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Keywords: co-integration; cotton lint; determinant; export growth; international trade; chad.

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Determinants of Agricultural Export Trade: A Co-Integration Analysis for Cotton Lint Exports from Chad

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Abstract- Following the dramatic decline in Chad's performance for production and export of cotton lint (from leading producer and among leading exporters in the 1960s to being at the bottom in rank among the C-4 countries of WCA since 1998), use is made of the Johansen Full Information Maximum Likelihood test to identify and estimate the magnitude and effects of key determinants of exports from the country. In this regard, I defined and estimated two primary co-integrating and error correction equations using volume and value of exports as dependent variables in the respective equations. Diagnostic tests performed revealed that the estimates observed are stable, and residuals for the respective models are normally distributed, non-serially correlated and homoscedastic. Results of the study show that cotton production, competitiveness of the country in exports of the commodity, volume of world exports of the commodity, and export price faced by the country are key determinants of export growth. Policies implemented in both the internal and external environments are noted to have had more harmful than beneficial implications for the cotton industry. In as much as volume of exports is found to be driven by both internal and external forces, the value of exports on the other hand is found to be driven more by external forces than internal forces. To awaken the cotton export industry from its present slumber, measures should be put in place to significantly increase production and improve on the country's competitiveness in export of the commodity. In addition, measures should be put in place to address existing inefficiencies in the domestic policy environment, as this could suitably position the country to benefit from increases in international trade. Minimization of distortions on the international market for cotton lint could as well play a significant role in reviving the cotton export industry for Chad.

Keywords: co-integration; cotton lint; determinant; export growth; international trade; chad.

I. INTRODUCTION

A gricultural export trade has received much international attention due to fragile nature of the sector, volatile nature of world prices for agricultural commodities, and to trade distortions induced by major players in various agricultural commodity markets. The world cotton market is one of the numerous agricultural markets that have attracted and received immense research attention over the past two to three decades. Majority of the researches conducted so far in this regard have focused on identifying relevant implications of subsidies and other distortions on trade and on farm-households and exporters in agriculture-founded economies, notably the C-4 countries of WCA (namely Burkina Faso, Benin, Chad and Mali). Majority of such studies have through simulations of price impact, specifically of cotton subsidies, confirmed losses to exporters, marketers and farmers in the aforementioned countries and elsewhere (Alston and Brunke 2006; Goreux 2003; Anderson and Valenzuela 2006). Dedication of time and energy towards identifying implications of such distortionary measures on the economies of these countries is due to the fact that, downward pressure induced on world cotton prices harms millions of households and over 10 million people across West and Central Africa region (Alston et al 2007). Although distortionary measures on the world cotton market are believed to harm farmers and exporters in all the C-4 countries and other developing economies, emphasis in this study would be placed on Chad as an entity/country whose cotton production and export industry has in the midst of such distortions and domestic inefficiencies witnessed a more or less continuous decline in performance since the year 1997 even when other countries in the region (e.g. Mali and Burkina Faso) witnessed significant increases in these indicators along the line. Chad has lost its stand of being the highest producer and among the leading exporters in the C-4 during the 1960s and 1970s to being at the bottom in rank among the four countries in terms of cotton production and exports.

Previously deemed an agrarian economy, Chad has attracted much international and local attention since the year 1928, following the introduction and cultivation of cotton in the country. From virtual nonexistence in the pre-1928 period, cotton production in the country grew steadily to 40,000 tonnes during the early 1960s, making the country the leading producer in West and Central Africa (Baffes 2007). Since its introduction, cotton has played and continues to play relevant roles in the Chadian economy. Besides income generation for farmers through production, processing and domestic marketing, cotton exports in the form of lint (about 96 percent of total production) facilitates earning of foreign exchange and generation of government revenues through taxes on local production.

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The cotton industry employs over 40 percent of the country's total population (about 2 million people). Although in decline, the cotton sector as of the year 2007 accounted for 20 percent of the country's total merchandize exports and 2.4 percent of GDP in 2001-2003 (Baffes 2007). By estimates of the FAO, cotton lint exports accounted for 42.09 percent of total value of agricultural exports from the country during the period 2005-2011. Due to the important role cotton played in the Chadian economy during the late 1920s to 1970s, the industry received great amount of attention from various stakeholders (including Cotontchad, DAGRIS and the local private banking sector). Supports in various forms helped increase not only production, but as well paved room for value addition and exports.

Until the year 2003, where crude oil displaced cotton as the key source of income for the government, the cotton sector served as the basic foundation for development of the Chadian economy. Following recession in the world cotton market between 1991 and 1993 however, most of the initiatives used for stimulating growth in the Chadian cotton sector (including stabilization of prices paid to peasant producers) were withdrawn. The decline in world cotton prices in 1985, the recession of 1991-1993, existing domestic inefficiencies, and downward pressure on world cotton prices due to continuous use of subsidies by major players on the world cotton market among other factors have pulled Chad from its reputable position in cotton production and exports during the 1960s to 1970s, to being the least in production and exports among the C-4 countries. As shown in figure 1, volume of exports of cotton from the country decreased from 72,000 tonnes in 1997 to as low as 10,462 tonnes in 2010 (increasing thereafter to 14,995 tonnes). The corresponding figures for the years 1997 and 2010 in terms of value are respectively \$113,000 (thousand) and \$18,000 (thousand) (increasing thereafter to \$41,921(thousand) in 2011). In spite of all attempts by the government to revive the sector since the year 2000, there is yet to be seen any major improvement in the sector's production and exports of cotton (most importantly cotton lint exports as it represents approximately 96 percent of the country's cotton production). It is in this regard, that I source identification of key determinants of cotton lint exports from Chad to help inform policy prescriptions on relevant agricultural and trade policies needed. In achieving this however, I employ the Johansen Full Information Maximum Likelihood test (for co-integration analysis). This approach facilitates estimation of both short- and long-run effects of key determinants of exports.



Figure 1 : Trends in Volume and Value of Cotton lint Exports from C-4 Countries in West and Central Africa *Data Source: Agricultural Trade Statistics of FAO (FAOSTAT)*

II. LITERATURE REVIEW

Knowing and understanding the mechanisms through which various economic and policy drivers influence exports is key to drafting and implementing appropriate trade policy measures to further stimulate exports and shield domestic industries from potential adverse implications of developments in international markets. Efforts made so far towards determining drivers of exports for various agricultural commodities have yielded quite interesting findings in economic, business and trade literature. In as much as some of the findings conform with economic and trade theories, others are either mixed signals or tend to disprove existing theories. In a study to assess the effect of agricultural and financial sector reforms on export of cotton lint from Pakistan, Anwar et al (2010) revealed that export of cotton lint is positively driven by increasing world demand for cotton, export competitiveness of the country, and increase in trade openness. In a study on performance, destinations, competitiveness and determinants for export of cucumber and Gherkin from India, Kumar et al (2008) discovered that a one percent increase in volume of international trade in the commodities under study leads to a 5.96 percent increase in demand for exports from India. Similarly, Kumar and Rai (2007) found a positive significant association between tomato exports from India and volume of international trade. Although increased production in an open economy is believed to stimulate export growth, Kumar and Rai (2007) found a significant negative association between exports of tomato and India's production of the commodity. In determining the key drivers of exports for fruits and vegetables from sub-Saharan Africa, Takane (2004) discovered that exports are driven by growing foreign demand, relatively short flight time, price competitiveness and market liberalization policies.

In contrast to the discovery by Kumar and Rai (2007) on the association between exports and production however, Nwachukuet al (2010) found a significant positive association between exports of cocoa and production for Nigeria. Apositive association between national exports and world volume of exports (as proxy for international trade) was however affirmed in this study as well. In a study on comparative analysis of economic reform and structural adjustment programme in Eastern Africa, Ngeno (1996) discovered that export growth is positively related to output level since higher production leads to increased export volumes. Similarly, Ball (1966) discovered that higher production stimulates export growth, while higher domestic demand dampens export growth. In investigating the determinants of export growth rate in Uganda for the period 1987-2006, Agasha (2009) found a significant negative association between foreign price level and exports in the long-run. This effect was deemed a mixed signal. In the short-run however, Agasha found a significant positive effect of foreign price on export growth at the second and third lags of foreign price level. In a similar study in Tanzania, Ndulu and Lipumba (1990) revealed that foreign prices of primary commodities significantly affect the export performance of country's involved in their production. Edwards and Golub (2004) also found a significant positive association between export supply for South Africa and foreign prices.

III. METHODOLOGY

a) Analytical Framework

Following trade liberalization in most developing countries and implications thereof, efforts have been made to assess responses of production and export dimensions forvarious industries worldwide to help inform policy decisions on implication of changes in some key development indicators. In such research and analytical efforts, one key technique that has received tremendous attention in economic, business and trade literature is co-integration analysis. This technique, unlike other approaches used to assess supply and production responses, helps in estimating both shortand long-run implications of changes in relevant development indicators. Three main approaches have been proposed in literature for performing co-integration analysis. These are the Engle-Granger two-step estimation technique (Engle and Granger 1987), Phillips-Ouliaris residual-based test (Phillips and Ouliaris 1998) and the Johansen Full Information Maximum Likelihood test (Johansen and Juselius 1990). Although deemed simple, intuitive and easy to perform, the Engle-Granger approach is flawed by small-sample biases (Stock, 1987; Bannerjeeet al 1986). This drawback is partly attributed to the fact that, in producing long-run estimates in the first stage, the approach tends to ignore short-run dynamics, thereby producing short-run estimates that are not guided by long-run estimates. This precludes potential consistency in estimates. In addition, both the Engle-Granger approach and the Phillips-Ouliaris residual-based test hold unto the assumption of a single co-integrating equation between variables, regardless of the number of variables considered in a system. This however does not reflect reality on the ground. In studying economic relationships, there exists a high probability of identifyingn-1 number of co-integrating equations between n variables. These flaws of the Engle-Granger and the Phillips-Ouliaris approaches are appropriately addressed through the use of vector co-integration techniques, noted amongst which is the Johansen Full Information Maximum Likelihood test. Accordingly, I employ the Johansen technique for my analysis.

The Johansen approach to co-integration analysis commences with the definition of a vector auto-regression given as follows:

$$X_t = \Pi_1 X_{t-1} + \Pi_2 X_{t-2} + \ldots + \Pi_p X_{t-p} + \mu_t$$
(1)

Where X_t represents an $(n \times 1)$ vector of I(1)(non-stationary) variables, Π_1 through Π_p represent (m×m) matrix of coefficient, and μ_t is (n×1) vector of innovations (white noise errors). Following definition of the vector auto-regression, appropriate lags are selected to guide identification of the number of cointegrating equations. Selection of appropriate lag order is sourced through the use of Akaike Information Criterion, Schwarz Criterion (SC) and the Hannan-Quinn Information Criterion (HQ). Lag order selected in this stage guides identification of the number of cointegrating equation(s) in the immediate succeeding stage. Test for the number of co-integrating equations is performed using two likelihood ratio (LR) tests proposed in economic, business and trade literature. These are the trace test statistic and the maximal-eigenvalue test. The trace test is a joint test of the null hypothesis of r cointegrating vectors against the alternative that it is greater than r. The trace test statistic is expressed as follows:

$$Jtrace(r) = -T \sum_{i=r+1}^{p} ln^{\frac{1}{10}} (1 - \lambda_i)$$
⁽²⁾

On the other hand, the maximal-eigenvalue test conducts separate tests on the individual eigenvalues for a null hypothesis that the number of co-integrating vectors is r, against an alternative of
$$r+1$$
. The maximal-eigenvalue test statistic is expressed as follows:

$$Imax(r, r+1) = -T \ln(1 - \lambda_{r+1})$$
(3)

Of these two likelihood ratio tests, the trace test according to Harris (1995) shows more robustness to both skewness and excess kurtosis in the innovations than the maximal-eigenvalue test. Accordingly, the trace test has been mostly used over the maximal-eigenvalue test in identification of co-integration equation(s). Confirmation of co-integrating relationships between variables in a system renders the vector auto-regression (VAR) model as specified in equation (1) inappropriate setup. In its stead, a special parameterization that supports analysis of the co-integrating structures is considered. This is primarily achieved through subtraction of Xt-1on both sides of equation (1). The resulting model is termed a vector equilibrium model (Lütkepohl and Krätzig 2004) or vector error correction model, and is expressed as follows:

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta X_{t-2} + \dots + \Gamma_{p-1} \Delta X_{t-p+1} - \Pi X_{t-p} + \mu_t$$

$$\Gamma_1 = \Pi_1 - I, \ \Gamma_2 = \Pi_2 - \Gamma_1, \ \Gamma_3 = \Pi_3 - \Gamma_2, \text{ and } \Pi = I - \Pi_1 - \Pi_2 - \dots - \Pi_p$$
(4)

In contrast to the I(1) (non-stationary) status of X_t in equation 1, ΔX_t in equation (4) is I(0) (stationary). In this regard, i= 1,2,...,p-1 are all stationary and u_t assumed to be I(0) as well. For the equation to be valid and meaningful, ΠX_{t-p} must also be stationary. In the above specification, the matrix Π determines the extent to which a given system is co-integrated and is referred to as the impact matrix (Ssekuma 2011). The matrix Π can further be decomposed into two unique sub matrices α and β , where α measures the rate at which deviations from the long-run equilibrium are restored in the current period (speed of adjustment of the system)

under study –also called the error correction coefficient) and β contains r co-integrating vectors. Γ_i in equation (4) represents short-run estimates, while Π contains the long-run estimates. In performing co-integration analysis however, all variables considered in a system are a priori treated endogenous unless some variables are found stationary at level. In the latter case, should the variables be perceived to have significant effect on the long-run co-integrating space and affect the short-run model, there arises a need to assume such variable(s) exogenous. In such situation, equation (4) can be rewritten as follows (Kuwornuet al 2011):

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta X_{t-2} + \dots + \Gamma_{p-1} \Delta X_{t-p+1} - \Pi X_{t-p} + \nu D_t + \mu_t$$
(5)

Where D_t represents the stationary (I(0)) variable(s). To appropriately capture rich dynamics in the system under study, Lütkepohl and Krätzig (2004) proposed the use of fewer but relevant variables. They debated that increasing the number of variable and equations (through use of inappropriate lags) does not generally lead to better model, but rather, it complicates things and precludes appropriate capturing of the dynamic, inter-temporal relocations between the variables considered. Along this same line of reasoning, Harris and Sollis (2003) advice the use of variables that have a high probability of affecting the short-run behavior of the model.

b) Model Specification

Although several indicators have been proposed in trade literature to affect exports of various agricultural commodities, in this study I stick to the use of fewer but relevant variables among the lots noted in literature. I however estimate two separate models. In Model 1, I set volume of cotton lint exports as the dependent variable and value of exports as the dependent variable in Model 2. The respective models are accordingly expressed as follows:

of the model.

$$ln (EXPVol) = f (ln(EXPPRICE), ln(PROD), ln(CEP), ln(EXPVolW))$$

ln(EXPVal) = f(ln(EXPPRICE), ln(PROD), ln(CEP), ln(EXPVolW))

Where

ln (EXPVol) -log of volume of cotton lint exports from Chad

ln (EXPVal) -log of value of cotton lint exports from Chad

ln (*EXPPRICE*) -log of cotton lint export price for Chad

 $\ln\left(\textit{PROD}\right)$ -log of cotton lint production (output) for Chad

ln (CEP) -log of the comparative export performance index for Chad in cotton lint

ln (EXPVolW) -log of world volume of cotton lint exports

In as much as various research works have made use of average world price as proxy for export price, I deem this inappropriate. This stand I take is justified on the grounds that, in spite of the world price quoted on the international markets for exports of various commodities, countries face different prices based on the quality of the products they export (with some attracting premiums in the process), their primary destinations and on their respective performances. In this regard, I make use of the export price faced by exporters from Chad instead of the world market price quoted on various websites. The export price for cotton lint from Chad is calculated as follows:

$$EXPPRICE = \frac{EXPVal}{EXPVol} \times 1000$$
(8)

The outcome represents the export price of cotton lint in \$/tonne. I multiplied the primary fraction by 1000 because value of exports reported by the agricultural trade statistics on the FAO is in \$1000, while the volume of exports is in tonnes. The comparative export performance index (CEP) is as well computed using the following formula:

$$CEP = \frac{(X_{IB} / X_B)}{(X_{iA} / X_A)} \tag{9}$$

Where

 X_{iB} - value of cotton lint exports from Chad

 X_{B} - total value of agricultural exports from Chad

- X_{iA} value of world exports of cotton lint
- X_{A}^{\prime} total value of world agricultural exports.

In line with specifications by Shende and Bhole (1999), Kumar et al (2008) and Nwachukuet al (2010), I include world volume of cotton lint exports to help capture implication of changes in international trade and demand on exports from Chad. Exclusion of nominal exchange rate from equations (6) and (7) is due to the fact that, with the exception of Ghana, and possibly other few countries (including Nigeria), all other countries in Central and West Africa have the same nominal exchange rate due to use of the CFA franc. By this, nominal exchange rate fails to reflectas a unique surrogate measure of incentive for Chad over the other countries that use the same currency. Developments in export from Chad are possibly driven by external factors

and by internal factors that are unique to Chad as a country. Besides own computations as shown in equations (8) and (9), data for all other variables were gathered from the agricultural production and trade database of FAO (FAOSTAT) for the period 1983-2011.

(7)

IV. Results and Discussion

Prior to discussing results for the respective long- and short-run models, effort is made in this section to provide some descriptive statistics on the variables considered in the models. In addition I provide information on outcome of the data verification process through a unit root test (in other to ascertain the order of integration of the respective data series), lag order selection and test of co-integration. Output for the models are then presented and discussed afterwards. Accordingly, this section is structured into four parts, starting with the descriptive statistics.

a) Descriptive Statistics

In contrast to the closeness of mean and median for all the variables considered. I note a wide variation between the maximum and minimum values for all the variables. For the six variables considered, the greatest variations are in volume of exports, value of exports, production and the index of competitiveness (comparative export performance index). Over the period 1983-2011, the maximum, minimum and mean values of export are respectively \$113,000.00 (thousand), \$18,000.00 (thousand) and \$65,208.10 (thousand). The corresponding volumes are 85,000.00 tonnes, 10,462.00 tonnes and 46,050.07 tonnes respectively. The country has over the aforementioned period observed а mean export price of \$1,448.12/tonne. For the maximum and minimum, the country observed export prices of \$2,795.67/tonne and \$952.74/tonne respectively.

	Mean	Median	Maximum	Minimum	Std. Dev.
EXPVal	65,208.10	60,000.00	113,000.00	18,000	26,629.65
EXPVol	46,050.07	46,906.00	85,000.00	10,462.00	17,367.20
EXPPRICE	1,448.12	1,411.77	2,795.67	952.74	348.65
PROD	54,436.31	57,938.00	103,236.00	16,500.00	19,956.71
CEP	29.08	31.34	44.40	11.78	8.42
EXPVolW	6,058,783.00	5,815,793.00	9,094,328.00	4,136,978	1,383,953.00

Table 1 : Descriptive Statistics

Throwing some light on production of cotton lint in Chad for the period 1983-2011, the country observed a mean output of 54,436.31 tonnes, a maximum of 103,236.00 tonnes and a minimum of 16,500.00 tonnes. Reflecting index of competitiveness (competitive advantage), the country observed a maximum comparative export performance index of 44.40 and minimum of 11.78. This indicates that the country has over the entire period had a strong competitive advantage in exports of cotton lint. A mean index of 29.08 was as well observed. As a measure of international trade and world demand for cotton lint, a mean export volume of 6,058,783.00tonnes of cotton lint was observed globally over the period 1983-2011. Respective maximum and minimum volumes of 9,094,328.00tonnes and 4,136,978.00 tonnes were as well observed.

are primarily expected to be integrated of the same order. In ascertaining the order of integration of variables, use in literature has been made of several unit root test approaches including the Dickey-Fuller (DF) test, Augmented Dickey-Fuller (ADF) test, Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test, Ng-Perron modified unit root test, unit root test with structural breaks, and the Phillips-Perron (PP) unit root test. I however in this study make use of the Phillips-Perron (PP) unit root test. The PP statistic primarily represents Dickey-Fuller statistic that has been made robust to serial correlation Newey-West heteroskedasticity-andusina the autocorrelation consistent matrix estimator. In ascertaining the order of integration of the variables, I held unto a linear trend assumption. Thus, a trend and intercept term were included in the test at level, and only intercept term on first difference.

b) Data Verification through Unit Root Test

For there to exist any long-run association between variables in a system, the variables involved

Table 2 : Unit Root Test.

Variables	PP-Stat Level	N-W Bandwidth	PP-Stat 1 st diff.	N-W Bandwidth
ln (EXPVal)	2.584642	4	-5.348980***	2
ln (EXPVol)	-1.829315	1	-5.348980***	2
ln (EXPPRICE)	-1.472680	1	-4.337257***	2
ln (PROD)	-1.685917	2	-6.114367***	4
ln (CEP)	-3.396113	2	-8.691028***	4
ln (EXPVolW)	-3.254905	1	-6.597208***	2
Critical value, 5%	-3.580623		-2.976263	

Trend + intercept at level, intercept on first difference

As shown in Table 2, all the variables are found to be I(1). Thus, all the variables are non-stationary at level, but become stationary on first difference (at the 1 percent significance level). Accordingly, all the variables are assumed a priori endogenous in the VAR specification for lag order selection and VECM should co-integrating vector(s) be confirmed.

c) Lag Selection and Co-Integration Test

In identifying the appropriate lag order to use for the respective specifications and tests, as shown in appendices 'A' and 'B', the Akaikeinformation criterion (AIC) selected lag order two, while the Schwarz information criterion (SC) and the Hannan-Quinn information criterion (HQ) selected lag order one. Similarly, in as much as the Final prediction error (FPE) as a secondary criterion selected lag order two, the sequential modified LR test statistic selected lag order one. Accordingly, I select lag order one for the VAR models. Subsequent tests for co-integration confirmed the existence of one co-integrating equation for each of the two primary specifications (equation 6 and 7). This confirmation renders the VAR a less appropriate set-up. I therefore make use of a vector error correction model (VECM). The VECM basically consists of a normalized (co-integrating/long-run) equation and an error correction (VAR/short-run) equation. The results for the respective normalized and error correction equations are presented and discussed in the next section.

d) Results and Discussion of Export Responses

Holding unto a linear trend assumption (to help capture policy implications) and employing the VECM

Model 1 : Dependent Variable - In (EXPVol).

Assumption: Linear trend in data (Intercept and trend in CE – no trend in VAR).

ln (EXPVol) = -0.173 ln (EXPPRICE) + 0.461 ln (PROD) + 0.705 ln (CEP) + 0.733 ln (EXPVolW) - 0.039 Trend - 6.273 ln (EX

Model 2 : Dependent Variable - In (EXPVal).

Assumption: Linear trend in data (Intercept and trend in CE - no trend in VAR)

 $\ln (EXPVal) = 0.827 \ln (EXPPRICE) + 0.461 \ln (PROD) + 0.705 \ln (CEP) + 0.733 \ln (EXPVolW) - 0.039 Trend - 13.181$

The respective short-run equations are expressed as follows:

 $\Delta \ln(EXPVol_t) = \Gamma_0 + \sum_{i=0}^n \Gamma_{1i} \Delta \ln(EXPVol_{t-1}) + \sum_{i=0}^n \Gamma_{2i} \Delta \ln(EXPPRICE_t) + \sum_{i=0}^n \Gamma_{3i} \Delta \ln(PROD_t) + \sum_{i=0}^n \Gamma_{4i} \Delta \ln(CEP_t) + \sum_{i=0}^n \Gamma_{5i} \Delta \ln(EXPVolW_t) - \propto (RESIDUAL_{t-1})$ (12)

 $\Delta \ln(EXPVal_t) = \Gamma_0 + \sum_{i=0}^n \Gamma_{1i} \Delta \ln(EXPVal_{t-1}) + \sum_{i=0}^n \Gamma_{2i} \Delta \ln(EXPPRICE_t) + \sum_{i=0}^n \Gamma_{3i} \Delta \ln(PROD_t) + \sum_{i=0}^n \Gamma_{4i} \Delta \ln(CEP_t) + \sum_{i=0}^n \Gamma_{5i} \Delta \ln(EXPVolW_t) - \propto (RESIDUAL_{t-1})$

From equations 12 and 13, the Γ s indicate short-run effect of changes in the explanatory variables on the explained variables and α represents the speed of adjustment in the system (thus, the rate at which deviations from the long-run equilibrium are corrected for in the current period). A negative and significant α validates the existence of co-integration, and implies that adjustments made in response to deviations from the long-run equilibrium are made towards restoring such equilibrium. Accordingly, the 'RESIDUAL' in equations 12 and 13 represents the error correction term. Diagnostic tests performed for the respective models indicate that the respective residuals are normally distributed, non-serially correlated and homoscedastic. In testing for stability of the coefficients for each of the models, the CUSUM and CUSUM of Squares tests employed (as shown in Appendix C) confirm that the coefficients for each of the models are stable.

In interpreting results for the respective models, the variables included in the models are found to explain about 66.3 percent of the variations in volume of cotton lint exports from Chad, and 73.2 percent of variations in value of exports. Deviations from the long-run equilibrium for volume of exports are found to be corrected faster than those for value of exports. Approximately 98.5 percent of deviations from long-run equilibrium in volume of exports are corrected for in the current period, while about 83.7percent of deviations in value of exports are corrected for in the current period. Negative coefficients of the intercept term in equations 10 and 11 indicate that, should there be no significant improvement in any of the other explanatory variables, both volume and value of exports would continue to decrease in the long-run. The significant and negative coefficients (-0.039) of the trend term in equations 10 and 11, signify that exports (both volume and value) from the country have responded negatively to changes in domestic and international policy environments. This indirectly means that trade policies drafted and implemented over the scope of the study (1983-2011) have been more harmful than beneficial to the cotton export industry of Chad. Over the period, both volume and value of exports are found to decrease by 0.039 units, significant at the 1percent level.

In the long-run, cotton production, comparative export performance index and volume of world exports of cotton lint are found to be the key determinants of volume of exports for cotton lint from Chad. These three variables together with export price are found to be the key determinants of value of exports of the commodity from Chad. One percent increase in output (production) of cotton may lead to a 0.46 percent increase in both volume and value of exports, significant at the 1percent level. Similarly, one percent increase in the index of competitiveness may leads to 0.71 percent increase in both volume and value of exports, significant at the 1% level. Increase in international trade and world demand

(13)

for the analysis based on confirmation of co-integrating vectors, the following normalized (co-integrating) equations were observed for the respective models

for the commodity is noted to stimulate export growth for Chad. This claim is based on the significant and positive coefficient of the world volume of exports. A one percent increase in world volume of exports may lead to a 0.73 percent increases in both volume and value of exports. Although negative, the effect of export price on volume of exports is noted to be insignificant. The positive (0.827) and significant coefficient for export price in equation 11 however indicates that a one percent increase in export price faced by exporters in Chad leads to a 0.827 percent increase in value of exports. By this, export price in the long-run is a key determinant only for value of exports and not volume.

In the short-run however, export price is observed to have guite interesting effects on exports of cotton lint from Chad. In as much as increases in export price significantly stimulate growth in value of exports, they as well dampen volume of exports from the country. These interesting implications could be attributed to the fact that export volumes have over the scope of the study not depicted any major improvements, and in such situations, any increase in price of exports is likely to increase the value of exports. Due to the distortionary induced down pressure on world prices however, increases in export price faced by exporters from Chad potentially leads to trade diversion in favor of exports from countries like the US and India where the commodity is offered at a relatively lower price due to subsidies levied for production and export of the commodity in such countries. In contrast to the long-run implications of production on both value and volume of exports, cotton production in the short-run is found to be a key determinant only for volume of exports, but not value. This again affirms propositions by Ball (1966) and Ngeno (1996) that higher production stimulate growth in volumes of export. The insignificant coefficient of production in model 2 indicates that value of exports for the country is determined more by other internal factors like competitiveness and external factors on the world market than by production.

Table 3 : Output for the Short-Run Equations

	Model 1	Model 2	
Variables	Coefficient	Coefficient	
	Std. Error	Std. Error	
$\Delta \ln (EXPVol (-1))$	0.233		
	(0.144)		
$\Delta \ln (EXPVal (-1))$		0.130	
		(0.127)	
$\Delta \ln (EXPPRICE)$	-0.513**	0.547**	
	(0.221)	(0.229)	
$\Delta \ln (PROD)$	0.303**	0.241	
	(0.133)	(0.142)	
$\Delta \ln (CEP)$	0.835***	0.826***	
	(0.142)	(0.147)	
$\Delta \ln (EXPVolW)$	0.853**	0.856**	
	(0.328)	(0.343)	
С	-0.067	-0.073*	
	(0.039)	(0.040)	
RESIDUAL (-1)	-0.985***	-0.837***	
	(0.226)	(0.201)	
R-squared	0.741	0.794	
Adjusted R-Squared	0.663	0.732	
Log likelihood	10.506	9.538	
F-statistic	9.513	12.864	
Prob (F-statistic)	0.000	0.000	
Durbin-Watson Stat	2.141	2.050	
Akaike info criterion	-0.260	-0.188	
Schwarz criterion	0.076	0.148	
Hannan-Quinn criter.	-0.160	-0.088	
Jarque- Bera [Probability]	0.493 [0.782]	0.643 [0.725]	
Q-stat 1 [Probability]	0.253 [0.615]	0.070 [0.792]	
Q-stat 2 [Probability]	0.681 [0.712]	0.283 [0.868]	
ARCH Test, F-stat [Probability]	0.533 [0.472]	1.124 [0.300]	

***1 percent, **5 percent, *10 percent.

Both comparative export performance index and the world volume of exports are found once again to be key determinants for value and volume of exports. Interestingly however, the effect of the index of competitiveness is found to be greater on volume of exports than value of exports, while the opposite holds for world volume of exports. A one percent increase in the index of competitiveness leads to a 0.84 percent increase in volume of exports and 0.83 percent increase in value of exports, both being significant at the 1percent level. Enhanced through the use of surrogate measures of incentive for exports like reduction in farm taxation, improvement in quality of exports, and increasing share of the country in global market for the commodity, the index of competitiveness, which reflects the country's competitive advantage in exports of the commodity, is found to be among the major drivers of exports from Chad. A one percent increase in world volume of exports (as a proxy for international trade and demand) leads to 0.85 percent increase in volume of exports and 0.86 percent increase in value of exports from Chad. A potential increase in volume and value of exports from Chad with increasing volume of world trade indicates that Chad as a cotton exporting nation has a competitive advantage in cotton lint exports, and that should existing inefficiencies in the domestic and global markets be addressed, the country stands benefiting from increasing international trade in the commodity. The insignificant coefficient of the intercept term for model 1 shows that, although volume of exports decreases in the short-run, the decrease is not significant. On the contrary however, value of exports decreases by 0.07 units in the short-run, significant at the 10percent level. This shows that, although the country may have a relatively better shielding capacity on volume of exports for the commodity, the same cannot be said about value of exports, as prices faced by exporters are primarily determined exogenously by forces on the international market (notably distortions in the form of subsidies levied by major players). Previous volumes and value of exports have no significant effect on current exports.

Although diverse opinions have been expressed and interesting findings shared in economic, business and trade literature on determinants of export growth, findings from this study generally affirm revelations by Anwar et al (2010), Ball (1966), Ngeno (1996), Nwachuku et al (2010), Ndulu and Lipumba (1990), Takane (2004), Kumar and Rai (2007) and Kumar et al (2008).

V. Conclusion

Following the decline in performance of Chad in cotton production and lint exports, as a result of inefficiencies in both domestic and international policy and market environments, I made use of the Johansen Full Information Maximum Likelihood test to identifying key drivers of exports of cotton lint from the country. In this regard, I defined and estimated two primarily longand short-run equations using both volume and value of exports as respective dependent variables. Results for therespective normalized and error correction equations show that production, competitiveness in exports, volume of world exports and export price are key determinants of exports, although the effect of the latter in the long-run was significant only for value of exports. In addition, the results reveal that policies drafted and implemented in both the internal and external environments have been more harmful than beneficial to the cotton export industry of Chad. In as much as volume of exports is found to be driven by both internal and external forces, value of exporters is found to be driven more by external forces than internal forces. To revive the Chadian cotton export industry, measures should be put in place to significantly increase production and improve on the country's competitiveness in exports of the commodity (through quality improvement and use of appropriate export enhancing initiatives like reduction in farm taxation. In addition, export enhancing measures used in the 1960s and 1970s could be revisited). Measures should as well be put in place to address existing inefficiencies in the domestic policy and trade environment, as this could suitably position the country to benefit from increases in international trade. Minimization of distortions on the international market for cotton lint could as well play a significant role in reviving the cotton export industry for Chad.

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Appendices

Appendix A : Lag Selection and Co.Integration Test for Model 1.

VAR Lag Order Selection Criteria Endogenous variables: LNEXPVOL LNEXPPRICE LNPROD LNCEPCHAD LNEXPVOLWORLD Exogenous variables: C Date: 05/13/14 Time: 22:05 Sample: 1983 2011 Included observations: 27

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-6.932628	NA	1.67e-06	0.883898	1.123868	0.955254
1	61.28769	106.1205*	7.04e-08	-2.317607	-0.877788*	-1.889473*
2	90.60878	34.75092	6.33e-08*	-2.637687*	0.001981	-1.852776

* indicates lag order selected by the criterion LR: sequential modified LR test statistic (each test at 5% level) FPE: Final prediction error AIC: Akaike information criterion SC: Schwarz information criterion HQ: Hannan-Quinn information criterion

Date: 05/13/14 Time: 22:05 Sample: 1983 2011 Included observations: 27 Series: LNEXPVOL LNEXPPRICE LNPROD LNCEPCHAD LNEXPVOLWORLD Lags interval: 1 to 1

Selected (0.05 level*) Number of Cointegrating Relations by Model							
Data Trend:	None	None	Linear	Linear	Quadratic		
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept		
	No Trend	No Trend	No Trend	Trend	Trend		
Trace	1	1	1	1	1		
Max-Eig	1	1	1	1	1		

*Critical values based on MacKinnon-Haug-Michelis (1999)

Appendix B : Lag Selection and Co-Integration Test for Model 2.

VAR Lag Order Selection Criteria Endogenous variables: LNEXPVAL LNEXPPRICE LNPROD LNCEPCHAD LNEXPVOLWORLD Exogenous variables: C Date: 05/13/14 Time: 22:12 Sample: 1983 2011 Included observations: 27

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-6.932628	NA	1.67e-06	0.883898	1.123868	0.955254
1	61.28769	106.1205*	7.04e-08	-2.317607	-0.877788*	-1.889473*
2	90.60878	34.75092	6.33e-08*	-2.637687*	0.001981	-1.852776

* indicates lag order selected by the criterion LR: sequential modified LR test statistic (each test at 5% level) FPE: Final prediction error AIC: Akaike information criterion SC: Schwarz information criterion HQ: Hannan-Quinn information criterion

Date: 05/13/14 Time: 22:12 Sample: 1983 2011 Included observations: 27 Series: LNEXPVAL LNEXPPRICE LNPROD LNCEPCHAD LNEXPVOLWORLD Lags interval: 1 to 1

Selected (0.05 level*) Number of Cointegrating Relations by Model

-					
Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend
Trace	1	1	1	1	1
Max-Eig	1	1	1	1	1

*Critical values based on MacKinnon-Haug-Michelis (1999).

Appendix C: Stability Test of Coefficients

