

Solved Static Long Run equation

```
       zam1 =    -7.325          +0.9069 zam2          -2.345 zam3
(SE)          (    3.717)       (   0.3443)          (    2.072)
               +7.767 zam4        +0.004186 zam7
              (    3.939)        ( 0.003358)
```

```
WALD test Chiý(4) = 4.7238 [0.3168]
AR 1- 1F( 1,  8) =  0.0094076 [0.9251]
ARCH 1 F( 1,  7) =  0.0012684 [0.9726]
Normality Chiý(2)=     2.7177 [0.2570]
RESET  F( 1,  8) =  0.0037452 [0.9527]
```

ZAMECM1 t-adf = -5.416 lag = 4

ANNEX-1 (cont...)

ZIMBABWE

```
LINEAR
  Solved Static Long Run equation
       zim1 =    +80.57              -1.449 zim2          -4.514 zim3
 (SE)         (    79.99)          (    1.365)          (    1.253)
                  -15.6 zim4       -0.0003235 zim7
               (    30.84)          (0.0005279)


 WALD test Chiý(4) = 16.125 [0.0029] **
 Normality Chiý(2)=      1.194 [0.5505]

 ZIMECM1  t-adf = -3.117  lag = 4
```

RWANDA

```
LINEAR
  Solved Static Long Run equation
       rwa1 =    +6.941             -0.08101 rwa2          +1.498 rwa3
       (SE)     ( 8.356)          (   0.2288)          (    1.903)
                 -8.594 rwa6       +0.0005883 rwa9
            (    102.1)             (0.0007557)

 WALD test Chiy(4) = 7.8218 [0.0983]
 AR 1- 2F( 2,  9) =   0.075792 [0.9276]
 ARCH 1 F( 1,  9) =   0.010539 [0.9205]
 Normality Chiy(2)=     9.7543 [0.0076] **
 RESET  F( 1, 10) = 0.00012556 [0.9913]
 RWAECM3  t-adf = -3.016  lag = 5
```

Annex- 2 Panel data Analysis Results

TSP Version 4.3A

Balanced data: NI= 15, T= 20, NOB= 300

MEANS

	GDPG	INVGDPR	POPG	EXPOG	EEIG
1	3.54500	18.52000	2.81841	9.43231	603.07157
2	13.59000	34.88500	4.15023	20.77029	21767.09816
3	3.77000	12.78000	2.08491	6.21717	115.81878
4	4.56500	23.56000	13.87686	1.09038	52893.29789
5	-0.38000	19.42500	2.53772	5.41773	423.25731
6	2.48500	12.16500	3.56841	3.46821	107.27949
7	1.82000	8.97500	2.83292	4.09433	2536.27179
8	5.29500	23.88000	4.07085	6.44201	1102.98652
9	4.72000	23.87500	3.17451	7.52049	7083.68951
10	5.80500	25.66500	1.21043	12.55891	8313.61710
11	2.76500	21.26500	3.41278	8.09153	2107.31949
12	0.90000	12.18500	1.98820	-0.18158	125.40569
13	2.47000	25.39000	2.67236	8.31227	281.75758
14	2.12000	26.70500	2.99067	5.94892	15687.00842
15	1.17000	22.28000	3.26446	2.92401	104.61897

TOTAL (plain OLS) Estimates:

Dependent variable: GDPG

Mean of dependent variable = 3.64267
Std. error of regression = 4.97719
Std. dev. of dependent var. = 5.70076 R-squared = .247938
Sum of squared residuals = 7307.86
Adjusted R-squared = .237741
Variance of residuals = 24.7724

Variable	Estimated Coefficient	Standard Error	t-statistic	
INVGDPR	.099494	.033277	2.98990	**
POPG	-.021615	.040537	-.533202	
EXPOG	.402179	.062763	6.40790	**
EEIG	-.38286E-03	.154312E-03	-2.48107	*
C	-1.16177	.693724	-1.67468	

F test of A,B=Ai,Bi: F(65,230) = 1.2143, P-value = [.06931]
Critical F value for diffuse prior (Leamer, p.114) = 8.6381

BETWEEN (OLS on means) Estimates:

Dependent variable: GDPG

Mean of dependent variable = 3.64267
Std. error of regression = 1.60049
Std. dev. of dependent var. = 3.24408 R-squared = .826142
Sum of squared residuals = 25.6156
Adjusted R-squared = .756599
Variance of residuals = 2.56156

Variable	Estimated Coefficient	Standard Error	t-statistic	
INVGDPR	-.063468	.099728	-.636413	
POPG	.316805	.395557	.800908	
EXPOG	.623974	.138863	4.49345	**
EEIG	-.396823E-04	.821141E-04	-.483258	
C	-.740459	2.00773	-.368804	

Annex –3 Estimated Effect of the Policy

From descriptive statistics, we know that average annual GDP growth rate of the region (r*) will be

$$r^* = \frac{\sum_{t=1}^{T}\sum_{i=1}^{N}\left(\frac{dY}{Y}\right)_{it}}{NT} \quad \text{.....A.1}$$

By substituting the right had side of equation (7.20) in (A..1) we get

$$r^* = \frac{\sum_{t=1}^{T}\sum_{i=1}^{N}(\hat{\beta}_0)}{NT} + \frac{\sum_{t=1}^{T}\sum_{i=1}^{N}\hat{\beta}_1\left(\frac{I}{Y}\right)_{it}}{NT} + \frac{\sum_{t=1}^{T}\sum_{i=1}^{N}\hat{\beta}_2\left(\frac{dL}{L}\right)_{it}}{NT} + \frac{\sum_{t=1}^{T}\sum_{i=1}^{N}\hat{\beta}_3\left(\frac{dx}{x}\right)_{it}}{NT} + \frac{\sum_{t=1}^{T}\sum_{i=1}^{N}\hat{\beta}_4\left(\frac{di^2}{i^2}\right)_{it}}{NT} \quad \text{...A.2}$$

To get average annual contribution of trade to growth($r^*_{4,5}$), we take the sum of the fourth and fifth components of the right hand side of A.2, as

$$r^*_{4,5} = \frac{\sum_{t=1}^{T}\sum_{i=1}^{N}\hat{\beta}_3\left(\frac{dx}{x}\right)_{it}}{NT} + \frac{\sum_{t=1}^{T}\sum_{i=1}^{N}\hat{\beta}_4\left(\frac{di^2}{i^2}\right)_{it}}{NT} \quad \text{.....A.3}$$

A.4 indicates the sought contribution in the past can be estimated by multiplying the parameter estimates by the mean of their respective variables. Accordingly,

$$r^*_{4,5} = \hat{\beta}_3 \frac{\sum_{t=1}^{T}\sum_{i=1}^{N}\left(\frac{dx}{x}\right)_{it}}{NT} + \hat{\beta}_4 \frac{\sum_{t=1}^{T}\sum_{i=1}^{N}\left(\frac{di^2}{i^2}\right)_{it}}{NT} = \hat{\beta}_3\overline{\left(\frac{dx}{x}\right)} + \hat{\beta}_4\overline{\left(\frac{di^2}{i^2}\right)} \quad \text{.....A.4}$$

$r^*_{4,5}$ = 0.402179 x 6.807132 +-0.0003828 x 7550.16

. =-0.153%.

Annex –4 Coditions for Effectiveness of the Policy

To gain long run benefit from trade in the form of growth $\mathbf{r^*_{4,5}}$ in A.3 of Annex -3 has to be positive, i.e. the net effect of trade has to be positive.

That is

$$r^*_{4,5} = \frac{\sum_{t=1}^{T}\sum_{i=1}^{N}\hat{\beta}_3\left(\frac{dx}{x}\right)_{it}}{NT} + \frac{\sum_{t=1}^{T}\sum_{i=1}^{N}\hat{\beta}_4\left(\frac{di^2}{i^2}\right)_{it}}{NT} . > 0 \quad \ldots\ldots A.5$$

A sufficient condition to fulfil requirement A.5 is to keep growth of stable component of export above some level as

$$\left(\frac{dx}{x}\right)_{it} > \frac{-\hat{\beta}_4}{\hat{\beta}_3}\frac{\sum_{t=1}^{T}\sum_{i=1}^{N}\left(\frac{di^2}{i^2}\right)_{it}}{NT} = \frac{-\hat{\beta}_4}{\hat{\beta}_3}\overline{\left(\frac{di^2}{i^2}\right)} \quad \ldots\ldots A.6$$

$$\left(\frac{dx}{x}\right)_{it} > \frac{-\hat{\beta}_4}{\hat{\beta}_3}\overline{\left(\frac{di^2}{i^2}\right)} = \frac{0.0003828}{0.402179} \times 7550.16 = 7.1874\%$$

If the region fulfils condition A.6 then the required target A.5 can be met . Algebraically, taking overall sum of both side of conditionality A.6 gives

$$\sum_{i=1}^{N}\sum_{t=1}^{T}\left(\frac{dx}{x}\right)_{it} > \sum_{i=1}^{N}\sum_{t=1}^{T}\frac{-\hat{\beta}_4}{\hat{\beta}_3}\overline{\left(\frac{di^2}{i^2}\right)} = \frac{NT}{NT}\frac{-\hat{\beta}_4}{\hat{\beta}_3}\overline{\left(\frac{di^2}{i^2}\right)} = \frac{-\hat{\beta}_4}{\hat{\beta}_3}\sum_{i=1}^{N}\sum_{t=1}^{T}\left(\frac{di^2}{i^2}\right)_{it} .$$

$$\frac{\sum_{i=1}^{N}\sum_{t=1}^{T}\left(\frac{dx}{x}\right)_{it}}{NT} > \frac{-\hat{\beta}_4}{\hat{\beta}_3}\sum_{i=1}^{N}\sum_{t=1}^{T}\left(\frac{di^2}{i^2}\right)_{it} \Leftrightarrow . \underbrace{\hat{\beta}_3\frac{\sum_{i=1}^{N}\sum_{t=1}^{T}\left(\frac{dx}{x}\right)_{it}}{NT} + \hat{\beta}_4\sum_{i=1}^{N}\sum_{t=1}^{T}\left(\frac{di^2}{i^2}\right)_{it}}_{=A.5} > 0$$

Declaration

The thesis is my original work, has not been presented for a degree in any other university and that all source of material used for the thesis have been duly acknowledged.

Decleared by
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Candidate

10 June, 1999
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Confirmed by
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