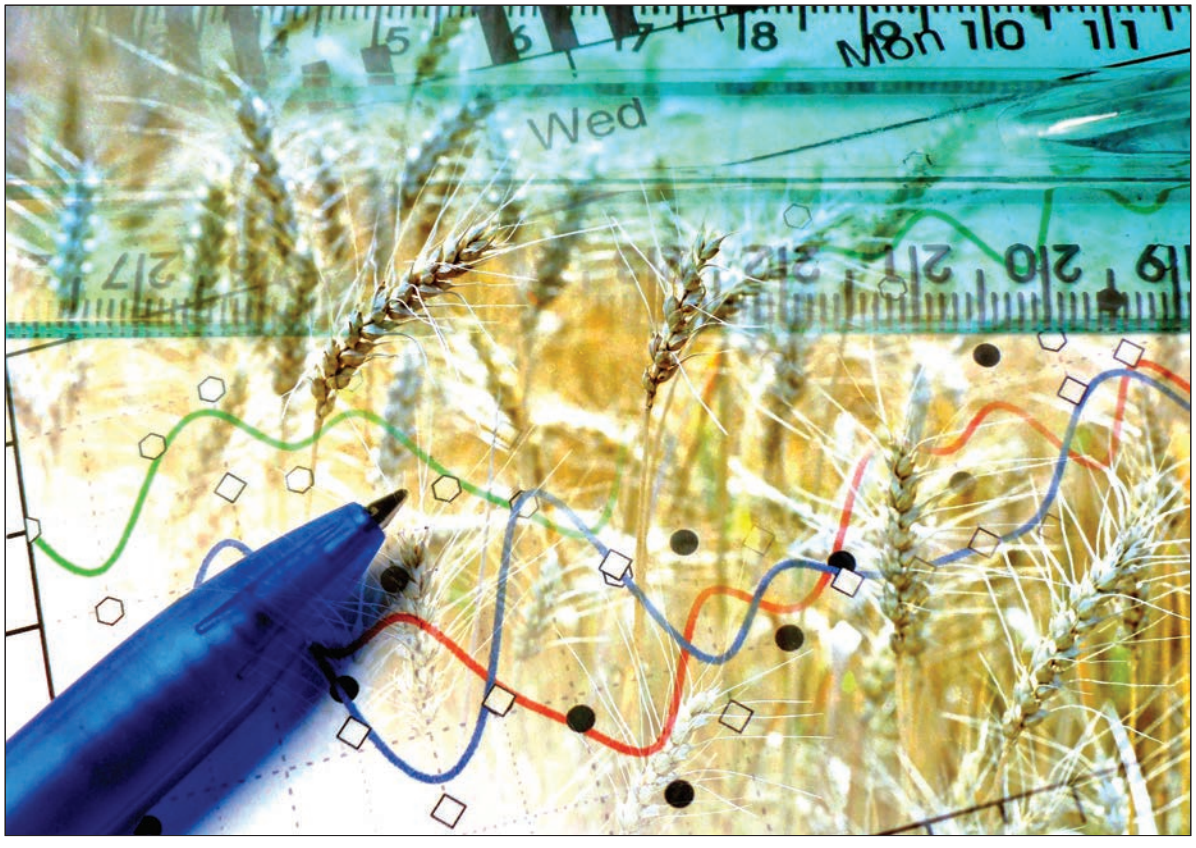

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An Assessment of the Impact of Exchange Rate Deregulation and Structural Adjustment Programme on Cotton Production and Utilization in Nigeria

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ABSTRACT

At Nigeria's independence, agriculture was the mainstay of the economy. It provided employment, food, raw materials for industry and foreign exchange. However, within 20 years of Independence the country became unable to cope with the overall needs of its food and raw materials. Increased foreign exchange earnings from the export of crude oil were implicated as leading to the neglect and subsequent decline in the performance of the Nigerian agricultural sector. The Structural Adjustment Programme SAP was adopted to restructure and diversify the productive base of the economy in such a way as to reduce dependency on the oil sector and imports. One of the key policy strategies designed to achieve the Nigeria's SAP goals was the adoption of a market-determined exchange rate. This paper set out to assess the impact of exchange rate deregulation and SAP on cotton production and utilization in Nigeria. Time series data on aggregate cotton production, Naira's average cross exchange rates with the US dollar and average capacity utilization rate of textile manufacturers in Nigeria for the period 1973-2007 were collected and analysed using Multiple-regression and the student's t test technique. Findings includes: exchange rate deregulation per se has no significant effect on cotton production in Nigeria; more cotton was produced in Nigeria during the post-SAP period; the average capacity utilization of domestic textile industry in Nigeria during the pre-SAP period was higher than during the post-SAP period. Based on the findings of the study some noteworthy lessons were highlighted.

Key words: Exchange rate deregulation, structural adjustment programme, cotton production, textile industry, Nigeria

INTRODUCTION

At Nigeria's independence in 1960, agriculture was the mainstay of the Nigerian economy. According to Ilugbuhi (1968), peasant agricultural production for export provided the stimulus to Nigeria's overall economic growth. Agriculture provided employment to over 75% of the population and accounted for over 70% of total food consumption. It also provided raw materials for industry, export earnings to finance imports and foreign exchange (Alamu, 1981).

The importance of the cotton crop to the Nigerian economy cannot be over-emphasised (Chikwendu, 1993; Adeniji *et al*., 2007). The lint removed from the seed is used as raw material for the textile industry. The cotton-seed provide edible vegetable oil for human consumption (Kudi *et al*., 2007). The cotton-seed cake is used as an important raw material for livestock feeds (Barje *et al*., 2008; Udo and Umoren, 2011). About 80% of total cotton production in Nigeria was carried out by peasant farmers (Adeniji, 2007). The Nigerian textile industry was the second

leading employer of labour after the public sector (Idem, 1999; Manyong *et al.*, 2005). Cotton was thus an important source of food for man, feed for animals, raw material for the textile industry, direct employment to cotton farmers as well as an indirect source of employment to workers employed by agro-based industries that relied on cotton as raw material i.e., textiles, edible oil and animal feed manufacturers.

About 21 years after Independence, Abdullahi (1981) observed: Nigeria can no-longer produce enough food for its fast growing population neither could the agricultural system cope with the increasing demands of the agricultural raw materials to keep the country's oilmills, textile and other agro-based industries operating at full capacity let alone have surplusses for export. In fact many of the agro-based industries which once depended on locally produced raw materials are closing down unless of course they are allowed to import part or all of these raw materials from abroad. Numerous other parameters point to the obvious and undeniable fact that the country is progressively becoming unable to cope with the overall needs of its food and raw materials.

Several reasons were advanced for the decline in the performance of the Nigerian agricultural sector, prominent among which is the increased foreign exchange earnings from the export of crude oil between 1972 and 1980 that led to the neglect of the Nigerian agricultural sector (Asiabaka and Owens, 2002; Walkenhorst, 2007; Sekumade, 2009).

The international oil market plunged in 1982, reducing significantly Nigeria's ability to finance imports, including food and persistent current account deficits began to emerge while unpaid trade bills began to accumulate (Osuntogun *et al.*, 1997). Signs of economic decline: trade deficits, budget deficits, inflation and balance of payments problems became seriously manifest (Osaghae, 1995). Experts pointed at structural adjustment as the panacea to Nigeria's persistent economic doldrums. The key argument of the structural adjustment framework for economic policy reform was that state and state interventionism were the sources of economic distortions to African economies since independence (Colclough and Manor, 1991; Olukoshi, 2004).

Structural adjustment, according to Ahmed and Lipton (1997) is: A set of measures that seek to permit renewed, or accelerated, economic development by correcting structural disequilibrium in the foreign and public balances. Often, such measures are required as conditions for receiving World Bank and IMF loans. These reforms attempt to eliminate distortions such as an overvalued exchange rate, high fiscal deficits and restrictions on trade and inefficient public services that often prevent an efficient allocation of resources in the economy.

The broad objective of Nigeria's SAP was to restructure and diversify the productive base of the economy in such a way as to reduce dependency on the oil sector and imports. One of the key policy strategies designed to achieve the Nigeria's SAP goals was the adoption of a market-determined exchange rate (Moser *et al.*, 1997). This is based on the argument in literature that overvalued exchange rates makes domestic products, including agricultural products, not only less competitive with imports but also less profitable as export (Mamingi, 1997). Exchange rate depreciation lowers the foreign currency price of exports and tends to increase the quantity of exports and export revenue in domestic currency (Fang *et al.*, 2005; Hadiwibowo, 2010; Azgun, 2011). Empirical studies by Bahmani-Oskooee and Kara (2003) and Abolagba *et al.* (2010) reported that currency devaluation increases exports.

Another side of Exchange Rate deregulation is its effect on a country's Real Exchange Rate (RER). A crucial component in evaluating a country's macroeconomic performance and the sustainability of its policies is competitiveness assessment, which routinely starts from an assessment of the RER level (Di Bella *et al.*, 2007). Many developing countries adopted real

exchange rate devaluation as an effective strategy to boosts exports (Haddad and Pancaro, 2010). Hausmann *et al.* (2005) and Adeniyi *et al.* (2011) reported a significant relationship between RER depreciation and rapid economic growth. Real overvaluation hampers exports with a consequent decline in economic growth (Easterly, 2005; Johnson *et al.*, 2007). According to Okonjo-Iweala and Osafo-Kwaako (2007), volatile fiscal spending contributes to real exchange rate volatility. Barnett and Ossowski (2002), domestic currency appreciation and reduction in competitiveness of the non-oil sectors of the economy are likely consequences of fiscal expansions funded by oil revenue. There is considerable theoretical and empirical evidence on the adverse effects of volatility for growth (Fatas and Mihov, 2003; Serven, 2003; Bleaney and Greenaway, 2001).

The main objective of this paper is to assess the impact of exchange rate deregulation and SAP on cotton production in Nigeria. Specifically the study seeks to:

- Determine relationship between the Real Exchange Rate (RER) of the Naira and the average cross exchage of the Naira to the US$ over the study period (1973-2007)
- Investigate the effects of exchange rates of the Naira to the US$ on the production of cotton in Nigeria (1973-2007)
- Assess the impact of SAP on the production and utilization of cotton in Nigeria (1973-2007)

To achieve the objectives of this study, the following hypotheses were formulated and tested:

- The SAP measures have no significant effects on the level of cotton production in Nigeria during the study period
- The exchange rates of the Naira to the US$ has no significant effects on the level of cotton production in Nigeria during the study period
- There is no significant difference in aggregate cotton production in Nigeria before and after SAP in Nigeria
- There is no significant difference in average annual capacity utilization of domestic textile industry in Nigeria before and after SAP in Nigeria

MATERIALS AND METHODS

This study utilised time series data on aggregate cotton production, Naira's average cross exchange rates with the US dollar and average capacity utilization rate of textile manufacturers in Nigeria for the period 1973-2007 to achieve its stated objectives (Appendix Table A1).

Conceptual framework: The conceptual framework for this study is based on the following arguments: First, to achieve SAP's lofty goal of restructuring and diversifying the productive base of the Nigerian economy so as to reduce dependency on the oil-sector and import, agriculture is expected to play a significant role. Second, two important indicators to monitor the attainment of these objectives are: (i) increase yield in agricultural export crops to reduce dependency on oil as source of foreign revenue, (ii) increase capacity utilization of agro-based industries that utilizes industrial crops as raw material to reduce importation. Third, a significant change in the levels of these indicators will signify the level of impact of SAP.

Estimation of RER: The Real Exchange Rate (RER) was captured using the following proxy (Mamingi, 1997):

$$RER = e.\ WPI/CPI \quad (1)$$

Where:
e = Official nominal exchange rate measured in Naira per US$
WPI = The US Wholesale Price Index
CPI = Domestic consumer price index

The Nigerian cotton WPI was taken as proxy for the US WPI following Harberger (1986), Bautista (1987) and Fosu (1992). The CPI for cotton was assumed constant because cotton is purely an intermediate good.

Model specification and estimation: The impact of exchange rate deregulation on the production of an export/industrial crop such as cotton is assumed its impact on changes in the level of cotton production resulting from changes in exchange rate. The impact of the SAP measures is assumed as its direct effect on the level of cotton production in Nigeria as captured by the dummy variable D.

Consider a typical cotton farm with a production function:

$$Y = f(X_1 \ldots X_m; Z_1 \ldots Z_n) \quad (2)$$

where, Y is output, X represent variable inputs and Z represent fixed and other shifter variables of the function. Ignoring the fixed costs, the production function becomes:

$$Y = f(X_1 \ldots X_m) \quad (3)$$

Based on the economics of production outlined above, an empirical aggregate model is developed for cotton production in Nigeria, leaving out variables of less interest to this study, as follows:

$$Y_t = \beta_1 + \beta_2 X_{1t} + \beta_3 X_{2t} + D \quad (4)$$

where, Y_t is cotton production in year t (measured in MT), X_{1t} is exchange rate of the Naira to the US dollar in year t (expressed as a ratio of the Naira to the US dollar), X_{2t} is average capacity utilization of domestic textile industry in year t (expressed in percent) and D is the dummy variable that takes a value of 0 for the years 1973-1985 and 1 for the years 1986-2007.

As noted in various literature, empirical analysis of time series data pose several challenges as empirical work, including causality tests of Granger and Sims based on time series data assumed that the underlying time series is stationary (Seddighi *et al.*, 2000; Enders, 1995; Patterson, 2002). Mercifully, as Gujarati (2003) noted, by simply establishing stationarity of the residuals from regression equation, the traditional regression methodology can be conveniently applied to data involving non stationary time series.

Cointegration was tested on the data collected for this study using the Cointegrating Regression Durbin-Watson (CRDW) Test method as expounded by Gujarati (2003).

Our regression model:

$$Y_t = \beta_1 + \beta_2 X_{1t} + \beta_3 X_{2t} + D + \mu_t \quad (5)$$

was estimated and the residuals obtained.

The DW d was computed using the following relation:

$$d = RER = e.WPI / CPI, \mu_{t-1})^2 / \sum_{t=1}^{t=n} \mu_1^2 \quad (6)$$

In CRDW Test, the Durbin-Watson d obtained from the cointegrating regression (6) is used, with a proviso that the null hypothesis is d = 0 rather than the standard d = 2 in the conventional DW test for autocorrellation.

The computed DW d (0.856) obtained from the cointegrating regression (5) is greater than the critical value of 0.386 at the 5% level, thus it was concluded that the regression residuals are stationary. However, the estimated DW d value of 0.856 is lower than the critical DW d_L value of 1.283, indicating an evidence of positive first order serial correlation (Appendix Table A2).

The first-order difference transformation method was not used to remedy the detected autocorrelation problem because it is not appropriate for our case despite its other advantages. This decision is guided by Maddala (1992) rule of thumb on the appropriateness of using the first-order difference method: use the first difference transformation method whenever $d<R^2$. It will be recalled that our computed d and R^2 from Eq. 5 are 0.856 and 0.505, respectively i.e., $d>R^2$.

The Praise-Winsten transformation method, as expounded by Gujarati (2003) was used to transform the model, using ñ estimated based on the Durbin-Watson d statistic. This is done, based on the following assumptions: (a) that the error term in Eq. 5 follows the AR (1) scheme and (b) that if Eq. 5 holds true at time t, it also holds true at time (t-1), thus:

$$Y^{t-1} = \beta^1+\beta^2X_{1t-1}+\beta_3X_{2t-1}+\beta_4D+\mu_{t-1} \quad (7)$$

Multiplying Eq. 7 by p:

$$\rho Y_{t-1}= \rho\beta_1+ \rho\beta_2X_{1t-1}+ \rho\beta_3X_{2t-1}+ \beta_4D+ \rho\mu_{t-1} \quad (8)$$

Subtracting Eq. 7 from Eq. 5:

$$(Y_t-\rho Y_{t-1}) = \beta_1 (1-\rho) + \beta_2 (X_{1t}-\rho X_{1t-1}) +\beta_3 (X_{2t}- \rho X_{2t-1}) +D+\beta_t \quad (9)$$

Where, $\beta_t = (\mu_t- \rho\mu_{t-1})$

Equation 9 was then expressed as follows:

$$Y^*_t=\beta^*_1 +\beta^*_2+\beta^*_3+D+ \varepsilon_t \quad (10)$$

Where, $\beta^*_1 = \beta_1 (1-\rho)$, $= (Y_t-\rho Y_{t-1})$, $= (X_{1t}-\rho X_{1t-1})$, $= (X_{2t}-\rho X_{2t-1})$, $\beta^*_2= \beta_2$ and $\beta^*_3= \beta_3$.

OLS was then applied to the transformed variables to obtain the usual optimum properties of the OLS coefficients asymptotically.

RESULTS AND DISCUSSION

Relationship between Real Exchange Rate (RER) and the average cross exchange of the Naira to the US$: Fig. 1 depicts a graphic representation of how average exchange rate and the

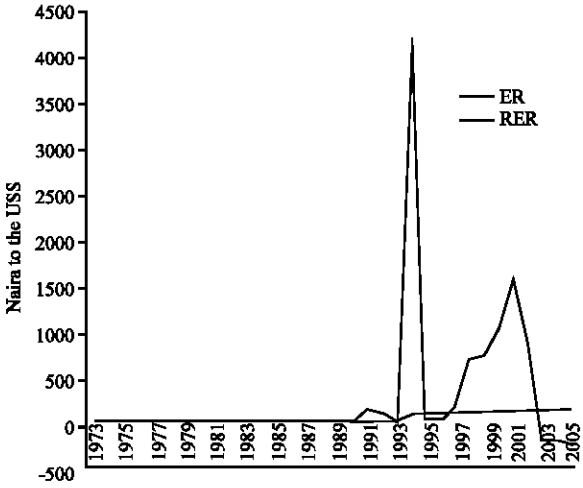

Fig. 1: Results of regression analysis with transformed variables Eq. 10

Table 1: Results of regression analysis with transformed variables Eq. 10

Independent variables	Coefficients	t-values	p-values
Constant term	178.256	4.203	0.000
Naira exchange rate per US$	-0.020	-0.574	0.570
Textile Indnstry capacity utilization	0.079	0.982	0.334
Dummy	165.803	2.986[a]	0.005

R^2: 0.287, Adjusted R^2: 0.218, R: 0.536, $F_{(model)}$: 4.167, p-value for $F_{(model)}$: 0.014, DW *d*: 0.566, Statistically significant statistics at both β: 5 and β: 1%

values of RER estimated in this study compare over the period 1973-2007. It is clear that the 2 sets of data have almost the same values up to 1985, the pre-SAP period. But beginning from 1986, the SAP period, when the country's exchange rate was first determined officially through a public auction in the foreign exchange market, a slight difference in values between ER and RER could be noticed. From 1989 when the autonomous market and the official foreign exchange market were merged to form a single Inter-bank Foreign Exchange Market (IFEM), the difference in values between ER and RER became pronounced. From 1991 the difference between the two values became glaring, indicating a case of RER volatility. The ER and RER values deviate extensively from one another, indicating distortions in resource allocation. This finding is in agreement with that of Adubi and Okunmadewa (1999), that exchange rate volatility has a direct negative effect on the level of agricultural export trade in Nigeria by causing a decline in export production.

The effects of exchange rates of the Naira to the US$ and SAP on cotton production in Nigeria: The specified aggregate cotton production model is estimated using the transformed time series data for the period 1973-2007 with SPSS 16.0 supported with Microsoft Excel 2007.

The R^2 and F values of obtained from our transformed regression Eq. 10 (Table 1), are considearbly smaller than those obtained from our level form regression Eq. 4 (Appendix Table A2). As noted by Gujarati (2003), this is because by taking the first-difference in the course of transforming our regression model, we are essentially studying the behavior of variables around their (linear) trend values. In such case, as observed by Maddala (1992), we cannot compare the R^2 and F values of Eq. 7 and 10 because the dependent variables in the 2 models are different. This

explains our decision to use the R^2 and F values of our level form model (7) in discussing the fitness of our model.

The F value of 10.535 computed for Eq. 7 is highly significant. This implies that the included explanatory variables (annual average exchange rate of Naira to the US$, average annual capacity utilization of domestic textile industry and the effects of the SAP measures on cotton production as represented by the dummy variable) together significantly explain the variation in aggregate cotton production. The R^2 value obtained from the equation is 0.505. This indicates that the explanatory variables included in the model explained, on the average, more than 50% of the variation in the total aggregate cotton production over the study period. The unexplained variation, less than 50%, in the model is attributable to other factors not specified in the model due to difficulties in quantification and availability of relevant data.

All estimated parameters of our regression Eq. 10, with the exception of that of the dummy variable D, were statistically not significant at the 5% level. The t value of 2.986 obtained for the coefficient of the dummy variable D from the regression equation is found to be significant when viewed in relation to its computed p-value of 0.005, hence the formulated null hypothesis is rejected. The statistically significant coefficient of the dummy variable indicates that the SAP measures have a positive impact on cotton production in Nigeria. This finding is in agreement with Adubi and Okunmadewa (1999) that increased in production of export crops followed the adoption of SAP in Nigeria.

The statistically not significant estimated exchange rate parameter (-0.574) with a p-value of 0.570 at the 5% level indicates that exchange rate deregulation per se has no significant effect on cotton production in Nigeria. This finding contradicts Abolagba *et al.* (2010) that exchange rate deregulation leads to increase production of export crops. However, this contradiction could be explained away as resulting from the double-edged sword characteristic of exchange rate deregulation, one of the lessons enumerate from this study as highlighted in the conclusion section of this paper.

The statistically not significant estimated average capacity utilization of domestic textile industry parameter (0.982) with a p-value of 0.334 at the 5% level indicates that domestic utilization has no significant effect on cotton production in Nigeria.

Impact of the structural adjustment programme on the production and utilization of cotton: As mentioned earlier and for the reasons advanced, the transformed regression Eq. 10 yielded parameters with considerably lower values. This informed our decision to utilize the Student's t test technique for comparison of means of independent samples, at the 5% level of significance to test hypotheses (iii) and (iv). For a description of the Student's t test technique, by Lehmann (1991), Hogg and Craig (1995) and Keller and Warrack (2003). Sulaiman and Ja'afar-Furo (2010) demonstrated the application of the Student's t test technique in socio-economic research.

From the results of the Student's t test (Table 2), the calculated t value of -3.400 is found to be highly significant when viewed in relation to the computed p-value of 0.002, hence the null

Table 2: Results of student's t test

Variable	t-value	Df	Sig.	Mean difference
Aggregate cotton yield	-3.400	33	0.002	-173.38
Average capacity utilization of domestic textile industry	5.846	31	0.000	26.45

hypothesis is rejected and it is thus concluded that there is a highly significant difference in mean aggregate cotton production between the pre-SAP period (1973-1985) and post-SAP period (1985-2006). The mean difference of -173.38 indicates that the mean aggregate cotton production in Nigeria in the post-SAP period is higher than the mean aggregate cotton production of the pre-SAP period. The aggregate mean of the pre-SAP period is 167.308 while that of the post-SAP period is 340.691. Thus, more cotton was produced in Nigeria during the post-SAP period. This finding is in agreement with our earlier finding that increased cotton production followed the adoption of SAP in Nigeria.

From the results of the Student's t-test, the calculated t value of 5.846 is found to be highly significant when viewed in relation to the computed p-value of 0.000, hence the null hypothesis is rejected and it is thus concluded that there is a highly significant difference in average annual capacity utilization of domestic textile industry between the pre-SAP period (1973-1985) and post-SAP period (1985-2006). The mean difference of 26.45% indicates that the average annual capacity utilization of domestic textile industry in Nigeria during the pre-SAP period is higher than that of the post-SAP period. The mean of average annual capacity utilization of domestic textile industry of the pre-SAP period is 71.14% while that of the post-SAP period is 44.69%. Thus, the average capacity utilization of domestic textile industry in Nigeria during the pre-SAP period was higher that during the post-SAP period.

CONCLUSION

This study set out to assess the impact of exchange rate deregulation and SAP on cotton production in Nigeria. The main findings of the study are:

- The ER deregulation that follows the adoption of SAP measures resulted in a pronounced deviation between the ER and RER values indicating distortions in resource allocation
- SAP measures have a positive impact on cotton production in Nigeria
- Exchange rate deregulation per se has no significant effect on cotton production in Nigeria
- Domestic utilization by textile manufacturers has no significant effect on cotton production in Nigeria
- More cotton was produced in Nigeria during the post-SAP period
- The average capacity utilization of domestic textile industry in Nigeria during the pre-SAP period was higher that during the post-SAP period

Based on the findings of this study, the following lessons are noteworthy: Exchange rate deregulation is a double edge sword. On the one hand, successful exchange rate devaluation could lead to increase in producer price which will increase producer incentives. On the other hand, devaluation could lead to increase in prices of agricultural inputs produced outside the economy like fertilizer, pesticides and machinery which as imported goods have their prices raised by exchange rate devaluation, which in-turn increases costs of input and decreases producer incentive to produce more. Thus, in a mineral resource dominated economy like Nigeria, exchange rate has little or no effect on export crop production.

The availability of adequate and functional infra-structure is critical for the success of SAP vis-α-vis the enhancement of the productivity of domestic agro-based industries is such a way as to reduce dependency on imports. The absence of supporting infra-structure, especially electric power supply in Nigeria, increased the operational costs of domestic textile manufacturers thereby

making their products less competative both for export and against imported textile materials. As a consequence, most textile manufacturers were sent out of business, and their teeming employees rendered jobless. It has been mentioned earlier, that the textile industry was the second largest employer of labour in Nigeria.

Effective policies to protect domestic agro-based industries in an oil dependent country like Nigeria are a pre-requisite to the adoption of SAP. The absence of such policies in Nigeria, due to its membership of the WTO, makes domestic textile manufacturers vulnerable to the excessive and aggressive competition and probably dumping, from established foreign textile manufacturers.

APPENDIX

Appendix Table A1: Time series data on aggregate cotton production, Naira's average cross exchange rates with the US dollar and average capacity utilization rate of textile manufacturers in Nigeria for the period 1973-2007

Year	Cotton yield (000MT)	Average cross exchange rate (Naira to the US$)	Average domestic textile manufacturing capacity utilization (%)
1973	85	0.6579	-
1974	481	0.6299	-
1975	313	0.6159	79.7
1976	294	0.6265	79.8
1977	269	0.6466	75.3
1978	211	0.606	80.1
1979	125	0.5957	84.0
1980	77	0.5464	84.4
1981	48	0.61	76.9
1982	38	0.6729	73.6
1983	12	0.7241	57.4
1984	108	0.7649	46.7
1985	114	0.8938	44.6
1986	100	2.0206	41.3
1987	195	4.0179	48.0
1988	194	4.5367	54.8
1989	187	7.3916	59.7
1990	276	8.0378	52.2
1991	309	9.9095	54.9
1992	346	17.2984	44.3
1993	192	22.0511	60.0
1994	218	21.8861	38.2
1995	251	81.0228	44.3
1996	301	81.2528	46.5
1997	309	81.6494	50.0
1998	349	83.8072	44.3
1999	351	92.3428	33.4
2000	353	100.8016	20.2
2001	358	111.701	21.4
2002	379	126.2577	31.8
2003	398.8	134.0378	35.5
2004	536.4	132.3704	51.08
2005	600	130.6016	46.65
2006	631.5	128.2796	48.0
2007	660.5	-	56.6

Source: CBN (2009)

Appendix Table A2: Results of regression analysis of level Eq. 4

Independent Variables	Coefficients	t-values	p-values
Constant term	8.533	-0.66	0.948
Naira Exchange Rate per US$	2.214	3.920[a]	0.000
Textile Indnstry Capacity Utilization	2.548	1.395	0.173
Dummy	92.235	1.472	0.151

R^2: 0.505, Adjnsted R^2: 0.457, R:0.711, $F_{(model)}$:10.535, p-value for $F_{(model)}$:0.000, DW d:0.856, [a]Statistically significant statistics at both β: 5% and β: 1%

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