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Primary-Export-Led Growth: The Evidence of Ghana*

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This paper investigates empirically the causal relation between GNP growth and export growth for Ghana from 1960 to 1992. The theoretical framework has been the staple theory of growth which emphasises the crucial role of primary export(s) in the economic growth process. In particular, the staple theory stresses the linkages (backward, forward and final demand) of the staple export(s) with the rest of the economy. The paper performs the Granger (1969) causality test for Ghana. The results support the primary-export-led growth strategy for Ghana. In other words, the evidence in favour of export promotion is stronger than previous statistical studies have indicated.

I. Introduction

Exports are supposed to enhance economic growth. There is considerable evidence supporting the *export promotion hypothesis* as a development strategy. The "success" stories of Hong-Kong, Singapore, South Korea and Taiwan need no further elaboration. The basic hypothesis is that growth in real exports leads to growth in real GNP. Trade theorists pinpoint a number of factors causing this link. Thus, we may postulate that most developing countries' growth has been influenced by their dependence on primary commodities export. The relevant economic theory underlying this primary-export-led growth is the *staple theory of growth*. The staple theory emphasizes three kinds of benefits to a trading country - improved utilization of existing resources, expanded factor endowments and linkage effects.[1] For Ghana, it may be interesting to analyse the extent to which the staple theory of primary-export-led growth is applicable to the economic growth process. Would the continued reliance on primary exports lead the country to sustained economic growth (as the fur and wheat trade did in early Canadian economic growth history)? Or is the evidence strongly against primary exports, implying the need to diversify, especially into manufactured exports? This paper investigates empirically the role of primary exports in Ghana's economic growth process, where economic growth is defined as a rise in national income or GNP.

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1. These are essentially the same as the dynamic effects of trade emphasized by the theory of comparative advantage: trade leads to specialization in production; trade provides a "vent-for-surplus" commodities; trade leads to expansion of production possibilities through competition, access to new knowledge and technology; and trade provides imports which may be used as substitutes in domestic production.

Section II briefly presents the staple theory of primary-export-led growth as the framework for the analysis. Section III presents an overview of the composition and role of primary exports in the Ghanaian economy. The presentation attempts to link the role of the primary exports to the staple theory within the economic growth process of Ghana. We also compare Ghana's comparative advantage in primary commodities with other countries which have successfully accomplished primary-export-led growth. Section IV deals with the econometric specification based on the Granger (1969) *causality test* as the main tool of analysis. Finally, Section V presents the estimations, analysis and conclusion of the paper.

II. The Staple Theory of Primary-Export-Led Growth

In order to integrate both historical and theoretical aspects of the export promotion hypothesis, we will adopt the staple theory of primary-export-led growth as the framework of analysis.[2] In the discussion of the staple theory, the literature of formal mathematical and geometrical growth models is not emphasised because these are unable to handle conveniently the number of variables required to explain the complex phenomenon of export-led growth (Roemer (1970)). The staple approach to the study of economic history is primarily a Canadian innovation, the leading innovator being Harold Innis in his pioneering historical studies, notably of the cod fisheries and the fur trade (Grant and Watkins (1993)).

A *staple* is a primary product that faces a large and growing demand in world markets, does not require elaborate processing, and has a high enough value-to-weight (volume) ratio to bear transportation costs. In other words, it is a profitable primary commodity export. Such an export industry may be established as a consequence of recent discovery, increased demand, cost-reducing technological change, or any combination of these. Staple production necessarily uses natural resources intensively.

The basic assumption of the staple theory is that staple exports are the leading sector of the economy. That is, the export sector acts as a key propulsive sector, propelling the rest of the economy forward. The limited - at first possibly nonexistent - domestic market, and the factor proportions - an abundance of land relative to labour and capital - create a comparative advantage in resource-intensive exports, or staples. Economic development will involve diversification around this export base. The central concept of the staple theory, thus, is the impact of export activity on domestic economy and society. To recap, the likely growth path of a staple economy may be the following. Growth is initiated by an increase in demand for a staple export.[3] If the spread effects are potent, as the export sector grows so too will the domestic sectors. This will lead to increasing demand for factors such as capital and labour. Domestic slack, if it exists at all, will be quickly absorbed, and the continuation of growth will depend on the ability to import scarce factors. If the supply of foreign factors is elastic, the customary tendency for the expansion of one sector - in this case exports - to affect domestic sectors adversely by driving up factor prices is mitigated. This explains

2. The presentation here is based on Grant and Watkins (1993) and Roemer (1970).
3. Corden (1971) analyses a "supply-motored" version of the staple theory that stresses growth in factor supplies and productivity.

the very strong booms that are a feature of growth in staple economies (Grant and Watkins (1993)). We can state the staple theory in the form of a disaggregated multiplier-accelerator mechanism. The domestic investment resulting from the increased activity of the export sector can be disaggregated into three linkage effects: backward, forward and final demand linkage.

Backward linkage measures the induced investment in the home-production of inputs, including capital goods, for the expanding export sector. The most important example of backward linkage is the building of necessary infrastructure to enable exportation. Facilities established to serve the staple industry, such as roads, electric and water supplies, will lower costs in other potential industries and may stimulate further investment.

Forward linkage measures the induced investment in industries which use the export industry's output as an input. The most obvious and typically most important is the further processing of the output from the export sector. The output from the processing industries may be used domestically or exported. The processed exports increase the value added from the export sector in foreign markets.

Final demand linkage measures the induced investment in domestic industries producing inputs (both consumer and intermediate as well as services) for the export sector. Its prime determinant is the size of the domestic market, which is in turn dependent on the level of income - aggregate and average - and its distribution. Final demand linkage will tend to be higher, the higher the level of income and the more equal its distribution.

The staple theory, although very illuminating, is beset by certain drawbacks which include, among others, (i) staple exporters (specifically, those exercising political control) will develop an inhibiting "export mentality." This may result in an overconcentration of resources in the export sector and a reluctance to promote domestic development; and (ii) the economy may get caught in a "staple trap" which may involve specialization in the wrong kind of staple. Sustained growth requires the capacity to shift attention to new foreign or domestic markets. This necessitates transformation of the institutions and values as the economy grows. In the absence of such transformation, the growth process propelled by the staple export(s) is likely to be halted. The next section briefly presents the composition and role of Ghana's export sector as well as linkages with the rest of the Ghanaian economy. We also compare Ghana's comparative advantage in primary commodities with other countries.

III. The Composition and Role of the Export Sector in the Ghanaian Economy

The presentation here focuses on data from 1960 to the present, based on Huq (1989), and is brief due to space limitation. Export proceeds are the main source of foreign exchange needed for the importation of intermediate and capital goods. The contribution of exports to the economy of Ghana has been substantial. Ghana has traditionally depended on export revenue as a major source of government revenue (this is a fiscal linkage). Exports comprised as much as a quarter of GDP during the immediate pre- and post-independence periods. Export duties comprised, on the average, between 10.2 and 35.3% of central government revenue from 1975 to 1990 (Kapur et al., (1991)).

A common characteristic of developing countries' exports is the dependence on one or a few primary commodities. Ghana's exports comprise basically primary products, notably cocoa, minerals (gold, diamonds, bauxite and manganese), and timber products. Since the mid-1960s, some cocoa beans have been processed into cocoa paste and butter so as to increase their value for export. In 1965, the quantity of cocoa exported reached its peak of 502,000 tonnes. The cocoa group contributed, on average, 59% of the total value of exports in the 1960s; this share rose to 72% by 1970, and by 1980, cocoa and cocoa derivatives accounted for about two-thirds of total export earnings. Timber (both logs and sawn) contributed 14% of total exports in 1960, but dropped to 3.3% in 1980. The share of gold was 10% in 1960, but contributed only 6% in 1970. In 1980, due to an increase in the world price of gold, its share rose to 17% of total export earnings. In value terms, the shares of the other minerals - bauxite, manganese and diamonds - have not been very significant.

1. Linkages

The **backward linkage** seems to be the most developed among the three linkage effects of Ghana's export sector. The network of constructed roads has been expanded since 1900, and consists of primary, secondary, feeder and town roads. Feeder roads connect the main roads with rural farming communities. These feeder roads facilitate the transport of foodstuffs and other raw materials to urban centres. The impact of the railway system on the Ghanaian economy has been substantial. Gold, manganese and bauxite mining all benefit tremendously from the railway network. The cocoa, timber and kola-nut industries are also major beneficiaries. Water transportation, especially on Volta Lake and the ocean, have been developed to meet the country's external trade requirements. The Takoradi harbour, which was opened in 1928 and expanded in 1953, is the main exporting port. It handles bulky exports like gold, manganese, bauxite, timber and cocoa. The Tema harbour, opened in 1962 as part of the Volta River Project, principally handles imports - basically imported capital goods for the manufacturing sector.

Electricity supply has also been developed to aid the growth of the economy. The Volta River Authority (VRA) was established in 1961, with the main function of constructing a dam at Akosombo on the Volta River for the generation and distribution of power for industrial and domestic use.

Institutional facilities (e.g., basic research, banking and insurance, etc.) have also been established. The aim has been to facilitate investment in the productive sectors of the economy. The Cocoa Research Institute at Tafo undertakes research pertaining to the cocoa industry with the aim of improving the efficiency and output of the industry. The Cocoa Marketing Board (CMB) was set up in 1947 to export cocoa. The Bast Fibres Board was also established in 1970 to produce the needed cocoa bags. Agricultural extension services in the country started around 1900, with travelling instructors who advised on cultivation of cash crops (mainly cocoa) and supplied inputs to farmers. Several banking institutions (central, commercial and rural) operate in the country. The Rural banks serve as catalyst institutions in the economic development efforts of the rural population.

The **forward linkage** is the least of the linkage effects of the export sector. It is rather unfortunate that much of the output of the primary sector is exported in raw rather than processed form. The only processed goods for export are cocoa butter/paste and plywood/veneer, which form only a small proportion of exports in terms of both value and volume.

The **final demand linkage** is relatively more developed than the forward linkage. It comprises the various manufacturing industries and social services which provide inputs and support for the export sector. As Ghana developed, investment in education and health (using revenue from the export sector) was undertaken to buttress the growth process. In 1965, government spent over 5% of GDP on education. Total government expenditures on health were 1.6% and 1.0% of GDP for 1965 and 1980, respectively.

2. Export Policies

Ghana's declared goal has always been to increase the volume of exports. Various policies have been implemented to achieve this objective. For instance, in 1977, the existing *export bonus* for *non-traditional exports* was raised from 20 to 30%, and for *traditional exports* (excluding cocoa), a new *export bonus* of 20% was instituted. Procedures relating to exportation have been streamlined to reduce inefficient bureaucratic practices. There have also been attempts at diversification (e.g., processing of timber into veneer and plywood, cocoa into cocoa butter/paste) in order to capture higher prices in external markets.

In 1979, to encourage timber exports, the government abolished the export duty on timber and increased the value of import licenses granted to the industry. In 1983, the government attempted to encourage exports by introducing a highly attractive export bonus scheme in the annual budget. Under the Economic Recovery Programme (ERP) of 1983, a flexible exchange rate policy was instituted and has contributed to an expansion in the volume of exports. In response, export volumes increased at an average annual rate of 10% between 1983 and 1990 (Kapur et al., (1991)). We discuss next Ghana's comparative advantage in primary commodities.

3. Ghana's Comparative Advantage in Primary Exports

This section compares Ghana's comparative advantage in primary commodities with Indonesia, Malaysia and Thailand which have successfully accomplished primary-export-led growth. These countries achieved an impressive expansion of GDP per person of 4 % annually between 1965 and 1988. The share of primary goods in merchandise exports are 53% for Indonesia, 39% for Malaysia and 34% for Thailand, and these countries remain important exporters of primary products (Snodgrass et al., (1995)). They have all gained from their comparative advantage in primary products. Malaysia, for instance, enjoys a rich resource base with a relatively small population, and its development strategy has been based on its comparative advantage in primary products: rubber, palm oil, wood and petroleum. As a consequence of its investments in primary and manufactured exports, Malaysia sustained rapid economic growth, over 6 percent a year, from 1965 to 1988 (Snodgrass et al. (1995)).

In order to analyse the comparative advantage of Ghana, Indonesia, Malaysia and Thailand in primary commodities, we will use the factor endowment and the revealed comparative advantage indicators. According to the Heckscher-Ohlin model, the source of comparative advantage lies in differences in *factor endowment*. The weight carried by different factors may, however, vary from country to country and from sector to sector. Differences in natural endowment (land, labour and natural resources) have been taken to be sources of comparative advantage in the case of raw-materials and agricultural products. Capital (physical and human), technology, scale economies, research and development have similarly been given high weight in manufactured products. *Factor endowment* for an economy can be measured in two ways: absolute factor endowment and relative factor endowment. We will use Leamer's (1984) resource abundance ratio to measure the absolute factor endowment in our analysis. This is defined as:

$$AFE_i = [(V_i/V_{iw})/(Y/Y_w)],$$

where V_i denotes endowment of resource i in a given country x, V_{iw} is world's endowment of resource i, Y is GNP of country x and Y_w is world GNP.

The country is posited to be abundantly supplied in factor i compared with other resources if an endowment share (V_i/V_{iw}) exceeds GNP share (Y/Y_w), that is if $[(V_i/V_{iw})/(Y/Y_w)] > 1$. The absolute resource endowment ratios for land and labour are presented in Table 1. We see that the absolute resource endowment ratio was greater than unity from 1970 to 1990 for Ghana, Malaysia, Thailand and for Indonesia from 1975 to 1990. The results indicate that Ghana, Indonesia, Malaysia and Thailand have comparative advantage in land and labour.

Table 1 Land and Labour Abundance Ratios

FACTOR	YEAR	GHANA	INDONESIA	MALAYSIA	THAILAND
LAND	1965	0.1303	0.2565	0.1443	0.1651
	1970	1.9320	0.3681	1.8527	1.4432
	1975	1.8424	2.2860	1.3253	1.2947
	1980	4.4077	2.1534	1.1913	1.3766
	1985	4.7411	1.9273	1.0364	1.1967
	1990	6.1986	2.7725	1.2395	1.0274
LABOUR	1965	0.1657	0.4965	0.1242	0.4485
	1970	2.4397	0.7436	1.7280	4.0727
	1975	2.2937	4.7293	1.3355	3.7512
	1980	5.3318	4.4715	1.2941	4.2488
	1985	6.0299	4.1072	1.1694	3.7750
	1990	8.2028	6.1242	1.4664	3.2844

Note: Data on land and labour are taken from FAO Production Yearbook Vol. 30 (1976) and Vol. 45 (1991).

A rigorous analysis of the patterns of comparative advantage, however, requires cost comparisons across countries.[4] But the data required for such an analysis are rarely available.

4. Domestic resource costs (DRC) and Net social profitability (NSP) (see Bruno (1967)) are the two measures commonly used in the analysis of production efficiency. The DRC is the ratio of domestic factor costs evaluated at social opportunity costs to value-added - the domestic resource cost of earning foreign exchange. The NSP is equal

The export performance index which reflects all types of costs and non-price factors and based on the empirical data pertaining to trade flows has often been used as an indicator of comparative advantage. Since this is revealed by the observed pattern of trade flows, it is called revealed comparative advantage (RCA) by Balassa (1965). The most popular index of RCA is the export performance ratio. According to Balassa, the comparative advantage of a country j in trade of a particular commodity i can be measured by the share of that commodity in the country's total exports relative to the commodity's share in total world exports. That is:

$$RCA_{ij} = [\,(x_{ij}/x_j)\,/\,(x_{iw}/x_w)\,]$$

If this ratio is greater (less) than unity, it is interpreted to mean that the country j has a comparative advantage (disadvantage) in the export of the product i.

The indices of RCA were computed for primary commodities for Ghana and compared with the other countries as shown in Table 2 below. Again, we see that all these countries have a comparative advantage in primary commodities from 1966 to 1985. The RCA values have exceeded unity for Ghana since 1960. The next section discusses the econometric specification.

Table 2 Revealed Comparative Advantage for Primary Commodities

YEAR	GHANA	INDONESIA	MALAYSIA	THAILAND
1966	2.686	-	2.403	3.260
1970	2.907	2.085	2.336	2.863
1975	3.629	0.931	3.437	3.520
1980	6.073	1.313	2.824	3.484
1985	6.500	2.143	2.600	1.458

Note: The RCA values for Ghana are computed by the author; the RCA values for Indonesia, Malaysia and Thailand are taken from Sachdev ((1933) Table 4, p.210). The RCA values for Ghana are 2.970 and 8.300 for 1960 and 1990, respectively.

IV. Econometric Specification

1. Previous Studies of the Export Promotion Hypothesis

Traditionally, the export promotion hypothesis has been tested empirically by regressing a growth variable on an export variable using OLS techniques. In these studies, the statistical significance of the export variable coefficient indicates the support for the export promotion hypothesis. A summary of some of these studies is presented in Table 3. All of the studies

to value-added in world prices less domestic factors evaluated at their social opportunity costs or shadow prices. These measures can be thought of as indicating the relative comparative advantages of competing activities. DRC values less than one identify activities in which the country in question appears to have an international comparative advantage and vice versa.

except those by Jung and Marshall (1985) and Darrett (1987) support the export promotion hypothesis.

Table 3 Previous Empirical Studies of Exports and Growth

Study	Data Set	Econometric Technique	Other Variables	Conclusions
Michaely (1977)	Cross-section 41 countries Ave of 1950-73	Rank correlation (per capita GNP growth on growth of export share)	None	Support for export growth hypothesis Threshold effect
Balassa (1978)	Cross-section 10 countries Aves of 1956-67 and 1967-73	Rank correlation, Production function, OLS (GNP growth on export growth or real export growth)	Labour force growth Domestic investment and foreign investment /output	Support for export growth hypothesis
Williamson (1978)	Cross-section 22 countries Ave of 1960-74	Linear models, OLS (change in GDP on lagged exports)	Country dummies, Direct investment, Other foreign capital	Support for export growth hypothesis
Fajana (1979)	Time series 1954-74 1 country	OLS (GDP growth on export share or export change/output)	Trade balance Current account	Support for export growth hypothesis
Tyler (1981)	Cross-section 55 countries 1960-77	Production function, OLS (GDP growth on export growth)	Labour force growth Investment growth	Support for export growth hypothesis Threshold effect
Feder (1983)	Cross-section 31 countries 1964-73	OLS (GDP growth on export growth or export change/output)	Labour force growth Investment/output	Support for export growth hypothesis
Kavoussi (1984)	Cross-section 73 countries	Rank correlation, Production function, OLS (GDP growth on export growth)	Labour growth rate Capital growth rate	Support for export growth hypothesis Threshold effect
Jung & Marshall (1985)	Time series 1950-81 37 countries	ML, Simultaneous linear functions, Granger causality (real GNP (GDP) growth and lagged real export growth)	Lagged GNP (GDP) growth	Little support for export growth hypothesis
Darratt (1987)	Time series 1955-82 4 countries	OLS white test for causality (real GDP growth on real export growth and lagged real export growth)	None	Rejection of export growth hypothesis in 3 out of 4 countries
Salvatore & Hatcher (1991)	Time series 1963-85 26 countries in 4 groups by trade policy orientation	Production function OLS (real GDP growth on real export growth)	Labour input growth Capital input growth Growth in industrial production	Support for export growth hypothesis
Greenaway & Sapsford (1993)	Cross-section 104 countries Ave of 1960-73, 1973-90, 1980-88	OLS tests for heteroskedasticity (real GDP growth on growth in export ratio)	None	Support for export growth hypothesis Indirect evidence of threshold effect

Source: Extract from Greenaway and Sapsford ((1994) 154-155).

These studies have a major methodological problem. They correlate growth measured by the change in the national product (whether total or per capita) with the change in exports. Since exports are themselves part of the national product, a *simultaneity* problem is present, and a positive correlation of the two variables is almost inevitable, whatever their true causal relationship (Michaely (1977)). Although the hypothesis of export promotion clearly implies a correlation between exports and real output growth, so do other hypotheses with quite different policy implications. Jung and Marshall (1985) provide some examples where output growth may not be due to any particular export promotion policies. Thus, while export growth may lead to output growth, an equally plausible hypothesis is the reverse flow of causality - that output growth causes export growth. Chenery and Syrquin's cross-country study found that, as incomes per capita rose from around US$300 to US$4,000 (in 1980 prices), the average export share of GDP rose from 15 to 21% (Snodgrass et al. (1995)). It is therefore of interest to study the relationship between output growth and export growth by recourse to *causality tests* or analysis rather than OLS estimates. We briefly review the causality concept in econometrics in the next sub-section.

2. Causality Concepts in Econometrics[5]

Feigl's philosophical definition: According to Feigl (1953), "*The clarified (purified) concept of causation is defined in terms of predictability according to a law (or more adequately, according to a set of laws).*" This definition, most importantly, links causation *not just to predictability but to predictability according to a law or set of laws.* According to this philosophical definition, predictability without a law or set of laws, or, as econometricians might put it, without theory, is *not* causation. Hence, linking predictability to a law or set of laws is critical in appraising various tests of causality.

Simon's Causal Ordering and Identifiability: Simon's (1953) notion of causality is that "*causal orderings are simply properties of the scientist's model, properties that are subject to change as the model is altered to fit new observations.*" Simon points out that such a notion of causality can be applied to probabilistic as well as deterministic models. Importantly, his notion of causality is a deductive logical concept relating to models' characteristics, not to empirical features of the world that require statements of inductive logic. Yet, it is the inductive aspect of this and other models that is critical for appraising the degree to which the model is causal (Zellner (1984)). Sims (1977) builds on Simon's notion of causality.

The Basmann-Strotz-Wold Definition of Causality: Strotz and Wold (1960) write:

> For us, however, the word (causality) in common scientific and statistical-inference usage has the following general meaning. Z is a cause of Y if, by hypothesis, it is or would be possible by controlling Z indirectly to control Y, at least stochastically. But it may or may not be possible by controlling Y indirectly to control Z. A causal relation is therefore in essence asymmetric, in that in any instance of its realization it is asymmetric. Only in the special cases may it be reversible and asymmetric in a causal sense. These are the cases in which sometimes a controlled change in Z may cause a change in Y and at other times a controlled change in Y may cause

5. For an extensive discussion on causality concepts and the empirical tests of causality, see Zellner (1984).

a change in Z, but Y and Z cannot both be subjected to simultaneous controlled changes independently of one another without the causal relationship between them being violated.

The Basmann-Strotz-Wold definition differs from Feigl's by bringing in the concept of controlled changes in variables. Note in passing, however, that the Basmann-Strotz-Wold definition is still subsumed under Feigl's more general definition of causation and causal laws.

The Wiener-Granger concept of causality: Granger (1969) provides an alternative theory of causality to those of Simon, Strotz, Wold and Basmann which is based on a suggestion by Wiener. Formally, if A_t is a stationary stochastic process, let A_t^* represent the set of past values $\{A_{t-j},\ j = 1, 2, \cdots\}$ and A_t^{**} represent the set of past and present values $\{A_{t-j},\ j = 0, 1, \cdots\}$. Further let $A^*(k)$ represent the set $\{A_{t-j},\ j = k, k+1, \cdots\}$. Denote the optimum, unbiased, least-squares predictor of A_t using the set of values B_t by $P_t(A \mid B)$. Thus, for instance, $P_t(X \mid X^*)$ will be the optimum predictor of X_t using only past X_t. The predictive error series will be denoted by $\varepsilon_t(A \mid B) = A_t - P_t(A \mid B)$. Let $\sigma^2(A \mid B)$ be the variance of $\varepsilon_t(A \mid B)$. Let U_t be all the information in the universe accumulated since time $t-1$, and let $U_t - Y_t$ denote all this information *apart* from the specified series Y_t. Given these assumptions, we then have the following definition of **causality**: If

$$\sigma^2(X \mid U) < \sigma^2(X \mid U^* - Y^*) \tag{1}$$

we say that Y_t is causing X_t, denoted by $Y_t \Rightarrow X_t$, if we are better able to predict X_t using all available information than if the information apart from past Y_t had been used.

Empirically, the Granger (1969) causality test is specified as follows: if we let Y_t and X_t be two stationary time-series with zero means, then the simple (i.e., linear in parameters) causal model is:

$$Y_t = \alpha_0 + \sum_{j=1}^{m} a_j X_{t-j} + \sum_{j=1}^{p} b_j Y_{t-j} + \varepsilon_t, \tag{2}$$

$$X_t = \beta_0 + \sum_{j=1}^{r} c_j X_{t-j} + \sum_{j=1}^{s} d_j Y_{t-j} + \eta_t, \tag{3}$$

where ε_t and η_t are taken to be two uncorrelated white-noise series, i.e., $E[\varepsilon_t \varepsilon_s] = 0 = E[\eta_t \eta_s]$, $s \neq t$, and $E[\varepsilon_t \varepsilon_s] = 0$ for all t, s. In Equations (2) and (3), m, p, r and s can equal infinity, but in practice, due to the finite length of the available data, m, p, r and s will be assumed to be finite and shorter than the given time-series. The causality tests to be performed may be stated as:

(a) *Unidirectional causality* from X_t to Y_t: X_t causes Y_t if $H_0: a_j = 0$, $j = 1, \cdots, m$, can be rejected and (b) does not hold.

(b) *Unidirectional causality* from Y_t to X_t: Y_t causes X_t if $H_0: d_j = 0$, $j = 1, \cdots, s$, can be rejected and (a) does not hold.

(c) *Feedback or bilateral causality* is said to occur if both (a) and (b) hold.

(d) *Independence* is said to occur if neither (a) nor (b) holds.

To determine the causal relationship between X_t and Y_t, we first fit Equation (2) by OLS and obtain the unrestricted residual sum of squares (RSS_{UR}). We then run another regression equation under the null hypothesis that all coefficients of the lagged values of X_t are zero and obtain the restricted residual sum of squares (RSS_R). To test the null hypothesis, we apply the F*-test*

$$F = \frac{(RSS_R - RSS_{UR}) \mid m}{RSS_{UR} \mid (n-k)} \tag{4}$$

which follows the F distribution with m and ($n-k$) *d.f.* Here, m is equal to the number of lagged X_t terms, k is the number of parameters estimated in the unrestricted regression, and n is the sample size. If the null hypothesis can be rejected, then we conclude that the data show causality.

Several characteristics of Granger's definition of causality may be noted. First, the use of the series U_t representing *all* available information makes the definition nonoperational. Granger (1969) suggests replacing "all the information in the universe" with the concept of "all relevant information." Second, the definition is unusual in that embedded within it is a particular confirmatory criterion, the variance of the forecast error of an unbiased least squares predictor. This confirmatory criterion is not applicable to processes that do not possess finite moments. Also, for most processes, even just stationary processes, which involve parameters whose values must be estimated from finite sets of data, an unbiased least squares "optimum" predictor is often not available. As solutions to these problems, Granger (1969) writes:

> In practice it will not usually be possible to use completely optimum predictors, unless all sets of series are assumed to be normally distributed, since such optimum predictors may be nonlinear in complicated ways. It seems natural to use only linear predictors and the above definitions may again be used under this assumption of linearity.

The main problem associated with Granger's definition is the failure to recognize explicitly the role of economic laws or theories in defining causality (Zellner (1984)). One gets the impression that the concept of causality can be defined entirely in terms of statistical considerations, a point of view that is contrary to the views of Feigl, Basmann, and others. Granger's definition could be broadened to ameliorate these setbacks especially by the inclusion of economic laws and/or theories. Indeed, this last approach seems very similar to that employed traditionally in econometrics. We next review some of the empirical studies of causality.

3. Empirical Studies of Causality

The empirical literature on causality is large, and we cannot do justice to it here. Some empirical studies of causality which relate closely to this discussion include the following. Jung and Marshall (1985) applied the Granger causality test to 37 developing countries to determine the direction of causality between output growth and export growth in order to test the validity of the export promotion hypothesis. The general conclusion from their study is that the evidence in favour of export promotion is weaker than previous statistical studies had indicated.

Serletis (1992) investigates the causality (using the Granger test) between exports, imports and GNP growth for Canada using data from 1870 to 1985. He tests for unit roots and cointegration of the variables and finds that GNP, export and import are not cointegrated. His main finding is a support for the export-led growth strategy in that expansion in exports promotes the growth of national income.

Bahmani-Oskooee et al. (1992) also found inconclusive results about the causal relations between exports and economic growth for 20 developing countries. Five countries (Dominican Republic, Indonesia, Korea, Taiwan and Thailand) exhibited positive causality, while three countries (El Savador, Paraguay and Peru) indicated negative causality from exports to economic growth. Positive causality was found from output to export growth in four countries (Korea, Nigeria, South Africa and Thailand), while Indonesia exhibited negative causality running from output growth to exports.

Dodaro (1993) used the Granger causality test for 87 developing countries in a study of the export promotion hypothesis. He found no support for the neoclassical theory in any of the NIC countries. Dodaro's results were in favour of the export-led growth hypothesis only in seven primarily poor and low-income countries.

Love (1994) found overall stronger support for causality from exports to economic growth than in previous studies for 20 developing countries. Love's result exhibited positive and statistically significant unidirectional causality from exports to output growth in the case of seven countries and negative causality in the case of four. Statistically significant and bi-directional causality was found for three countries. Love interprets his results as a sign of substantial support for the hypothesis that export growth causes growth of output.

Yaghmaian (1995) used the Granger causality test to test the causal relation between export orientation and economic growth for a sample of 44 countries in Africa. The conclusion from this study is that the case for export-led growth in Africa is very weak and unsubstantiated by empirical evidence. For 38 of the countries in the sample, the causality test does not support the contention that better export performance causes economic growth. The results also fail to support the opposite contention that economic growth causes the growth of exports.

The review of causality tests above clearly indicates that the dominant technique is the Wiener-Granger concept of causality. We will thus employ the Granger (1969) causality test in this study. Note, however, that, to make the Granger (1969) concept of causality operational, several issues must be investigated. First, one must have an economic theory, or in Feigl's sense, a law or set of laws. In this study, this condition is satisfied by the *staple theory of growth*. Second, the variables in the analysis must be linear and stationary which calls for the time-series analysis of the variables. Here, the Phillips-Perron (1988) unit root test of stationarity will be used to test for stationarity. Third, the regression residuals must be normally distributed. This can be tested using the Jarque-Bera (1987) test. Fourth, the issue of mis-specification is also important. The Hausman (1978) specification test for simultaneity and Schwarz (1978) criterion for lag lengths will be employed. The exact form of Equations (2) and (3) will be determined using Hendry and Richard's (1983) model specification error test. Also, equation specification errors will be tested using the Ramsey (1969) RESET test and residuals tests. Finally, the causality tests are carried out. These tests will be performed in order to analyse the causality between exports and economic growth in Ghana, the subject matter of the next section.

V. Estimation, Analysis and Conclusion

This section presents the empirical estimates for the causal relation between exports and growth for Ghana from 1960 to 1992 (see *Appendix* for the data sources and notes). The study period was determined by data availability. The variables in this analysis are the growth rates of real gross national product ($RGNP$) and real export value ($REXP$).[6]

1. Tests of Unit Roots and Cointegration

One major assumption of the causality test is that the time-series variables are stationary. The stationarity properties of the variables were examined using the Phillips-Perron (1988) test with a specification which includes a constant and a trend variable. The Phillips-Perron (1988) tests have been widely used in testing for unit roots since they are known to have decent power against the stationarity alternative hypothesis. The Augmented Dickey-Fuller (1984) tests (ADF) have been popular, too. Although the ADF tests are more or less correct under the null of a unit root, they are not very powerful (Lee and Mossi (1996)). Diebold and Rudebusch (1991) found the ADF tests to have quite low power. Balke and Fomby (1991) found the standard Dickey-Fuller critical values to result in too many rejections of the unit root null hypothesis. See also Schwert (1989) and Serletis (1992) for further discussion. The results of the Phillips-Perron unit root tests are presented in Table 4.

Table 4 Phillips-Perron (1988) Stationarity Test Results

Variable	τ-statistic[a]	z-statistic[b]	Conclusion
RGNP	-5.5193	-32.0900	Stationary
REXP	-5.6886	-32.4940	Stationary

[a] The asymptotic critical value at 10% of the τ-*test* is -3.13.
[b] The asymptotic critical value at 10% of the z-*test* is -18.2.

From the results, we see that both the growth rate of real GNP and the growth rate

6. To get real GNP and real export value, GNP and total export value were deflated by the GDP deflator and the export price index, respectively.

of real exports are stationary since the test-statistics are greater than the 10% asymptotic critical values (i.e., we may reject the unit root hypothesis). Hence both variables are integrated of order zero, that is, **I(0)**. This also implies that real GNP and real export value are integrated of order one, that is, **I(1)** (as we would expect). We thus use the levels of the variables in the analysis. A test for cointegration of the residuals of the variables indicated *no long-run* relation between them. The absolute value of the test-statistic is 2.8570 which is less than the asymptotic critical value at 10% which is 3.50 for the specification with constant and trend.

2. Model Specification and Tests

Model specification: We used the Hendry and Richard (1983) specification test (the TTT methodology) as well as the Schwarz (1978) Criterion to determine the appropriate form of the causality model. We selected the following form of the VAR model for the causality tests:

$$RGNP_t = \alpha_0 + \sum_{j=0}^{9} a_j REXP_{t-j} + \sum_{j=1}^{5} b_j RGNP_{t-j} + \varepsilon_t. \tag{5}$$

$$REXP_t = \beta_0 + \sum_{j=1}^{3} c_j REXP_{t-j} + \sum_{j=0}^{5} d_j RGNP_{t-j} + \eta_t. \tag{6}$$

Note that our specification departs from Granger's Equations (2) and (3) in one important way. Equations (2) and (3) are treated as single equations. However, since our discussion makes room for simultaneity, our VAR model is specified as a simultaneous-equation system by including current values $RGNP_t$ and $REXP_t$ as explanatory variables in Equations (5) and (6). This will enable us to test for simultaneity (Hausman (1978)) between the endogenous variables. We will perform the causality tests based on the VAR model. But first we have to evaluate the results of the regression equations. Due to space limitations, we present here only the evaluation of the crucial Equation (5), the Export-GNP causality equation.

Simultaneity test: If the VAR model is affected by simultaneity bias, the OLS estimators are inconsistent. We use the Hausman (1978) specification test to analyse simultaneity bias in our model. Using the Hausman (1978) methodology, we first regress the growth rate of real GNP (Equation (5)) on all the lagged pre-determined variables in the VAR model excluding the current growth rate of real export value. This is the reduced-form regression. The predicted growth rate of real GNP and the estimated residuals are substituted for the growth rate of real GNP in Equation (6). The *t-statistic* of the estimated residuals is 0.88373 which is less than the *t-critical* value of 2.120 for 16 *d.f.* at $\alpha = 0.05$ and *p-value* = 0.3899 for a *two-tailed test*. Since the estimated residuals are statistically insignificant, we conclude that there is no simultaneity bias in the VAR specification.

Residuals tests: The results of the residuals tests (Normality, Equation specification error, ARCH(p)) are summarized in Table 5 below:

Table 5 Normality, Equation Specification Error and ARCH(p) Tests

Type of Test	Test-statistic	Deg. of freedom	P-value	Critical value 5%	Conclusion
NORMALITY JARQUE-BERA(JB)	0.1337	2	≈0.940		Approximately normally distributed
RAMSEY RESET					
RESET(2)	4.1349	F(1, 6)		5.99	No mis-specification bias
RESET(3)	4.2620	F(2, 5)		5.79	No mis-specification bias
RESET(4)	5.1252	F(3, 4)		6.59	No mis-specification bias
ARCH(p)					
ARCH(1)	0.5260		≈0.468		No autoregressive conditional heteroscedasticity
ARCH(2)	0.6660		≈0.625		
ARCH(3)	0.7743		≈0.825		

The normality test indicates that the *p-value* exceeds 5%, and we may conclude that the residuals of the regression equation are approximately normally distributed. We see that the RESET tests are statistically insignificant at the 5% level of significance, which indicates no equation specification error. With time-series data, it is pertinent to test for the twin problems of autocorrelation and heteroscedasticity. This is done using the autoregressive conditional heteroscedasticity (ARCH(p)) model.[7] The results indicate that the error variance is not affected by autoregressive conditional heteroscedasticity.

Test for multicollinearity: Multicollinearity is checked by using the Tolerance (TOL_j) and the Variance Inflation Factor (VIF_j) tests from the auxiliary regressions.[8] Since the VIF_j values (falling between 1.700 and 2.434) are all less than 10, and the TOL_j values (falling between 0.411 and 0.617) are not very close to zero, we may conclude that the specification is not seriously affected by multicollinearity. Since even with near collinearity the OLS estimators are still BLUE and the problem of multicollinearity is a question of degree rather than the absence of multicollinearity, we may accept the specification for our purpose.

3. The Causality Tests

The results of the Granger (1969) test of causality between the growth rate of real GNP and real export value are presented in Table 6.

Table 6 Results of the Granger (1969) Causality Tests

Direction of Causality	F-statistic	F-critical at α=0.01	Decision
REXP ⇒ RGNP	30.18	3.59	Reject H_0; that is, there is causality
RGNP ⇒ REXP	3.00	3.72	Do not reject H_0; that is, there is no causality

7. The *ARCH(p)* model has the test statistic $nR^2 \sim \chi^2_p$ where *n* = number of observations and R^2 = coefficient of determination from the auxiliary regression of the square of the residuals on its different lags (see R. Engle (1982)).

8. The *VIF*$_j$ is defined as $VIF_j = 1/(1-R_j^2)$, where R_j^2 is the R^2 in the (auxiliary) regression of X_j on the remaining $(k-2)$ regressors; Tolerance is also defined as *TOL*$_j$ = *1/VIF*$_j$ (see D.G. Kleinbaum et al. (1988)).

The results indicate that the growth rate of real export value do cause (in Granger-sense) the growth rate of real GNP for the study period. The reverse causality test (from GNP to Exports) does not hold. Thus, in the first case, the null hypothesis may be rejected, indicating *unidirectional causality* between Exports and GNP. On the other hand, the growth rate of real GNP does not cause the growth rate of exports.

The causality tests indicate that Ghana has been able to spread the dynamic gains from trade to other sectors of the economy. For the period under study, the support for the benefits of economies of trade and positive externalities (the dynamic gains) does exist in Ghana. In other words, primary exports have been a major growth-generating force during the study period. We may postulate that Ghana has gained from its comparative advantage in primary commodities as a source of economic growth. The positive role of the primary sector in the economic growth process is thus comparable to that of Indonesia, Malaysia and Thailand. Bahmani-Oskooee et al. (1992) found positive causality between exports and economic growth for Indonesia and Thailand. Our findings reinforce that of Serletis (1992) who uses similar methods and finds that the evidence in favour of export promotion is stronger than previous statistical studies have indicated.

4. Conclusion

This paper has attempted to test the hypothesis of primary-export-led growth using Ghana as a case study for the period 1960-1992. The theoretical framework used in the study is the staple theory of growth. A staple is a primary product that faces a large and growing demand in world markets, does not require elaborate processing, and has a high enough value-to-weight (volume) ratio to bear transportation costs. The staple theory emphasises the fact that staple exports are the leading sector of the economy which set the pace for economic growth. Economic growth is a consequence of the trickle-down effects of the primary export sector. The inducement to domestic investment resulting from the increased activity of the export sector can be disaggregated into three linkage effects: backward-, forward- and final demand-linkage. These linkage effects are analogous to the dynamic gains from trade (see the introduction) as stressed by neoclassical economic theory.

Several econometric tests were performed, the ultimate test being the Granger (1969) causality test. The test indicated *unidirectional causality* between the growth rate of real GNP and real Exports. In other words, export growth is a cause (in Granger-sense) of the growth of real GNP (or economic growth). Thus Ghana has been able to spread the dynamic gains from trade to other sectors of the economy. For the period under study, the support for the benefits of economies of trade and positive externalities (the dynamic gains) exists in Ghana. In other words, primary exports have been a major growth-generating force during the study period. We may postulate that Ghana has gained from its comparative advantage in primary commodities as a source of economic growth. Our findings reinforce those of Love (1994) and Serletis (1992) that the evidence in favour of export promotion is stronger than previous statistical studies have indicated.

One concern is related to the data used in the analysis. Given the limited data used in the study, the evidence is suggestive and may not be conclusive. Again, since the data are for one country, the results may have limited implications. However, the results might have greater reliability since the model has avoided the problems of cross-country analysis. It may also be of interest to replicate this study using data from other developing countries to assess the validity of the export promotion hypothesis.

Appendix

Data Sources and Notes

Gross National Product (GNP) in million cedis at current prices - Statistical Service, Accra: *Quarterly Digest of Statistics, various issues; Economic Survey, various issues*; 1990-1992 from World Bank: *World Tables*, 1994 issue. World and country GNP data are from UN: *National Accounts Statistics International Tables* and World Bank: *World Tables*, various issues.

Export (EXP) value in million cedis at current prices - Statistical Service, Accra: *Quarterly Digest of Statistics, various issues; External Trade Statistics, various issues*; 1990-1992 from World Bank: *World Tables*, 1994 issue. The data were in US$m and were converted to cedis using the annual average cedi/$ exchange rates. Data on percentage distribution of exports for Ghana are from Huq ((1989) Table 10.5). Data on primary exports as a percentage of world exports are from the UN: *Yearbook of International Trade Statistics*, various issues.

Export Price Index (EPI) - IMF: *International Financial Statistics, various issues*; World Bank: *World Tables, 1987 and 1994 issues*. The data were in 1958, 1963, 1980 and 1987 base years and were converted to 1980 common base year.

Nominal GDP (NGDP) and Real GDP (RGDP) in million cedis - 1960-1984 from M.M. Huq ((1989) Table A.1, p. 287); 1985-1992 from IMF: *International Financial Statistics, various issues*. The real GDP data were in 1970 and 1985 base years and were converted to 1970 common base year. The GDP deflator is estimated using the following formula: *GDP deflator* $= [(NGDP/RGDP)\times 100]$.

Land and Labour - FAO: *Production Yearbook* Vol. 30 (1976) and Vol. 45 (1991). Land area refers to total area, excluding area under inland water bodies. Labour is the economically active population.

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