Full Length Research Paper

Performance of Cotton Production in Malawi

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Accepted 4 March, 2014

The study was conducted to analyse the performance of the cotton sub-sector in Malawi in terms of output, area and productivity, since independence. Specifically, the study aimed at 1) estimating the compound growth rate in area, production and productivity of cotton in Malawi since 1963/64 growing season and 2) estimating the level of instability in production, area, and productivity. To this end, compound growth rate model and instability index analysis were used to achieve the specific objectives, respectively. The study used annual data on production, yield and area from 1963 to 2012 growing seasons. It was analysed in three time periods defined as the overall study period (1963 to 2012); Pre-SAP (1963 to 1980) and Post SAP (1981 to 2012). The results revealed that there has been a statistically insignificant growth in area, output and yield before and after the implementation of SAPs. However, it was observed that area, output and yield have grown positively during the overall time period. The Pre-SAP period experienced a negative growth in area with positive growth in output and yield. Area, output and yield growth rates for the Post SAP period were positive. Analysis of instability indices showed that area, output and yield have not experienced much variability over time, hence suggesting that the cotton subsector in Malawi has been quite stable. The study recommends more investment in productivity enhancing technologies through research as well as finding innovative ways of ensuring that farmers adopt recommended cotton production practices. This entails ensuring that there is proper coordination amongst all stakeholders as well as improving capacities of extension service providers in delivering extension messages.

Key words: Cotton; productivity; instability index, and technologies

INTRODUCTION

Background information

Cotton is one of Malawi’s important cash crops. It is the fourth most important export crop after tobacco, tea and sugarcane (Government of Malawi, 2006). It is, mostly, a smallholder crop with very few estate farmers involved. The crop is produced by between 120,000 and 150,000 farm households whose production has fluctuated between 10,000 and 65,000 metric tonnes annually over years (Limbe, no date).

Cotton is grown in three areas in Malawi; the Lower shire accounting for up to 50% of national production; the southern region upland areas around Balaka, accounting for up to 30% of production; and the lakeshore area around Salima accounting for the remaining 20% of production (Limbe, no date). Cotton has been grown on an average 50840 hectares of the past 50 years, with area fluctuating between 21,000 and 150,000 hectares.

Over the years, the Government of Malawi (GoM) and other stakeholders have undertaken a lot of interventions so as to improve cotton production and marketing. One of the most important developments in the subsector was the enactment of African Growth and Opportunity Act by United States of America of which Malawi was one of the beneficiaries (Chatima, 2007). Chatima (2007) reported that the Malawi export sector experienced annual growth in clothing and textile exports since Malawi joined AGOA in the textile and apparel category in august, 2001. This phenomenon made cotton industry a growth sector of the economy.

The Malawi Government has also developed the
Malawi Cotton Sector Implementation Strategy to that complements the Cotton-to-Clothing Strategy that was developed by Common Market for Eastern and Southern Africa (COMESA) with the African Cotton and Textiles Industry Federation (ACTIF). The Malawi Cotton Sector Implementation Strategy will run for five years, and among others, it aims to: improve the production and supply of seed cotton and cotton lint; encourage the development of spinning, weaving and knitting textiles for supplying traditional and new markets; assist and encourage profitability and growth in the garments sector; create a business and investment environment that encourages closer value chain integration; and encourage collaboration with international and regional organizations in the sector (WTO, 2010).

Recently, the government of Malawi has shown great interest in developing cotton production as a strategy for insuring the economy against decreased profitability and revenue from tobacco. The government has started to provide subsidies to smallholder cotton farmers as well as introduce cotton growing in “untraditional” cotton growing areas like Karonga, Mulanje and Nkhata Bay. For example, MK1.6 billion (US$6, 153 846.15 at 2011 exchange rate) was dedicated to cotton production and it benefitted 76, 299 households through Farm Input Subsidy Programme in 2011/12 farming season (ZodiakOnline, 2012). Also, efforts are being made to commercialize cotton through agro-processing and other institutional arrangements like contract farming (GoM, 2011; GoM, 2006).

Statement of the Problem

Despite Malawi being in cotton production for decades, an inventory of the determinants of cotton production growth has not been conducted yet. Consequently, economists and other policy makers often make sub-optimal policy decisions regarding investments in cotton development programmes and projects as there is no full understanding of the performance of factors that influence growth in cotton production. Such absence of an evidence-based policy making framework translate into a scenario whereby policy decisions made tend to be very costly to the economy in the medium to long-run since decisions are made in a “trial and error” fashion.

Justification

Keeping in view the importance of cotton to national and household incomes in Malawi, quantitative assessment of the performance and contributions of the various factors to growth of cotton output is helpful in improving and modifying programmes and priorities of cotton development, so as to achieve higher growth. There are so many factors, which affect the growth of any agricultural output. Among these, area and yield are the major ones. These sources of output growth have importance in deciding programmes of agricultural development and priorities of investment in it. Thus, it is important to find why these growth rates differ from one another, so that bottlenecks could be removed to achieve the speedy development of cotton sub-sector.

OBJECTIVES

Main objective

The main objective of the study was to analyse the performance of the cotton sub-sector in Malawi, in terms of output, area and productivity, since independence.

Specific objective

To estimate the compound growth rate in area, production and productivity of cotton in Malawi since 1963/64 growing season.

To estimate the level of instability in production, area, and productivity.

Hypotheses

There has been an insignificant change in area allocated to cotton production, output and yield over the past 49 years. Cotton Production has changed insignificantly since independence.

METHODOLOGY

Nature and source of data

The study was based on secondary data that was collected from United States Department of Agriculture and the Ministry of agriculture of the Malawi Government. The study used annual data on production, area and productivity from 1963 up to 2012 to assess the dynamics of cotton production for over 49 years. The data was analysed in three time periods as follows:

The overall period was divided into Pre-SAP and Post-SAP because the introduction of Structural Adjustment Programmes changed the structural and functional relationships in agriculture in terms of government support, access to local and international markets as well as pricing and subsidies to cite but few. Structural adjustment policy measures in the agriculture sector included:

I. The removal of all government subsidies on food and other agricultural products.

ii. Promotion of production and export of non-traditional agricultural products.

iii. Imposition of restrictive measures on food and other
locally produced agro based raw materials. The overall objective for implementing structural adjustment in agricultural sector was to increase agricultural production and product exports because of its relative importance to the economy with the ultimate goal of improving the overall economy.

**Analytical techniques**

**Exponential growth rate in area, production and productivity**

To estimate the compound growth rate in area, production, and productivity of cotton in Malawi since 1962/3 growing season, compound growth rate model was used. The growth rate was measured following the procedure adopted by Moyo; Mahir and Abdelaziz (2010) and the steps followed were presented below.

Let

\[ Y_t = AB_t \]  

Where

\[ Y_t = \text{area / production / productivity of cotton in the year } t. \]
\[ A = \text{intercept} \]
\[ T = \text{year} \]
\[ B = 1 + r/100 \]

Where, \( r \) refers to the percentage rate of compound growth of area / production / productivity crop per annum.

By taking logarithm of both sides of the equation, we get:

\[ \log Y_t = \log A + t \log B \]  

\[ \log Y_t = a + bt \]  

By using ordinary least square techniques, we have normal equation of the type

\[ \Sigma \log Y = Na + b \Sigma t \]  

\[ \Sigma (t \log Y) = a \Sigma t + b \Sigma t^2 \]  

Where, \( N \) is the number of observations (years).

By solving equation (1.4) and (1.5) the value of \( a \) and \( b \) were computed. When derivations are taken from middle year, i.e., \( \Sigma t = 0 \), the above equation takes the following form:

\[ \Sigma \log Y = Na \]  

Then

\[ a = (\Sigma \log Y)/N \]  

And

\[ \Sigma (\log Y) = b \Sigma t^2 \]  

Then,

\[ b = (\Sigma (t \log Y))/\Sigma t^2 \]

For deriving compound growth rate from the regression coefficients, the following procedure is adopted. When time is measured in discrete intervals, such as quarter or years, a constant growth series would be expressed as

\[ Y_t = Y_0 (1 + r)t \]  

Where,

\[ Y_0 = \text{base year (value of year } 0 \text{) base year} \]
\[ Y_t = \text{value of } Y \text{ in year } t. \]
\[ r = \text{compound growth rate} \]

Taking logarithms of (1.9) to base 10 gives

\[ \log Y_t = \log Y_0 + (\log (1+r))t \]  

This is the equation estimated with actual data.

Thus

\[ \text{Intercept } = \text{estimate of } \log Y_0 \]
\[ \text{Slope } = \text{estimate of } \log (1+r) \]

And so an estimate of \( r \) can be obtained. Comparison of equation (1.10) with (1.3) shows that

\[ \log B = \log (1 + r) \]

\[ r = \text{antilog } B - 1 \]

Percentage rate of compound growth per annum was calculated as:

\[ r = (\text{antilog } B - 1) \times 100 \]

This represents a rate of change from observation to observation during the period under study.

**Students t-test for testing statistical significance of change in area, output and productivity**

To assess the statistical significance of the change in
Table 1: Description of time periods used for data analysis

<table>
<thead>
<tr>
<th>Period number</th>
<th>Name of period</th>
<th>Duration of period</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Overall period</td>
<td>1963-2012</td>
</tr>
<tr>
<td>II</td>
<td>Pre-SAP</td>
<td>1963-1980</td>
</tr>
<tr>
<td>III</td>
<td>Post-SAP</td>
<td>1981-2012</td>
</tr>
</tbody>
</table>

Figure 1: cotton area, yield and output in Malawi (Data Transformed using Natural Logarithms)

area, production, and yield pre- and post-SAP, the following formula was used:

\[
t = \frac{\bar{y}_1 - \bar{y}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}
\]

Where \( t \) = calculated t value

\( \bar{y}_i \) = mean of the data of period \( i \)

\( S_i^2 \) = Variance of the data of period \( i \)

\( n_i \) = number of years

Instability index

The standard deviation and coefficient of variation have been used by many economists for estimating the instability in agricultural production. Hazell (1982) estimated the instability in Indian food production using the coefficient of variation, Farh (1996) adopted the standard deviation and coefficient of variation for studying the instability in agricultural production in Sudan. (Singh, 1989), Gangwar et al (2006) used the coefficient of variation when investigating agricultural instability and farm poverty in India.

However, Moyo observed that the simple coefficient of variation (CV) often contains the trend component and thus over estimates the level of instability in time series data characterized by long term trends. To overcome this problem, the instability index developed by Cuddy and Della (1978) was used as below:

\[
I = C.V \cdot \sqrt{1 - R^2}
\]

Where

\( I \) = instability index

\( C.V. \% = \frac{SD}{\text{mean}} \times 100 \)

\( SD = \text{Standard Deviation} = \sqrt{\text{variance}} \)

\( \text{variance} = \frac{\sum (y_i - \bar{y})^2}{n-1} \)

\( R^2 \) is the adjusted coefficient of determination of the trend regression which best fits the time series. A linear and nonlinear (log linear) trend equation was estimated for determining \( R^2 \).

RESULTS AND DISCUSSION

Overview of cotton production in Malawi

Generally, cotton production has increased over the past 50 years. As can be seen from figure 2, output, area and yield have all experienced upward trend during the
Figure 2: Historical performance of cotton productivity in Malawi

Table 2: Compound Growth Rate of production, area and productivity in Malawi in the overall period (1963 to 2012)

<table>
<thead>
<tr>
<th>Field of measurement</th>
<th>Overall Period</th>
<th>Pre-Sap</th>
<th>Post-Sap</th>
<th>T-Value</th>
<th>P-Value (T&lt;0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area (%)</td>
<td>1.623255</td>
<td>-0.9536</td>
<td>2.1768</td>
<td>0.010129</td>
<td>0.993552</td>
</tr>
<tr>
<td>Production (%)</td>
<td>1.679805</td>
<td>2.94509</td>
<td>1.1049</td>
<td>0.004216</td>
<td>0.997316</td>
</tr>
<tr>
<td>Productivity (%)</td>
<td>1.767641</td>
<td>1.778633</td>
<td>2.194911</td>
<td>0.000432</td>
<td>0.999725</td>
</tr>
</tbody>
</table>

Figure 3: Compound growth rate of production, area and productivity in Malawi

Malawi since 1963. Research Into Use (No Date) identified lack of innovative ways for transferring improved cotton technologies to farmers as a major constraint to improving productivity in Malawi. They emphasized low participation from government extension staff, low capacity amongst extension service providers and other stakeholders to effectively transfer cotton production technologies and other husbandry practices to farmers as the main reasons affecting productivity. They also indicated lack of a sustainable seed supply system and conflicting extension messages from ministry of agriculture.
Table 3: Instability indices of production, area, productivity in Malawi

<table>
<thead>
<tr>
<th>Field of measurement</th>
<th>Overall Period</th>
<th>Pre-Sap</th>
<th>Post-Sap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area (%)</td>
<td>10.16</td>
<td>14.8</td>
<td>6.35</td>
</tr>
<tr>
<td>Production (%)</td>
<td>15.12</td>
<td>5.373859</td>
<td>5.368</td>
</tr>
<tr>
<td>Productivity (%)</td>
<td>6.77</td>
<td>17.22</td>
<td>6.9555</td>
</tr>
</tbody>
</table>

Figure 4: Instability indices of cotton production, area and productivity in Malawi

agriculture and other companies as affecting Malawi’s realization of its productivity potential. This is because farmers, in the end, tend to lack recommended cotton production knowledge and skills.

**Compound growth rate of production, area, productivity**

The compound growth rates for cotton during the overall period as well as the Pre-SAP and Post-SAP periods were estimated using an exponential growth model. The results of the exponential growth analysis are shown in Table 3 below.

As can be seen from the table above, during the overall period (1963 to 2012), production, area and productivity experienced positive growth. Production grew at 1.679805%, area at 1.623255% whereas productivity grew at 1.767641%. Generally, area and productivity contributed equally to the positive growth in production as they grew at a more or less similar rate, 1.623255% and 1.767641%, respectively. Figure 1 below summarizes the growth rates of cotton production, area and productivity.

Moyo (2012) found similar results for India, Pakistan, USA and Australia. Area, output and yield registered positive growth rates in the overall period. However, he observed that China and Brazil experienced a negative growth (-0.15% and -3.25%, respectively) in area in the overall period.

In time period II (1963 to 1980), area experienced a negative growth of -0.9536% whereas production and productivity experienced positive growth rates of 2.94509% and 1.778633%, respectively. From the foregoing, it can be seen that the positive growth in cotton output (2.94509%) in Period II was as a result of growth in productivity alone, as area grew negatively in this time period. Mahir and Abdelaziz (2010) made the same observation when they found out that area allocated to sorghum production grew at a negative rate (-5.03%) in the Pre-SAP period whereas yield grew a positive rate (2.54%) in the same period. Moyo (2012) observed that India experienced a negative growth in area (-2.96%) in the Pre-SAP period while output and yield registered positive growth rates (5.76 % and 4.32%, respectively). USA, Pakistan and Australia experienced positive growth rates in all variables during the Pre-SAP period (Moyo, 2012).

In the Post-SAP period (1981 to 2012), production, area and productivity recorded positive growth, 1.1049%, 2.1768% and 2.194911% respectively. As shown by the results, area and productivity contributed more or less equally to cotton output growth in this period. However, period III results show that area and productivity growth rates were higher than that production growth rate. In essence, this shows that despite more land being allocated to cotton production and the increase in cotton output per hectare, output grew at a modest 1.1049% rate after Malawi adopting Structural Adjustment Programmes. This modest growth in output in the Post-SAP period can be attributed to exogenous factors like increasing incidences of droughts in Balaka as well as generally alternating occurrences of floods and droughts in the Lower Shire that resulted in crop failures at most (FEWSNET, 2010).
Across the periods, the t-test (t-values in table 2 above) indicates that there have been insignificant changes in area, yield and output before and after SAP. This implies an insignificant change in the cotton subsector since independence. The implication is that the implementation of the SAPs has done very little to incite any meaningful changes to the cotton subsector. These results concur with what Ng‘ong‘ola (1996) found that, general, SAPs did very little in improving the agricultural sector of the Malawi economy. Mkandawire and Soludo (1999) observed the same that SAPs brought more misfortunes than opportunities for African economies.

**Instability indices of production, area, productivity**

The study used an instability index model to estimate the variability in cotton production, area and productivity in Malawi. As stipulated by Moyo (2012), agricultural growth with stability has been a matter of concern in the strategy of agricultural development in the world, especially in developing countries. This study used the Instability index as used by Cuddy and Della (1978). Table 3 below summarizes the instability indices for cotton production, area and productivity in Malawi since 1963.

As can be seen from the table above, area (10.16%) and production (14.8%) experienced a relatively higher rate of instability in the overall period as compared to productivity (6.35%). This is likely the case because cotton productivity has not seen much growth over time due to limited innovation in the quality of inputs, for example, improved cotton seeds, tolerance to pests and diseases, and more importantly little improvement in cotton husbandry practices due to low adoption of improved cotton production technologies available (RIU, No Date). This has resulted in cotton yield stability to be generally consistent over time. On the other hand, area and production experienced comparatively higher instability indices because they are direct functions of produce market dynamics of access and pricing as well as export arrangements. Generally, land allocated to cotton production in a given year T is a function of last year’s (T-1) output price. If prices were better in previous season (T-1), farmers tend to allocate more land in the succeeding season T hence production increases. The reverse is also true. This phenomenon is explained by Cobweb theorem (Ezekiel, 1938). Hence, since cotton prices have been fluctuating over years due to dynamics of international cotton market, they have resulted in higher instability rates in area and production of cotton in Malawi for the past 50 years.

In period II, however, area experienced high instability rates (15.12%) relative to production (5.37%) and productivity (5.37%). As observed above, area experienced higher instability index as it responded to output price fluctuations. During this time period, ADMARC was the sole buyer of cotton produce such that farmers had no market alternatives (Ng‘ong‘ola, 1996).

When ADMARC experienced poor prices on the international cotton market, it transferred all price shocks to the farmers which in turn influenced farmers’ enterprise decisions. However, production tended was generally stable due to the consistent stability of productivity within that time period. Also, agricultural loans and subsidies prevalent during the Pre-SAP period helped stabilize cotton production as farmers could afford to buy inputs. These loans and subsidies, among others, made the farmers resilient to production and market shocks within the cotton sector, both domestically and internationally.

Furthermore, production might have fared well in as far as variability is concerned because of the consistent domestic demand for cotton lint by David Whitehead and Sons and other domestic ginners which provided an incentive for continued cotton production.

In the Post-SAP period (1981 to 2012), however, cotton production experienced higher levels of variability with instability index registering 17.22%. This level of production variability has been brought about as a result of an unpredictable production environment in which farmers are carrying out cotton production and marketing as a result government’s adoption of the Structural Adjustment Programmes (Mkandawire and Soludo, 1999) and droughts and floods as a result of climate variability (FEWSNET, 2010). For example, all the subsidies, loans and pricing mechanisms as well as the marketing role of ADMARC which used to give cotton farmers some resilience against production and marketing risks and uncertainties were removed as part of implementing the SAPs. Also, some exogenous factors like frequent occurrences of droughts and floods in key cotton producing areas have contributed a great deal to the higher instability cotton output in the Post-SAP period. The figure below graphs the instability indices for output, area and yield for all the time periods.

It has to be noted, however, that the cotton sub-sector in Malawi is generally stable by world standards. For example, Moyo (2012) found relatively higher indices of instability for cotton production, area and yield for China, India, Australia, Pakistan, Brazil and USA, which are world’s major cotton producers.

**CONCLUSION**

The study has shown that cotton output, area and yield in Malawi have grown over past 50 years. However, the output, area and yield have grown at various rates. The main determinants of growth in cotton production were found to be increasing land allocation to cotton, liberalization of the cotton market and improvement of the policy environment in terms of formulation and implementation of various policies and frameworks like ACTIF, AGOA and others.

Furthermore, the study has shown that area grew at a negative rate in the Pre-SAP period whereas it grew
positively in the Post-SAP period. It has been posited that this might be a result of an increase in companies and organizations that participated on the domestic cotton market. Plausibly, they gave competitive prices that accorded farmers an incentive to allocate more land to cotton. In the same vein, output and yield were found to have grown at positive rates both in the Pre-SAP and Post-SAP periods.

Analysis of instability indices showed that the cotton sector in Malawi is relatively resilient to external shocks. Generally, area, output and yield have not experienced great variability over time, hence suggesting that the cotton subsector in Malawi has been quite stable. Specifically, all variables have shown less variability in the Post-SAP period as opposed to the Pre-SAP period, implying an improvement. Comparatively, output has experienced more fluctuations, followed by area and yield in the whole study period.

To this end, the study fails to reject all the hypotheses and concludes that area, output and yield have not grown significantly in Malawi since independence.

RECOMMENDATIONS

The study has shown that Malawi has been performing poorly in increasing cotton productivity. It has been revealed that cotton yield is growing at a lower rate than it did during the Pre-SAP period. Also, it has been discovered that cotton output growth in Malawi has mainly been due to area effect. This means that, overall, area allocation has contributed more to output growth relative to productivity. However, given the rate at which the population of Malawi is growing and the rate at which land is being fragmented, this scheme of developing the cotton subsector as a function of land allocation will be short-lived. To grow the cotton subsector sustainably, there is a great need to invest more in productivity-enhancing technologies through research as well as finding innovative ways of ensuring that farmers adopt recommended cotton production practices. This entails ensuring that there is proper coordination amongst all stakeholders as well as improving capacities of extension service providers to deliver extension messages in such a way that many farmers would adopt recommended husbandry practices.

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