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Review

Impact of exchange rate volatility on net-export in selected West African countries

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This main thrust of this study is the estimation of the impact of exchange rate volatility on net-export in some selected West African countries. We draw a sample of West African economies namely Nigeria, Cote d'Ivoire, Gambia, Ghana and Togo and utilize the Johansen co-integration technique to determine the level of impact. The results of the analysis suggests that there is a long run relationship between net-export, exchange rate volatility, foreign income, relative price, and index of openness for all the countries. In particular, exchange rate volatility depresses net-export in Cote d'Ivoire, but its effect in Nigeria, Gambia, Ghana and Togo seems to be growth enhancing. The study recommends that stability in exchange rate system and lower volatility are desirable to promote higher export in these countries.
Key words*: Exchange rate volatility, Net-export, Co-integration techniques, Selected West African countries*

INTRODUCTION

The collapse of the Breton woods system of fixed exchange rate system marked the arrival of the flexible exchange rate system in 1970's. This system of floated exchange rate system was adopted by many countries, developed and developing alike. Continued exchange rate adjustment eliminates discrete parity adjustment and instability which is potentially associated with the fixed exchange rate system. Efficient floating of exchange rate system is expected to adjust automatically to ensure balance of payment equilibrium. Since it reflects the market-determined prices of currencies, it will contribute to the efficient resource allocation both internally and internationally.

Flexible exchange rate regime is criticized for increasing the level of uncertainty and thus reducing the incentive to trade, leading to depressed export. Nominal and real exchange rate volatility under flexible exchange rate is much higher than volatility in fixed exchange rate regime. Such level of volatility may lead to reduced export and trade in general. These criticisms, has generated a larger literature that focuses on the impact of exchange rate volatility on trade. Although there is growing body of literature on the impact of exchange rate volatility on trade, empirical evidence has been ambiguous both within the developing and developed countries and across countries (Cote, 1994).

Many empirical findings support the hypothesis that an increase in exchange rate volatility leads to a decrease in trade flow because in most international transactions, goods are denominated in terms of the currency of either the exporting or importing country. Therefore, unanticipated variations in exchange rate should adversely affect trade through the effects on profits. This will depend on if the producers and exporters are risk averse or not. There is also some conflicting evidence on the impact of exchange rate volatility on trade, which suggests that exchange rate volatility has positive impact on trade. Given such contradictions the debate on the impact of exchange rate volatility on trade remains inconclusive.

The poor performance of some of the macroeconomic variables in most developing countries is often blamed on exchange rate volatility. This often gives rise to proposal for

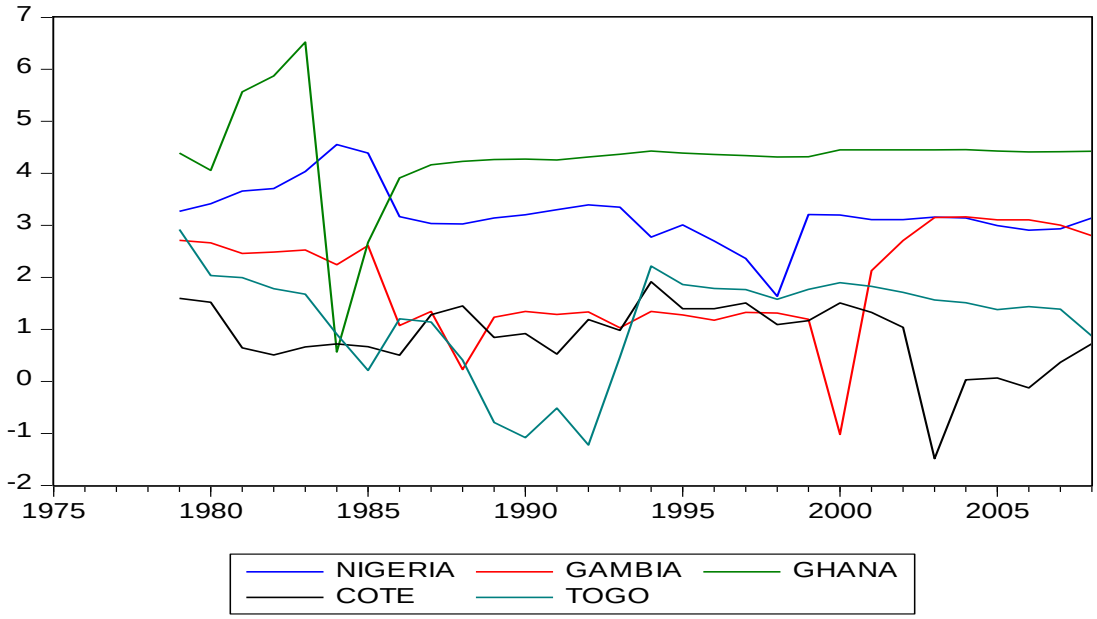

Figure 1. Exchange Rate Volatility in Selected Countries
Source: International Financial Statistics (IFS) various years.

government intervention in exchange rate market with policies to limit the volatility and thus deviating from domestic monetary policy goals. Many developing countries have targeted real effective exchange rate (the value of a currency against a weighted average of several foreign currencies divided by a price deflator), implying that if trade does not act as a stabilizer, the policy intervention will reduce the bilateral exchange rate volatility.

Most countries of West Africa adopted the flexible exchange rate policy after the collapse of the Breton Woods system of fixed exchange rate. This has led to a higher level of volatility in the exchange rate of these countries and the subsequent reduction in the volume of export and international competitiveness. The volatility in the exchange rate of these countries namely: Nigeria, Ghana, Togo, Gambia and Cote d'Ivoire can be seen in figure 1.

It can be inferred from the graph that the exchange rate volatility of these countries have been erratic over the years. This situation has been pinpointed as the main cause of low level of export of these countries. The development has put the government of these countries in a more difficult situation as the reduction in export earning normally affect the current account negatively precipitating in balance of payment deficit. It is the view of most authors that the more stable the exchange rate, the higher the level of trade. This research work seeks to examine the impact of exchange rate volatility on the net export of these countries.

Objectives of the Study

The main objective of this study is to measure the impact of exchange rate volatility on net-export of selected West African countries. In order to achieve the above objective, a risk model for the economies anchored on the risk portfolio school hypothesis was adopted. The results of the analysis suggest that risk aversion may not be sufficient to conclude that exchange rate volatility reduces the level of trade. However, the result of the restricted co-integration relation suggests that the volatility of exchange rate, depresses export growth in Cote d'Ivoire. But, the impact on Nigeria, Gambia, Ghana and Togo seems to be export enhancing. It is also followed from the results that a long-run stable relationship exists between the variables under study.

Problem Statement

A sound exchange rate and trade policy is one that reduce the level of volatility in exchange rate on the one hand, while

increasing the level of export and other economic activities on the other hand. This position has been unattainable in these West African countries, making it possible for exchange rate to fluctuate erratically and for export to be below the expected level. This is a serious economic problem because, when exchange rate fluctuates, exporters due to uncertainty may refrain from engaging in trade. This reduces export earnings, pushing the current account into deficit which may culminate in balance of payment crises.

The current account and balance of payment of some of these countries have over the years remained in deficit, thus pushing the government to borrow to finance its obligations over time. Some of these governments are already waist-deep in debt. A lot of steps have been taken by the government to boost the level of export performance through trade adjustment programmes and export expansion/promotion yet the problem of low export and higher volatility still persists.

Research Questions

From the above objectives, the research question of the study is hereby stated as follows;

1. Does exchange rate volatility have significant impact on net-export of selected West African countries?

2. Is there a long term relationship between exchange rate volatility and net-export of selected West African countries?

Research Hypothesis

The research hypotheses of the work which will be tested later are as follows:

Hypothesis 1

H0: Exchange rate volatility does not have significant impact on net-export of selected West African countries.
H1: Exchange rate volatility has significant impact on net-export of selected West African countries.

Hypothesis 2

H0: Exchange rate volatility does not have long run relationship with the net-export of West African countries.
H1: Exchange rate volatility has long run relationship with net-export of West African countries.

Justification of the Study

The purpose of scientific research is to discover answer to questions through the application of scientific procedures. These procedures have been developed in order to increase the likelihood that the information gathered would be relevant to questions asked and would be reliable and unbiased (Magel, 1934). Bearing this in mind, this research work is justified on two grounds:

1. Earlier works on the impact of exchange rate volatility on export trade did not provide a clear-cut conclusion on the impact of exchange rate volatility on export and as such, there is the need to embark on this research work.
2. This research work is justified as it serves as a projection of earlier work on the subject matter, this is because; some of the works already conducted on the subject matter are already out of date. This will enable us proffer solutions to the problems affecting the variables

Scope and Data Sources

This research work is strictly on the appraisal of the impact of exchange rate volatility on net-export. A sample of West African economies is drawn for the analysis namely: Nigeria, Gambia, Ghana, Cote d'Ivoire and Togo. These countries were chosen on the basis of their GDP growth rate and exchange rate management system practiced over the years. Econometric model is specified and applied using 1975-2011 exchange volatility and net-export as reference point.

Data on Nigerian economy are collected from secondary sources such as CBN statistical bulletin and the National Bureau of Statistics. Data on other African countries were collected from the World Development Indicator (WDI) online data base and the International Financial Statistics (IFS) online data base.

LITERATURE REVIEW

Theoretical Literature

The theoretical strand of exchange rate volatility is basically drawn from two schools of thought. These schools include the traditional school, which holds that higher volatility in exchange rate increases risk and therefore depresses trade flows and the risk portfolio school which maintains that higher risk presents greater opportunity for profit and should therefore increase trade. Apart from these two schools of thoughts, a third school of thought referred to as the political economic theory which is not as prominent as the above two still exist. These schools of thought are discussed in turn.

The Traditional School

The early study on exchange rate volatility and trade focused on firm behavior and presumed that increased exchange rate

volatility would increase the uncertainty of profit on contracts denominated in a foreign currency and would therefore reduce international trade to level lower than would otherwise exist if uncertainty were removed. This uncertainty of profit or risk would lead risk-averse and risk neutral agents to redirect their activities from higher risk foreign market to the lower risk home market.

Cote (1994), in her comprehensive review of the literature, points out that the traditional school has examined not only the presence of risk, but also its degree, which in turn depends upon such factors as whether production inputs are imported, the opportunity to hedge risk and the currency in which contracts are denominated.

An early example of the traditional school is provided by Clark (1973). He developed a model of an exporting firm that produces under perfect condition, and homogenous commodity that is sold entirely abroad. In the simplest version of the model, the firm uses no imported inputs and the price of the exported goods in foreign currency is an exogenous variable. The firm is paid in foreign currency and hedging is limited. Output is constant over the planning horizon. Uncertainty about future exchange rates translates into uncertainty on future export receipts in domestic currency.

The firm maximizes the expected value of utility, which is assumed to be a quadratic function of profits expressed in the home currency: (ucπ) = aπ + b π_2). With risk aversion (b<O), the first order condition requires that marginal revenue exceed marginal cost. So as uncertainty increases, Clark contends that a risk averse firm will reduce the supply of goods to the level where marginal revenue actually exceeds marginal cost in order to compensate for the additional risk, thereby maximizing utility.

Baron (1976), relaxes the assumption of perfect competition to analyze the effect of exchange rate volatility on prices, highlighting the role of invoicing currency. When the exporter invoice in foreign currency, he or she faces price risk. This is because the quantity demanded is known, since prices do not change during the contract period, but the revenue stream and profit are uncertain. Baron posited that when invoicing in home currency, the exporter faces quantity risk. Quantity demanded is uncertain because the price facing the buyer is uncertain. In addition to revenues, cost of production becomes uncertain. In both cases, the risk avert firm wants to reduce its risk exposure but the price effect will differ. If the firm invoices in foreign currency, an increase in risk results in a price increase exercising movement along the supply curve. The high prices, reduces expected profits (demand is elastic at the optimal prices) but increases expected utility. If the firm invoices in domestic currency, its respond will depend on the properties of the demand function in the destination market. If the function is linear, Baron shows that prices decline. The price decline leads to increase demand, but the price-cost margin diminishes, which reduces the expectation and variance of profit.

In their seminal paper, (Hooper and Kohlhagen, 1978), also examine the effect of exchange rate volatility on bilateral trade. They derived the demand and supply schedules for individual firms, where the explanatory variables include the currency denomination of contracts, the degree of firms' risk aversion and the percentage of risk hedged in the forward market. The most significant contribution of this study is how it allows nominal exchange rate volatility to only impact the amount of risk that remains unhedged. Their study includes a number of priori assumptions, including the importer being a price taker (where imports are assumed to be inputs used for producing goods that are sold domestically), the importer facing a known demand curve and exporter that sells all of their products abroad in a monopolistic market framework. They found that increased exchange rate volatility leads to both downward-shifting supply and demand curves, where quantities and prices decline when importers face the exchange rate risk (depending on demand elasticity and their degree of risk aversion), and quantities decline and price increase when exporters (suppliers) bear the risk.

One of the main objections to the traditional school is that it does not properly model how firms manage risk, not only through the use of derivatives, but also as an opportunity to increase profitability. On the sideline also is the fact that perfect hedging against exchange rate risk is impossible or costly and that exchange rate variability is not the only source of uncertainty facing the firm. To be able to take care of the above, we turn to the risk portfolio school because the risk portfolio school relaxed these assumptions.

Risk Portfolio School

What is referred to here as the risk-portfolio school is not a unified body of thought, but is comprised rather of multiple theories, varying in complexity but united in the opinion of the traditional school as unrealistic.

One of the main assumptions of the traditional school is that risk aversion is sufficient to conclude that exchange rate volatility reduces the level of trade. The risk portfolio school relaxes this assumption by positing that the result depends on the properties of the utility function. This is because according to Cote (1994), an increase in risk have both a substitution and an income effect, which works in the opposite direction. It lowers the attractiveness of the risky activity, leading agents to reduce that activity (substitution effect) on the other hand, it lowers the expected total utility of the activity and to compensate for that drop additional resources might be devoted to the activity (income effect).

De Grauwe (1988), in support of the above assertion derived a model of a firm operating under a perfectly competing condition that can allocate its production between domestic and foreign market. He discovers that the effect of an increase in exchange risk (a mean preserving spread) will depend on the convexity properties of the utility function, which in turn depends on the degree of risk aversion. He argued that if exporters are sufficiently risk averse, an increase in risk raises the expected marginal utility of export revenue and induces

them to increase their export activity. He emphasized that the result obtained by (Hooper and Kollhagen, 1978), follows from the restriction that is imposed on the utility function. Constant absolute risk aversion is assumed, which eliminates the income effect of changes in risk.

Furthermore, the risk portfolio school of thought relaxes the assumption that hedging or forward cover reduces the effect of exchange rate volatility on trade. They posit that there might be several reasons why firms cannot choose, or choose not, to completely eliminate exchange risk through forward contracts. For developing countries, forward exchange markets may simply not exist. For industrial countries, short term exchange risk can probably be easily hedged in forward exchange market. Also, managing future portfolio normally entails some cost and hedging risk over longer horizons is much more difficult as forward contracts are typically offered for relatively short horizons.

Some studies have examined how the presence of a forward exchange market affects the link between exchange rate volatility and trade. Baron (1976), concluded that with perfect forward market and no other source of uncertainty but exchange rate, the volume of trade is unaffected by exchange rate volatility. The level of output only depends on the forward rate, while exchange rate volatility affects the hedging decision. (Viaene and de Vries, 1992), in their study emphasized that even in the presence of a forward market; spot exchange rate volatility can affect indirectly the volume of trade through its effect on the forward rate. They show that an increase in exchange rate volatility has opposite effects on exports and imports because exporters and importers are on opposite sides of the forward market and as such, the sign of the trade balance and the aggregate measure of risk aversion determine which flow yield more net benefit.

Moreover, the risk portfolio school, posit that for the modern firm, exchange rate volatility may represent a relatively minor and highly diversifiable risk. This position came from the fact that exchange rate volatility is not likely to represent the only source of uncertainty for a firm. Therefore, to correctly evaluate its effects, one needs to know how the exchange rate moves with the other factors that influence the firm's profits. Makin (1978), stated that what is relevant is the effect of exchange rate volatility on the risk and return of the firm's overall set of activities. He stated that a diversified firm holds a portfolio of asset and liabilities denominated in a variety of currencies and exports and imports affects both account receivable and account payable. So even if the variability of the rate of return on a particular security is high, that security can still be attractive if it diversifies the portfolio as a whole. Farel et al. (1983), summarized this tenet by asserting that economic agents maximize profitability by diversifying the risk levels in their investment portfolios by simultaneously engaging in low, medium and high risk activity with corresponding potential rates of return. Greater exchange rate volatility resulting in higher risk would then not possibly discourage risk-neutral agents from engaging in trade, but would present an opportunity to diversify their risk portfolio and increase the likelihood of profit.

Furthermore, the risk portfolio school clearly showed that movement in exchange rate, do not just represent a risk, but they can create an opportunity to make more profits. By relaxing the assumptions that exchange rate does not affect the real opportunities facing the firm, that the firm is constrained to make production and export decision before exchange rate is known, the risk portfolio school posits that exchange rate volatility can create possible opportunity for a firm to generate more profits because, price uncertainty may increase the average profit of a firm. De Grauwe (1992), presents the results for the simple case of a price-taking firm in a model without adjustment cost. He showed that when the price is high, the firm increases output to benefit from the higher revenue per unit. It gains a higher profit for the unit it would have produced anyway and in addition, it expands its output. When the price is low, the firm does the opposite and by so doing, it limits the reduction in its total profit. Gros (1987), concentrated on the effect of exchange rate variability in the presence of adjustment cost and arrived at a similar conclusion.

The Political – Economic Theory

Apart from the above two schools of thoughts, De Grauwe (1988), suggests a third school of thought. This approach known as the political economic theory, proposes that real exchange rate misalignment in an economy will generate a net increase in protection risk pressure and therefore negatively affect trade. According to Cote (1994), the idea is that producers in countries whose currencies become overvalued and see their profits squeezed will organize themselves to pass protectionist legislation and that this legislation will tend to stay in place when the currency later drops and even becomes undervalued. This assumption is intuitively appealing. Critics of this approach points out that industries vulnerability, due to adverse exchange rate often reflects deeper competitiveness issues. Also, flexible rates help absorb the output and unemployment cost of misalignment. These counter-arguments, according to Pickard (2003), speak more to the welfare effects of De Grauwe's theory than to its validity. This is because, it is not difficult to produce modern examples of U.S industries even those industries suffering from non-exchange rate induced competitiveness problems, e.g. steel, that have successfully lobbied the federal government to increase tariffs on imports whose prices were argued to be artificially low. That firms successfully lobby governments to restrict (trade) is evident.

Pickard (2003), states that a more salient problem with De Grauwe's political-economic theory is how to quantify the degree of misalignment and the resulting effect of exchange rate induced lobbying on trade flows.

From the reviews undertaken so far, it is evident that microeconomic theory does not allow one to draw any firm conclusion on the consequences of exchange rate volatility for international trade. To obtain the result that exchange volatility necessarily reduces the level of trade, one has to rely on a rather stringent set of assumptions. Price effects are always ambiguous, depending on the market structure, the currency denomination of currency and the availability of forward cover. Because micro-economic theory does not provide any clear-cut conclusions, a great deal of recent research has been devoted to empirical analysis of the issues. These analyses we will look at in the empirical literature.

Empirical Literature

Because economic theories have not been able to provide a clear cut conclusion on the impact of exchange rate volatility on trade, researchers have over the years resorted to the use of empirical analysis with the hope of arriving at a plausible conclusion. Some of these empirical works are hereby reviewed below.

Farrel et al. (1983), and the IMF (1984), present detailed survey of the early empirical work on exchange rate volatility and trade. They concluded that the majority of studies are unable to establish a systematically significant link between measured exchange rate variability and the level of trade, whether on the aggregate or on a bilateral basis. Bilateral results are somewhat more supportive of the view that exchange rate volatility has a negative effect on trade. However, majority of these studies include relatively few observations on the floating exchange rate period.

Belanger et al. (1988, 1992), examined the impact of nominal exchange rate volatility on Canada-U.S trade flows in five sectors. They used risk measure based on three months forecast error on the forward market. They discovered that volatility has a negative and significant impact in two sectors, industrial supplies and autos. But despite the attention given to the estimation techniques, some authors argued that the results of Belanger et al are not too convincing, since several of the explanatory variables do not have the expected signs.

(Bailey and Tavlas, 1988), report standard test of volatility on aggregate U.S export volume over the 1975-1986 period. They examined the impact of short term volatility as well as misalignment and discovered that both measures were insignificant. (Perre and Steinhar, 1989), focused on the problem of finding meaningful proxies for long run exchange rate uncertainty and misalignment. They estimate equation for export volume of five industrial countries over the period 1960 to 1985. They discovered that for the United States, the uncertainty variable is never significant, while for the other countries, their effect is negative and often significant.

(Asseery and Peel, 1991), also examined the influence of volatility on multilateral export volume of five countries. The novelty in their paper is the use of an error correction framework. It is argued that the non-robust results found in previous empirical work may be due to the fact that the export variable and some of its determinants are potentially non-stationary integrated variables. The volatility measure is based on the residual from an ARIMA process for the real exchange rate. For all countries except the United Kingdom, they find that volatility has a significant positive effect on export over the 1973 to 1987 period.

The study by (Kroner and Lastrapes, 1993), examines the impact of volatility on multilateral export volumes and prices using a joint estimation technique in the context of a parameterized model of conditional variance (multivariate GARCH-in-mean model). In contrast with convectional two-step estimation procedure, the model imposes rationality on the variance forecast. They discovered that volatility has a negative effect on trade volumes only for the United States and United Kingdom. For the other countries, the coefficient is positive. For export prices, volatility has a negative effect in U.S and German equations and a positive effect in others. (Kroner and Lastorapes, 1993), show that the results are not robust to using the conventional estimate strategy.

Gagnon (1993), posited that exchange rate volatility does not play a large role in explaining trade flow through the use of a simulation analysis. He derived a dynamic optimizing model characterized by rational expectation and adjustment cost. The model of risk-averse traders finds that exchange rate variability reduces the level of trade. In contrast to previous research, the magnitude of the effect is assessed through various parameterization of the model.

Bini-Smaghi (1991), finds strong support for the conventional assumption about volatility effect on trade. He focuses on trade in manufactured goods within the European Monetary System (EMS). Equations are estimated over the 1976 to 1984 period for export volumes and prices of Germany, France and Italy. It is found that volatility, measured by the standard deviation of weekly rates of changes of the intra-EMS effective rate for the quarter, has a negative and significant effect on export volumes in all three countries. It also has significant effects on prices. The sign of the latter is negative for Germany and positive for the other two countries.

Some studies focus on the effect of volatility on trade prices. Two of these studies are more prominent. Mann (1989), tests the effect of exchange rate trend and volatility on U.S, Japanese and German export prices for five industrial categories. Destination-weighted exchange rates for these categories were constructed. Exchange risk always has a negative effect on the export prices for the United States, suggesting that buyers of U.S product absorb the risk. The effect is significant at 10 per cent for three industries. For Japan and Germany, the effect often positive, is generally insignificant. (Feenstra and Kendall, 1991), test their assumption about the connection between the estimated risk premium and the impact of exchange rate volatility on prices. Regressions for U.S import prices from the U.K, Japan and Germany are presented. The exchange rate variance is estimated as a GARCH model. A significant negative-time-varying premium is found for the yen but not for the pound and mark.

(Brada and Mendez, 1998) conducted a study quite different from the previous ones in that their study examines the effect of exchange rate regime, rather than exchange rate volatility per se, on the volume of trade. The study uses a gravity model of bilateral trade flows, which includes domestic and foreign incomes, population, distance between countries and dummy variables for the exchange rate system and trade arrangement. The model is estimated with data on 30 developed and developing countries for each year from 1973 to 1977. With one exception, the coefficients of the exchange rate regime are significant at 5 per cent.

(Frankel and Wei, 1993), also used a gravity model of bilateral trade flows to test the effect of nominal and real exchange rate volatility. Regressions are estimated for 1980, 1985 and 1990 using a data covering 63 countries. They find that nominal and real volatility has a negative and significant impact on trade flow in 1980, the effect is positive but insignificant in 1985. It remains positive and statistically significant in 1990.

Savvides (1992), used a two-step estimation method to test the assumption that only the unanticipated component of exchange rate volatility effect trade. Annual data for 62 industrial and developing countries were used to estimate the regression over the 1977-1986 periods. The degree of openness and terms of trade shocks are found to have a significant effect on real exchange rate volatility. The effect of expected and unexpected variability, based on the equation result, is tested on export volumes. Only the latter is negative and significant. Nominal exchange rate variability does not have significant effect either. Kumar (1992), also test his assumption regarding the differential effect of volatility on intra-industry versus net trade. The result partly supports Kumar`s assumptions. Risk increases intra-industry trade and reduces net trade in the United State as predicted by the model.

Some other studies employed co-integration analysis to analyze the impact of exchange rate volatility on trade. (Koray and Lastrapes, 1989), (Flam and Jansson, 2000), taking into account, the trend characteristics of the time series, finds evidence that suggest a significant negative effect of exchange rate uncertainty on trade. (Fountas and Aristotlelous, 1999), found significant negative long run effect of exchange rate volatility on export taking account of futures and option instrument to hedge risk. Baum et al. (2004), showed evidence of a positive relationship between exchange rate volatility and trade using a poison flexible lag structure. (Caporale and doroodian, 1994), used generalized auto regressive conditional heleroscedasticity (GARCH) techniques to measure the volatility of exchange rate and discovered significant negative effect of volatility on import trade.

More recent work on the impact of exchange rate volatility on trade includes the works of (Hook and Boon, 2000). He used the VAR techniques and found negative effect of exchange rate volatility on trade. Das (2003), used an error correction model and co-integration and found significant negative effect on export. Baak (2004), using the OLS method, found significant negative effect on export. For more empirical analysis on the impact of exchange rate volatility on trade, see: Vergil (2002), Tenrayro (2004), (Kasman & Kasman, 2005), (Hwang and Lee, 2005) and (Lee and Saucier, 2005).

In Nigeria, Ajayi (1988), and Osagie (1985), while taking the structuralist approach, in their study of external trade flow, opposed the adoption of a more flexible exchange rate policy in Nigeria. Their argument were based on the structuralist thesis that exchange rate devaluation would be stag-flationary and have no significant effect on the external trade balance in less developed countries. The findings of Ajayi (1988), and Osagie (1978), supports an earlier study by Ojo (1978), who suggests that exchange rate changes need not play any significant role in the explanation of Nigerian import-export balance.

Aliyu (2007), uses a gravitational model for Nigerian-Indian bilateral trade and discovered that exchange rate coefficient is theoretically consistent and statistically significant in the import model for Indian economy but not for Nigerian economy. However, Oyejide (1986), Ihemodu (1993), discovered that exchange rate depreciation caused significant changes in the structure and volume of Nigeria agricultural exports. Egwaikhide (1999), in his dynamic specification model of import determinant in Nigeria from 1953 to 1989 discovered that short run changes in the availability of foreign exchange earnings, relative prices and real output (income), significantly explained the growth of total import in Nigeria.

Aliyu (2007), shows that exchange rate significantly affects import more than export due largely to the mono-cultural nature of Nigeria export and inexhaustible and multifarious nature of imports.

According to a study by the C.B.N. (2007), using the fundamental variables: TOT, nominal effective exchange rate (NEER) and lagged real exchange rate, the findings suggest that the three variables accounted for 22, 55 and 99 per cent of variations in the independent variables respectively.

Osuntogun et al. (1993), in their analysis of strategic issues in promoting Nigeria's non oil export determined the effect of exchange rate uncertainty on Nigerian non-oil export performance as a side analysis. Theirs was a pioneering effort in Nigeria to determine the effect of exchange rate risk on exports. However, their model did not take into account the cross price effects. More so, estimates of the exchange rate risk obtained are not standard and are sensitive to the measure of exchange rate risk proxy that is used.

Empirically, the volatility trade link is ambiguous. Dornbusch (1993), observed that the effect of an appreciated exchange rate on trade would be to make the production of tradable unprofitable and non-tradable goods more profitable. In other words, import would be high while export would tend to be discouraged. Loaza et al. (2002), also found a negative relationship between over valuation and growth, holding other macro economic variables constant.

Conclusively, our review of the empirical studies leads us to conclude as other writers have done in the past that the evidence of the effect of exchange rate volatility on trade is mixed. It is not easy comparing the result of the different studies since the sample period, countries and more importantly, the measure of risk vary widely. In several cases, long-run measures are used that may be a better proxy for trend changes in the exchange rate than volatility. A large number of studies appear to favor the conventional assumption that exchange rate volatility depressed the level of trade, (Koray and lastropes, 1989), (Perre and Steinheir, 1989), Bini-Smaghi (1991), and Savvides (1992) etc. On the other hand, (Assery and Peel, 1991) and (Kroner and Lastrapes, 1993), found evidence of a positive effect of volatility on export volumes of some industrial countries.

Measuring Volatility

In the process of examining the effect of exchange rate volatility on trade, one of the major problems normally encountered by economist is how to measure volatility. According to Cote (1994), a lot of considerations are involved in measuring exchange rate volatility. They include: whether it should be bilateral or effective, real or nominal. Also, to be considered is the appropriate way of measuring risk. Whether it should be: short run versus long run horizon, ex ante versus ex post, sustained deviation from trend versus period to period movement.

According to Pickard (2003), two common measures of volatility are: the standard deviation (or variance) of real and/or nominal exchange rate levels and the differential between the forward and current exchange rates.

Apart from the above two measures of volatility, numerous other methods have been used to measure volatility in exchange rate. They include the popularly known Box-Jenkins (BJ) methodology but technically known as the ARIMA (Autoregressive moving average) methodology which focuses on analyzing the probabilistic, or stochastic properties of economic time series, the (ARCH) autoregressive conditional heteroscedasticity model developed by Engle (1982), which model the first differences of economic variables (because of their non-stationary natures). The ARCH model was later generalized by Bollerslev (1986), to form what is popularly known as the GARCH model. Also in use is the vector Autoregression (VAR) methodology which was developed by Sims (1980).

According to Pickard (2003), no consensus have been reached as to the best measure of volatility, and the tendency for exchange rate data to have skewed distributions or volatility clusters have been used to argue against the use of simple descriptive statistics to measure volatility.

It is worthwhile to note that many empirical analyses have stressed the importance of choosing the best measure of volatility without first properly defining the difference between expected and unexpected volatility.

Similar to much of modern consumer theory, where the expectations of consumers are what matters, it is argued that economic agents' expectations of exchange rate volatility are what effects trade levels Pickard (2003).

METHODOLOGY

Theoretical Underpinnings

A variety of models exist as framework for analyzing the effect of exchange rate volatility on export growth. Although a micro-economic perspective is adopted in almost all the models, their analysis generates important implications for the macro-economy. An idea common to almost all the models is their general interpretation of exchange rate volatility in terms of risk, which will elicit different reactions from exporters. Under this setting, an exporter is either very risk averse or less risk averse. Risks avert exporters view adverse exchange rate movement as permanent and in order to protect their income level, may increase export activities. This is an income effect that tends to increase export volume. Conversely, where the exporter is less risk averse, adverse exchange rate movement is usually interpreted in terms of greater risk. Consequently, the exporter would divert resources from export activities into their domestic substitute. Such a substitute effect would be mirrored in declining export volume.

The model adopted by this study is the Risk-portfolio approach earlier used by De Grauwe (1988), and Oluremi (1998).Consider an individual exporter who produces for both foreign and domestic markets. The exporters' gross revenue would be represented as:

Table 1. Summary of some Empirical Literatures

Author/Year	Nature of Data	Risk measure	Methodology	Findings
Belenger et al (1988)	Quarterly	Squared of forecast error defined as 90 day forward spread	U.S export volumes to Canada: 5 sectors IVF	Significant and negative in two sectors
Bailey and Tavlas (1988)	Quarterly	Deviation between REER and NEER	OLS	Not significant
Asseery and Peel (1991)	Quarterly	Squared residual from ARIMA process fitted to RER	OLS – ECM	Significant and positive except for U.K
Kroner and Lastrapes (1993)	Monthly	Nominal exchange rate	GARCH Model	Significant, varied signs and magnitude
Gagnon (1993)	Quarterly	Real exchange rate	Simulation analysis	Not statistically significant
Bini-Smaghi	Quarterly	Nominal	OLS	Significant and negative effects in volumes
Mann (1989)	Quarterly	Nominal effective rate	OLS	Few significant
Feenstra and Kendall (1991)	Quarterly		GARCH	Negative effect
Brada and Mundeze (1988)	Annual	Real exchange rate	Cross section	Positive effect
Frankel and Wei (1993)	Annual	NER and RER	Cross section OLS and IV	Small effect, negative in 1980, positive in 1990
Savvides (1992)	Annual	RER	Cross section	Significant negative effect
Koray and lastrapes (1989)	Monthly	REER	VAR	Weak negative relationship
Flam and Jansson (2000)	Annual	RER	Co-integration Analysis	Negative effect
Caporale and Doroondian (1994)	Monthly	RER	GARCH/joint estimation	Negative effect
Hook and Boon (200)	Quarterly	RER and NER	VAR	Negative effect on export
Das (2003)	Quarterly	RER and NER	ECM and co-integration	Significant negative effect on export
Arize et al (2005)	Quarterly	RER	Cointegration, ECM	Negative effect on export
Tenrayo (2004)	Annual	NER	Gravity model	Insignificant and no effect on trade
Kasman and Kasman (2005)	Quarterly	RER	Cointegration, ECM	Significant positive effect on export
Hwang and Lee (2005)	Monthly	RER	GARCH Model	Positive effect on import and insignificant effect on export
Lee and Saucier (2005)	Quarterly	NER	ARCH-GARCH Model	Negative effect on trade
Ojo (1978)	Annual	NER	Time series	Insignificant effect on export import balance
Aliyu (2007)	Annual	RER	Gravitational Model	Not significant in import model of NIG
Oyejide (1986)	Quarterly	RER	Time series	Significant effect in agric export
C.B.N (2007)	Annual	RER	Time series	
Egwaikhide (1999)	Annual	NER	Dynamic specification Model	Significant effect on import not export

$$Y = eP_f q(X_f) + P_d q(X_d) \ldots\ldots\ldots\ldots\ldots\ldots 1$$

Where a tilde in each variable indicate its random nature; e is exchange rate; P_f is the price of the output sold in the foreign market measured in domestic currency; P_d is the price of the output sold domestically; and $eP_f = P_d$, suggesting an absence of market segmentation. If it is assumed that similar technology is used in producing for both foreign and domestic market, then $q(X_f)$ refers to the quantity produced for the foreign market from using X_f amount of resources, and $q(X_d)$ is the quantity produced for the domestic market from using (X_d) amount of resources.

The exporter maximizes expected utility defined over gross revenue so that,

$$\max E\{U(\tilde{Y})\} = E\{U[eP_f q(X + P_d q(X_d)]\} \ldots\ldots\ldots\ldots\ldots\ldots 2$$

Where U is a concave function of Y. In other words, the exporter is assumed to be risk averse. The first order condition for maximization is by taking the first partial differentiation as follows:

$$\delta E/\delta X_f = E\{U^{'}(\tilde{Y})[eP_f q(X_f) - P_d q(X_d)]\}(eP_f q) \ldots\ldots\ldots\ldots 3$$

Equation 3 can be written as:

$$E[U^1(\tilde{Y})e] = P_d/P_f \cdot q^1(X_d)/q^1(X_f) \cdot U^1(Y) \ldots\ldots\ldots\ldots\ldots\ldots 4$$

To demonstrate how an increase in movement of e affects the optimal amount of resources put into export production (i.e.,X_f), we follow De Grauwe (1988), by considering how a "mean preserving" spread in e affects $E[U^1(\tilde{Y})e]$. A mean preserving spread is defined as the effect of an increase in exchange rate risk. If such an increase raises $E[U^1(\tilde{Y})e]$ then the right hand side of equation 4 must also increase, and this can only occur if X_f increases. In other words, if exchange rate movement increases the expected marginal utility of gross revenue, then such a movement will lead to more export production and vice verse.

The over ridding issue is whether the function $U^1(\tilde{Y})\bar{e}$ is convex or concave in e. If it is convex (concave), then every mean-preserving increase in the spread of e will increase (decrease) the expected value of the function $U^1(\tilde{Y})e$. The condition under which the function $U^1(Y)e$ is convex or concave can be found by differentiating it twice with respect to e, this gives:

$$d^{2U1(Y)e}/d^2e = 1/e[R(1-R) + R^1Y] \ldots\ldots\ldots\ldots\ldots\ldots 5$$

Where $R = U^{11}(Y)/U^1(Y)$ is the coefficient of relative risk aversion. If equation 5 is positive (negative), then the function $U^1(Y)$ is convex (concave). It follows therefore that convexity or concavity depends on the degree of risk aversion. If it is assumed conventionally that the coefficient of relative risk aversion R is constant, then $R^1 = O$. By implication, convexity holds if R>1 and concavity holds if R<1.

Thus, if exporters are sufficiently risk averse (R>1), an increase in exchange rate risk raises the expected marginal utility of gross revenue and therefore induces them to increase their export activities. However, if exporters are less risk averse, (R<1), a higher exchange rate risk reduces the expected marginal utility of gross revenue and therefore leads them to produce less for export.

Empirical Model

From the risk model specified above, an appropriate equation of net-export growth for the economies would be one that combines the effect of RER movement as demonstrated in the preceding section with other factors suggested by conventional economic theory as influencing export growth. In line with the variables incorporated by Oluremi (1998), and Aliyu (2008), we have

$$NX = F(FY, RP, OPN, V) \ldots\ldots\ldots\ldots\ldots\ldots 6$$
$$\quad + \quad + \quad + \quad -$$

Where

NX = net-export volume, FY = is foreign (trade partners) real income

RP = relative prices (RER), OPN= index of openness, V = exchange rate volatility

In a linear form, equation 6 can be expressed as follows:

$$NX = bo + b_1FY + b_2RP + b_3OPN + b_4V + e \ldots\ldots\ldots\ldots\ldots\ldots 7$$

In natural logarithm form equation 7can be expressed as follows:

$$InNX = bo + b_1InFY + b_2\,InRP + b_3InOPN + b_4\,InV + e \ldots\ldots\ldots 8$$

For the hypothesis that exchange rate volatility has significant impact on net-export to be accepted for each country, b_4 is expected to be significantly different from zero.

Measurement of Variables

The variables used to explain the pattern of the countries net-export trade include: exchange rate volatility (V), foreign real income (FY), relative prices (RP), and index of openness (OPN). These variables are hereby defined as they are applied in the analysis.

There are armful literatures on the measurement of exchange rate volatility. This research work, in line with Toshihiro (2004), measures exchange rate volatility as the logarithm of the 5-year standard deviation of each series of quarterly observation from the average real exchange rate vis-a-vis the United States dollar. Thus

$$V = log\left|\sqrt{\frac{1}{n}\sum\left(RER - \overline{RER}\right)^2}\right| \quad \text{.....9}$$

Real foreign income (FY) is the real income of trading partners, for the purpose of this study; it is proxied by the real U.S GDP. The data series of real U.S GDP is obtained from WDI online data base and converted into natural log to obtain several degree of elasticity.

A relative price (RP) is an indicator of external competitiveness and is measured as the natural logarithm of real exchange rate of the currencies.

The index of openness is measured in line with Aliyu (2008), as the sum of total trade, imports and exports divided by gross domestic products. The data is also converted into natural log.

Method of Data Analysis

The data generated for the study was analyzed using both descriptive and econometric analytical method. The econometric method employed is the Ordinary Least Square (OLS) technique which has the advantage of the best linear unbiased estimator (BLUE) property. Results based on OLS are generated using E-Views 7.1 in order to capture the impact of exchange rate volatility on net export. The data series is tested for stationarity data using the Augmented Dickey-Fuller (ADF) test and the Phillip-Perron (PP) test. This process examines the time series characteristics of the selected variables to overcome the problem of spurious correlation often associated with non-stationary time series data and generate long run relationship concurrently.

Estimation of Parameters

The unit root test is the first estimation procedure applied to the data. It is important because it allows us to examine whether a time series data is stationary or not. To avoid running a spurious regression, the unit root test is inevitable because by so doing, we ensure the validity of the usual test statistics which include the t, F and R^2 statistics. Stationarity could be achieved by appropriate differentiation which is called the order of integration. The Augmented Dickey-Fuller test and Phillip-Perron test is used to check the stationarity of the tested variables. The ADF test is based on the following regression equation:

$$\Delta Y_t = b_1 + b_2 t + \delta Y_{t-1} + \Sigma \alpha i \Delta Y_{t-1} + \varepsilon_t \text{.....10}$$

Where: Y = time series, t = linear time trend, Δ = difference operator

b_1= constant, n = optimum number of lags on dependent variable

ε = random white noise or error term

Apart from the unit root test, the existence of long run equilibrium (stationary) relationship among the variable is tested. The existence of long run equilibrium relationship among economic variables is referred to as co-integration. The Johansen procedure is employed, to examine the question of co-integration. Johansen (1995), developed a VAR-Based co-integration test, the specification of which runs as follows:

Consider a VAR of order:

$$Yt = A_1 yt - 1 + \ldots + Apyt - p + Bxt + \varepsilon t \text{ .....11}$$

Where: Yt is a k vector of endogenous variables, xt is a d vector of exogenous variables, A1……Ap and B are matrices of coefficients to be estimated, and et is a vector of innovations or impulse or shocks.

In matrix format the VAR equation is presented as follows:

$$\begin{bmatrix} \ln nx_t \\ \ln fy_t \\ \ln rp_t \\ \ln opn_t \\ \ln v_t \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \\ \alpha_5 \end{bmatrix} + \sum_{i=1}^{k} \begin{bmatrix} \beta_{11i} & \beta_{12i} & \beta_{13i} & \beta_{14i} & \beta_{15i} & \beta_{16i} \\ \beta_{21i} & \beta_{22i} & \beta_{23i} & \beta_{24i} & \beta_{25i} & \beta_{26i} \\ \beta_{31i} & \beta_{32i} & \beta_{33i} & \beta_{34i} & \beta_{35i} & \beta_{36i} \\ \beta_{41i} & \beta_{42i} & \beta_{43i} & \beta_{44i} & \beta_{45i} & \beta_{46i} \\ \beta_{51i} & \beta_{52i} & \beta_{53i} & \beta_{54i} & \beta_{55i} & \beta_{56i} \end{bmatrix} \begin{bmatrix} \ln nx_{t-i} \\ \ln fy_{t-i} \\ \ln rpt - i_{-it} \\ \ln opn_{t-i} \\ \ln v_{t-i} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \end{bmatrix} \quad \text{.....12}$$

Table 2. Unit root test for variables using ADF and PP tests

	ADF test	PP test
	First difference	
Critical values		
1%	-3.6576	-3.6496
5%	-2.9591	-2.9558
10%	-2.6181	-2.6164
Variables	ADF value	PP value
	Nigeria (1975-2008)	
Lnnx	-6.174800*	-7.673534*
Lnfy	-3.598839**	-3.985214*
Lnrp	-3.417582**	-4.503202*
Lnopn	-5.784109*	-8.625257*
Lnv	-4.088444*	-5.646933*
	Cote d'voire (1975-2008)	
Lnnx	-5.340071*	-7.892512*
Lnfy	-3.558093**	-3.985214*
Lnrp	-4.085893*	-5.739185*
Lnopn	-5.327938*	-7.601736*
Lnv	-4.672264*	-7.456922*
	Gambia (1975-2008)	
Lnnx	-4.047213*	-6.427212*
Lnfy	-3.558093**	-3.985214*
Lnrp	-3.142559**	-4.443732*
Lnopn	-3.550979**	-6.245792*
Lnv	-4.117598*	-7.559455*
	Ghana (1975-2008)	
Lnnx	-5.882598*	-12.85022*
Lnfy	-3.558093**	-3.985214*
Lnrp	-3.324976**	5.469239*
Lnopn	-7.677121*	-12.22039*
Lnv	-4.094027*	-8.304859*
	Togo (1975-2008)	
Lnnx	-4.941530*	-7.869587*
Lnfy	-3.558093**	-3.985214*
Lnrp	-4.7515568*	-6.466481*
Lnopn	-5.242823*	-4.894924*
Lnv	-3.999887*	-4.446013*

ANALYSIS OF DATA AND DISCUSSION OF RESULTS

Since time series data were used for the analysis, it is necessary to start by examining the time properties of the data. Such time properties of interest include the test for the stationarity and the co-integration test of the data.

Unit Root Tests

We begin this analysis by examining the time properties of the data. This is done in order to avoid running a spurious regression. The orders of integration of the variables are examined using the Augmented Dickey-Fuller (ADF) and the Phillip-Perron (PP) test statistics. The result of this test is presented in (table 2),

(Table 2), shows the result of the unit root test of the variables using the Augmented Dickey-Fuller and the Phillip-Perron test statistics. All the variables (natural log of net-export, foreign income, relative prices, index of openness and real exchange rate volatility) for all the countries are integrated at their first difference (i.e. of order {1(1)}, at 5% critical value based on the Augmented Dickey-Fuller (ADF) tests. The Philip-Perron (PP) tests statistics also indicates that all the variables are integrated of order {1(1)} at the 5% critical value. This shows that the variables were found to be stationary after the first difference for all the countries.

Lag Length Determination

The lag length for co-integration analysis was determined using Akaike Information Criteria (AIC) and Schwarz Bayesian

Table 3. Lag Length Selection

Countries	AIC	SBC
Nigeria	1	1
Gambia	1	1
Ghana	1	2
Cote d'Ivoire	1	2
Togo	1	3

Criteria (SBC). The lag length selected for each country on the basics of AIC and SBC are reported in (table 3).

Co-integration Test

Having determined that the variables are integrated of order one, we move forward to determine if the variables are co-integrated using the Johansen procedure. The Johansen procedure shows the long-run equilibrium relationship between two or more economic series. In conducting the co-integration test, we utilized unrestricted intercept and no trend in the VAR, the result of this analysis is presented in (table 4).

Table four shows the result of the co-integration test applying Johansen's maximum likelihood technique, which also shows the long run equilibrium relationship among the variables. The first and second column shows the null and alternative hypothesis, the third and fourth column shows thetrace statistics and the critical value at 0.05 levels of significance, the fifth and sixth column showcase the maximum eigen value statistics and its critical value at 0.05 levels of significance respectively, while the last column showcase the eigen value statistics.

According to the Johansen test results as presented in (table 4), the series are co-integrated. Both trace statistics and maximum eigen value suggest at least r = 1 (one co-integrating vector) for all the economies under investigation. Some economies have more than one co-integrating vector. For Ghana and Nigerian Economy, trace statistics detects two co-integrating vectors. That is the hypothesis that r = 0 is rejected against r = 1 but the hypothesis that r = 1 cannot be rejected against r = 2. The Togo economy has four co-integrating vectors. In all cases, the eigen value statistics drops sharply for alternative hypothesis of five co-integrating vectors (r = 5). Thus we conclude that our model with five variables is a fair representation of five countries and that a stable long-run relationship exists between the variables under study for all the five countries.

In estimating the long-run co-integration coefficients, we assume r = 1 for all the countries. The results are reported in (table 5).The results in (table 5), gives the long run estimates of imposed restrictions on the net export function. From the results, foreign income (Infy) is consistent with the stated a-priori sign (positive) for four countries namely: Gambia, Ghana, Cote d'Ivoire and Togo but is inconsistent with the stated a-priori sign for the Nigerian economy. At 5% level, foreign income (Infy) is statistically significant for all the countries except for Gambia, where it is found not to be statistically significant. The inconsistency of the coefficient of foreign income to a-priori sign for Nigerian economy may stem from the low level of export of the Nigerian economy or from the monocultural nature of export. In all cases, the magnitude of the coefficient of foreign income for all the countries is low and below unity except for Togo economy, where it is above unity. This implies that a 1% change in foreign income will bring about at least a 0.92%, 1.97%, 0.17% and 4.14% increase in net-export in Gambia, Ghana, Cote d'Ivoire and Togo respectively, while it will reduce net-export by 4.03% for the Nigerian economy.

More so, relative price (LNRP) is consistent with the stated a-priori sign (positive) for four countries: Nigeria, Gambia, Ghana and Cote d'voire but it does not conform to the stated a-priori sign for Togo. At 5% level, it is statistically significant in four countries namely: Nigeria, Gambia, Cote d'Ivoire and Togo. For the Ghana economy, it is found not to be statistically significant at 5% levels. The insignificance of the coefficient of relative price for the Ghana economy may be as a result of the fluctuations in exchange rate over time. For all the countries, the magnitude of the coefficient of relative price is also low and less than unity except for Gambia where it is above unity. This implies that a 1% change (increase/decrease) in relative price, will bring about at least a 0.63%, 4.63%, 0.043% and 0.45% increase in net-export for the Nigeria, Gambia, Ghana and Cote d'Ivoire economy respectively, while it will bring about a 3.09% decrease in export for Togo.

Index of openness (Inopn) is consistent with the stated a-priori sign (positive) in four counties namely: Nigeria, Gambia, Cote d'Ivoire and Togo but it is not consistent with the stated a-priori sign for Ghana. At 5% level, it is statistically significant

Table 4. Co-integration test with unrestricted intercept and no trend in VAR

		Trace		λ –max		
Null	Alternative	Statistics	5%	Statistics	5%	Eigenvalue
			Nigeria			
r = 0	r = 1	89.56307	69.81889	41.64870	33.87687	0.759853
r ≤ 1	r = 2	47.91437	47.85613	27.58434	27.58434	0.522381
r ≤ 2	r = 3	20.50176	29.79707	14.88295	21.13162	0.481508
r ≤ 3	r = 4	5.618816	15.49471	5.473645	14.26460	0.217032
r ≤ 4	r = 5	o.145171	3.841466	0.145171	3.841466	0.027380
			Gambia			
r = 0	r = 1	78.50482	69.81889	35.56160	33.87687	0.759853
r ≤ 1	r = 2	42.94322	47.85613	21.01002	27.58434	0.522381
r ≤ 2	r = 3	21.93320	29.79707	15.28011	21.13162	0.481508
r ≤ 3	r = 4	6.653094	15.49471	5.237626	14.26460	0.217032
r ≤ 4	r = 5	1.415469	3.841466	1.415469	3.841466	0.027380
			Ghana			
r = 0	r = 1	145.6010	69.81889	82.72101	33.87687	0.759853
r ≤ 1	r = 2	62.87994	47.85613	38.14225	27.58434	0.522381
r ≤ 2	r = 3	24.73770	29.79707	12.41520	21.13162	0.481508
r ≤ 3	r = 4	12.32250	15.49471	12.07106	14.26460	0.217032
r ≤ 4	r = 5	0.251443	3.841466	0.251443	3.841466	0.027380
			Cote d'Ivoire			
r = 0	r = 1	83.55699	69.81889	38.51566	33.87687	0.759853
r ≤ 1	r = 2	45.04133	47.85613	19.95143	27.58434	0.522381
r ≤ 2	r = 3	25.08990	29.79707	17.73441	21.13162	0.481508
r ≤ 3	r = 4	7.355489	15.49471	6.605925	14.26460	0.217032
r ≤ 4	r = 5	0.749565	3.841466	0.749565	3.841466	0.027380
			Togo			
r = 0	r = 1	293.5694	69.81889	166.8144	33.87687	0.759853
r ≤ 1	r = 2	126.7550	47.85613	56.63912	27.58434	0.522381
r ≤ 2	r = 3	70.11591	29.79707	50.56819	21.13162	0.481508
r ≤ 3	r = 4	19.54773	15.49471	19.19850	14.26460	0.217032
r ≤ 4	r = 5	0.349223	3.841466	0.349223	3.841466	0.027380

for all the countries. The magnitude of the coefficient of index of openness for all the countries is high and above unity except for Ghana, where it is below unity. This implies that a 1% change in the openness index will bring about at least a 17.7%. 9.18%, 20.3% and 1.12% increase in Nigeria, Gambia, Cote d'Ivoire and Togo economies respectively, while it will bring about at least a 0.16% decrease in net-export for Ghana.

For exchange rate volatility, which is the core variable under consideration, it is found to be consistent with the stated a-priori sign (negative) in only one country namely Cote d'Ivoire while it is inconsistent with the stated economic a-priori sign for the other four countries. At 5% level, the natural log of exchange rate volatility (Inv) is found to be statistically significant for three countries namely: Nigeria, Gambia and Ghana. It is found not to be statistically significant for Cote d'Ivoire, while it is found to be statistically significant at 10% level for the Togo economy. The nonconformity of the coefficient of exchange rate volatility to a-priori sign for the four countries goes to support the assertions by some authors De Grauwe (1998), (Assery and Peel 1991), (Brada and Mundez, 1998) etc of the existence of a positive impact of exchange rate volatility on export trade. The conformity of the coefficient of exchange rate volatility to stated economic a-priori criteria sign for Cote d'Ivoire lends credence to the assertions made by other authors Savvises (1992), (Koray and Lastrapes 1989), Bellenger et al. (1988), (Hook and Boon, 2000), Arize (2005), etc of the existence of a negative impact of exchange rate volatility on export trade. In all cases, the

Table 5. Estimates of Restricted Co-integration Relations

	Variables				
Countries	Innx	Infy	Inrp	Inopn	Inv
Nigeria	1	-4.031032* (0.73784)	0.630690* (0.08610)	17.77459* (0.93657)	0.869259* (0.11478)
Gambia	1	0.920207 (1.24175)	4.635196* (1.16260)	9.185454* (1.05498)	0.523938* (0.18349)
Ghana	1	1.970935* (0.14745)	0.043944 (0.03676)	-0.160183* (0.08056)	1.176308* (0.08815)
Cote d'Ivoire	1	0.177641* (0.03390)	0.458653* (0.07089)	20.37993* (0.25433)	-0.003329 (0.00910)
Togo	1	4.14986* (0.12756)	-3.098558* (0.30638)	1.129021* (0.20343)	0.029089** (0.01867)

Note: (i) * and ** indicates significance at 5% and 10% respectively.
(ii) The figures in parenthesis are the standard errors of the estimates.

magnitude of the coefficient of exchange rate volatility is low and below unity except for Ghana where it is slightly above unity. This implies that a 1% change in the level of volatility will bring about at least a 0.86%, 0.52%, 1.17% and 0.02% increase in net-export in Nigeria, Gambia, Ghana, and Togo respectively, while it will bring about at least a 0.003% decrease in Cote d'Ivoire.

Are there any policy implications from these results? Some possible implication of this result is that volatility of exchange rate does not really have the same effects on the export of all countries. While it impacts the export of some countries positively, it has a negative impact on others. Since exchange rate volatility is widely interpreted in terms of risk, it is plausible to assume that the nature of impact (whether positive or negative) which it has on a country could likely be explained by the nature of exchange rate policy put in place by the authorities, the nature of export and export portfolio and the response of exporters to changes in exchange rate. More so, the appreciation of exchange rate normally tends to reduce export and increase import. This is because; goods and services from a country whose currency appreciates relative to others will be uncompetitive in the international market. The imported goods and services will appear to be relatively cheaper in the home country compared to locally produced goods and services. This can compound the problem of balance of payment and current account deficit leading consequently to the decline of foreign reserves.

The nature of export and the type of export portfolio which a country has can also determine the type and level of impact which volatility in its exchange rate will have on its export. This is because; it is the opinion of some authors that it is not only the volatility of a country's exchange rate that affects its level of exports but also the volatility of its trading partners (Esquivel and Larraine, 2002). If a country is dependent on one product for its foreign earnings as it is the case with Nigeria, the volatility of exchange rate of its partners may affect it adversely when these exchange rates appreciates. This calls for export diversification in order to reduce the impact of trading partners' exchange rate volatility on the home country.

The level to which a country is open to international transactions may determine the rate at which volatility in exchange rate may impact its export transactions. From the results, the log of index of openness is statistically significant for all the countries. This shows that for countries that are relatively less open to international trade, the volatility in exchange rate is more likely to impact the level of export more adversely.

It also appears from the result that exchange rate volatility depresses trade in one country (Cote d'Ivoire) while in the other four countries; its impact seems to be growth enhancing.

CONCLUSION

The major focus of this research work is to analyze the impact of exchange rate volatility on net-export. To do this, we used a sample of West African economies namely Nigeria, Gambia, Ghana, Cote d'Ivoire and Togo. A risk model for the economies, which was anchored on the risk portfolio school hypothesis, was adopted. This hypothesis posits that risk aversion may not be sufficient to conclude that exchange rate volatility reduces the level of trade. The Johansen co-integration procedure was used to analyze the data set for the countries under consideration. The result of the restricted co-

integration relation suggests that the volatility of exchange rate, depresses export growth in Cote d'Ivoire. The impact on Nigeria, Gambia, Ghana and Togo seems to be export enhancing. For all the economies included, the Johansen co-integration relation also indicates the presence of a long-run stable relationship among the variables.

We do not claim the results presented here are as robust as it might be affected by data constructions, sources, and technique of estimation. However, these findings suggests that a reduction in the volume of exchange rate volatility and a better exchange rate management frameworks may be desirable in order to promote more export in the countries.

A higher level of export is no doubt necessary for a much needed foreign income earning which will in due course, put a country on a part of economic growth and development. But this may not be possible, when volatility in exchange rate and other unforeseen economic variables are at work. There is the need for these African economies to be among the top 20 economies by the year 2020 and for this to be possible, there must be more efforts made to reduce the level of volatility in the exchange rate, to increase foreign earning and encourage export production. This can be achieved, when the key policy actions recommended as follows is adopted.

RECOMMENDATION

In the light of the foregoing findings, the following key policy actions are hereby recommended:

1. There is need to reduce to the lowest minimum, the level of volatility associated with the exchange rate of the countries under consideration. This can be accomplished through putting in place appropriate exchange rate policies aimed at maintaining stability in the exchange rate market. This when achieved will to a large extent reduce the risk encountered by exporters which would to a large extent boost the level of export. Enacting appropriate exchange rate policies may not just be enough; there is the need for conscientious monitoring and proper implementation.

2. Export diversification, creating and maintaining a stable macroeconomic environment which provides exporters with the much needed adequate incentive for export promotion is necessary to boost export investment in the countries. This can be achieved by granting export incentives, tax exemptions, tax holidays and low export tariffs to exporters of goods and services.

3. There is need for an increased openness of the economies to international trade. This can be accomplished through the removal of most policy measures that in any way restrict the level of export activities.

4. Provision of finance for export oriented enterprises (export financing) is necessary in these economies. Export production, more especially in finished product is capital intensive and as such, it may be difficult for some enterprises to embark upon even when they are ready to try because of the financial obligations involved.

Conflict of interest

Authors have none to declare

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