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**AN ANALYSIS OF SOME ASPECTS OF THE
AUSTRALIAN DOMESTIC RAW COTTON MARKET, 1968-69 TO 1985-86**

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1. Introduction

While cotton has been grown in Australia since the earliest days of settlement, for most of the period up to the late 1950s it was a marginal cropping operation. However, a number of developments in the late 1950s and early 1960s, including the completion of a number of irrigation projects, successful trials with irrigated cotton, and more rational assistance arrangements, introduced in the Raw Cotton Bounty Act 1963, provided the stimulus for structural changes in the industry. As a result of these structural and policy changes, Australia changed from being a net cotton importer at the beginning of the 1970s to a significant world exporter by the mid-1980s. In 1986-87 Australia was the fifth largest exporter, surpassing traditional exporters such as Egypt, Mexico, Turkey and Sudan.

Despite this transformation in the industry, there has been very little research undertaken on the economics of production and marketing of Australian raw cotton. The BAE undertook two surveys of the industry, the first of which was in the early 1960s and the second in the early 1970s. Since then, there has been very little significant economic examination of the industry apart from some recent work by Mues and Simmons (1988a, 1988b). The purpose of this paper is to examine the trends in Australian raw cotton demand and supply and to derive estimates of own-price elasticities of demand and supply over the period 1968-69 to 1985-86. The costs of the domestic raw cotton marketing arrangements will also be examined.

2. Background

The structural changes in the industry which commenced in the early 1960s are described by Vidler (1988). However, they involved a swing to larger scale production under irrigated conditions with higher yields and improved quality of lint. Most of the expansion at this time occurred in New South Wales although there was a small expansion in Queensland. The trends in Australian cotton area harvested, lint yield and lint production since 1968-69 are shown in Table 1.

Table 1 Australian Cotton Area, Yield and Production

| Crop Year | Area harvested | Lint yield | Lint production | Cottonseed production |
|-------------|----------------|------------|-----------------|-----------------------|
| | ('000 ha) | (kg/ha) | (kt) | (kt) |
| 1965-69 | 33.0 | 985 | 32.5 | - |
| 1969-70 | 31.3 | 910 | 28.5 | - |
| 1970-71 | 35.0 | 566 | 19.8 | 31.9 |
| 1971-72 | 40.1 | 1080 | 43.3 | 69.1 |
| 1972-73 | 43.3 | 725 | 31.4 | 50.7 |
| 1973-74 | 41.7 | 731 | 30.5 | 49.8 |
| 1974-75 | 35.1 | 940 | 33.0 | 53.8 |
| 1975-76 | 29.8 | 836 | 24.9 | 40.6 |
| 1976-77 | 33.7 | 831 | 28.0 | 46.6 |
| 1977-78 | 41.2 | 1073 | 44.2 | 72.1 |
| 1978-79 | 49.4 | 1072 | 53.0 | 78.5 |
| 1979-80 | 71.4 | 1165 | 83.2 | 135.8 |
| 1980-81 | 83.6 | 1183 | 98.9 | 161.4 |
| 1981-82 | 103.5 | 1300 | 134.3 | 219.1 |
| 1982-83 | 96.5 | 1044 | 100.8 | 154.4 |
| 1983-84 | 137.0 | 1052 | 141.3 | 190.2 |
| 1984-85 | 183.1 | 1358 | 248.7 | 410.4 |
| 1985-86 (p) | 173.0 | 1484 | 256.7 | 366.0 |
| 1986-87 (s) | 146.0 | 1370 | 200.0 | 313.0 |
| 1987-88 (s) | 175.0 | 1400 | 245.0 | 382.0 |

p Preliminary

s BAE estimate

Source: BAE (1986), table 107; (1987), tables 8, 10, 12.
 BAE (1974), Trends in Australian Rural Production, Exports,
 Income and Prices: 1952-53 to 1972-73, table v.

A feature of the development of the Australian cotton industry was the rapid increase in the exportable surplus. From 1978-79, the volume of exports increased strongly and Australia's share of world exports also increased. Up until 1978-79 Australia accounted for less than 1 per cent of world exports but by 1985-86 this had increased to about 5 per cent. Australia's main export markets are in East Asia which reflects the competitive advantages of the Australian industry over other suppliers because of our proximity to East Asian processors.

3. Domestic Marketing Arrangements

Domestic consumption of Australian raw cotton reached a peak of 31.5 kilotonnes in 1973-74. After that time it declined but has been steady at about 20 kilotonnes per annum in the 1980s. Sales of raw cotton on the domestic market occur within the framework of a voluntary market sharing agreement, first introduced in 1969, between the processors and spinners. Under this agreement, which has an exemption from section 45 of the Trade Practices Act, the estimated quantity of raw cotton required by spinners for the coming season ('quota cotton') is withheld from the export market by processors. This quote is shared among processors on the basis of their share of total production. The movement of domestic consumption is shown in figure 1.

Australian cotton is sold on the domestic market at a price known as the Base Price, which is the Liverpool price of Strict Middling 1-1/16 inch cotton to which freight costs are added and then converted into Australian currency. Prices of other types of cotton sold on the domestic market are based on this price after adjusting for quality and staple length. Unit returns on the domestic market depends, therefore, on both world prices and the types of cotton qualities purchased.

Australian cotton export prices reflect world prices for the particular grade, crop quality and exchange rate movements, particularly the relationship between the Australian and United States currencies.

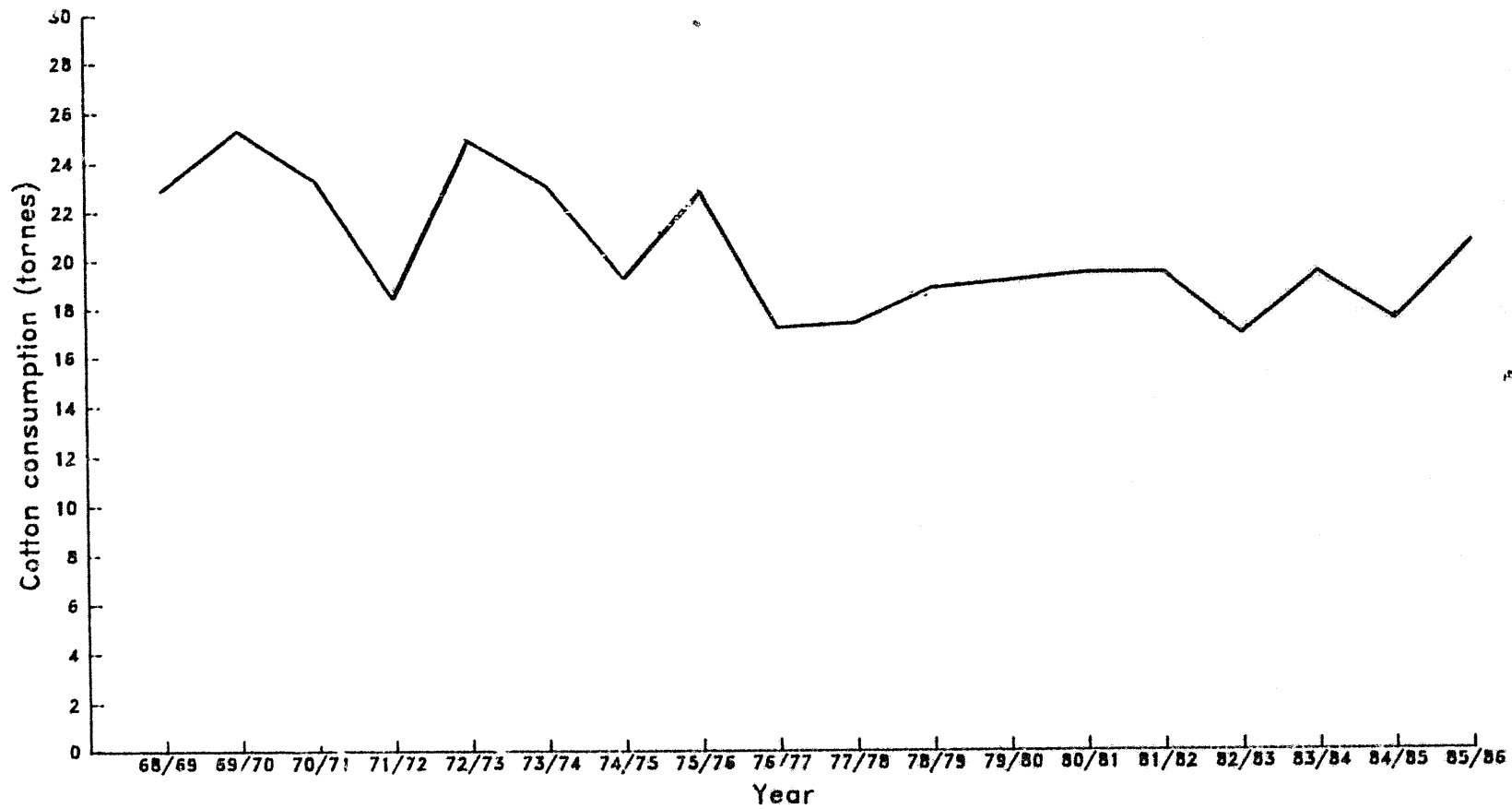


Figure 1 Domestic Consumption of Australian Raw Cotton, 1968-69 to 1985-86

For identical grades of cotton, unit export returns will be lower than unit returns from local sales generally by an amount which represents transport costs. The levels of the domestic and export prices and the differential between the two is shown in Table 2. The export price has historically been no more than 80 per cent of the domestic price except for 1981-82 and 1985-86 when it was about 90 per cent. Despite the existence of this differential, grower returns for cotton sold on both the domestic and export markets are determined by movements in world cotton prices.

The supply and demand position of the industry can be depicted as in Figure 2. Point B is the point where the industry would operate in the absence of the domestic marketing arrangements, at the export parity price P_e . With the domestic marketing arrangements it operates at Point A, at the import parity price P_i . The increase in revenue flowing to the cotton industry under the arrangements is $P_e P_i A C - Q_i C B Q_e$.

4. The Analytical Model

The model which is developed in this study consists of equations representing domestic demand and New South Wales and Queensland supply. Since the ginnery withhold from the market the spinners estimated raw cotton requirements for each year, exports are treated as a residual, ie, as the difference between supply and domestic demand in any year. Supply in any year is considered to be perfectly inelastic with respect to current price. With supply in any year being predetermined, exports are a function of domestic demand and therefore of the domestic price of Australian raw cotton.

4.1 Domestic Demand

A quantity dependent domestic demand function is formulated because spinners' demand for raw cotton is determined by the domestic Base Price, but this will not be influenced in any way by the domestic consumption of Australian raw cotton.

Table 2
Average Domestic Base and Unit Export Prices

| Year | Domestic Base Price (\$M 1-1/16") | Unit Export Value, f.o.b. (All grades) | Difference | Export as Proportion of Base |
|---------|---|--|------------|------------------------------------|
| | c/kg | c/kg | c/kg | % |
| 1968-69 | 59.8 | 50.6 | 9.2 | 0.846 |
| 1969-70 | 58.5 | 44.4 | 14.1 | 0.759 |
| 1970-71 | 64.7 | 46.3 | 18.4 | 0.716 |
| 1971-72 | 72.2 | 64.2 | 8.0 | 0.889 |
| 1972-73 | 71.8 | 50.9 | 20.9 | 0.709 |
| 1973-74 | 119.5 | 56.6 | 62.9 | 0.474 |
| 1974-75 | 90.4 | 70.0 | 20.4 | 0.774 |
| 1975-76 | 116.7 | 72.2 | 44.5 | 0.619 |
| 1976-77 | 166.4 | 130.0 | 36.4 | 0.781 |
| 1977-78 | 135.4 | 111.7 | 23.7 | 0.825 |
| 1978-79 | 156.1 | 120.8 | 35.3 | 0.774 |
| 1979-80 | 179.0 | 137.8 | 41.2 | 0.770 |
| 1980-81 | 192.3 | 157.2 | 35.1 | 0.817 |
| 1981-82 | 164.1 | 148.1 | 16.0 | 0.902 |
| 1982-83 | 200.6 | 152.9 | 47.7 | 0.762 |
| 1983-84 | 236.6 | 181.6 | 55.0 | 0.767 |
| 1984-85 | 224.9 | 185.8 | 39.1 | 0.826 |
| 1985-86 | 172.1 | 156.8 | 15.3 | 0.911 |

Source: BAE (1986), Commodity Statistical Bulletin, Table 110.

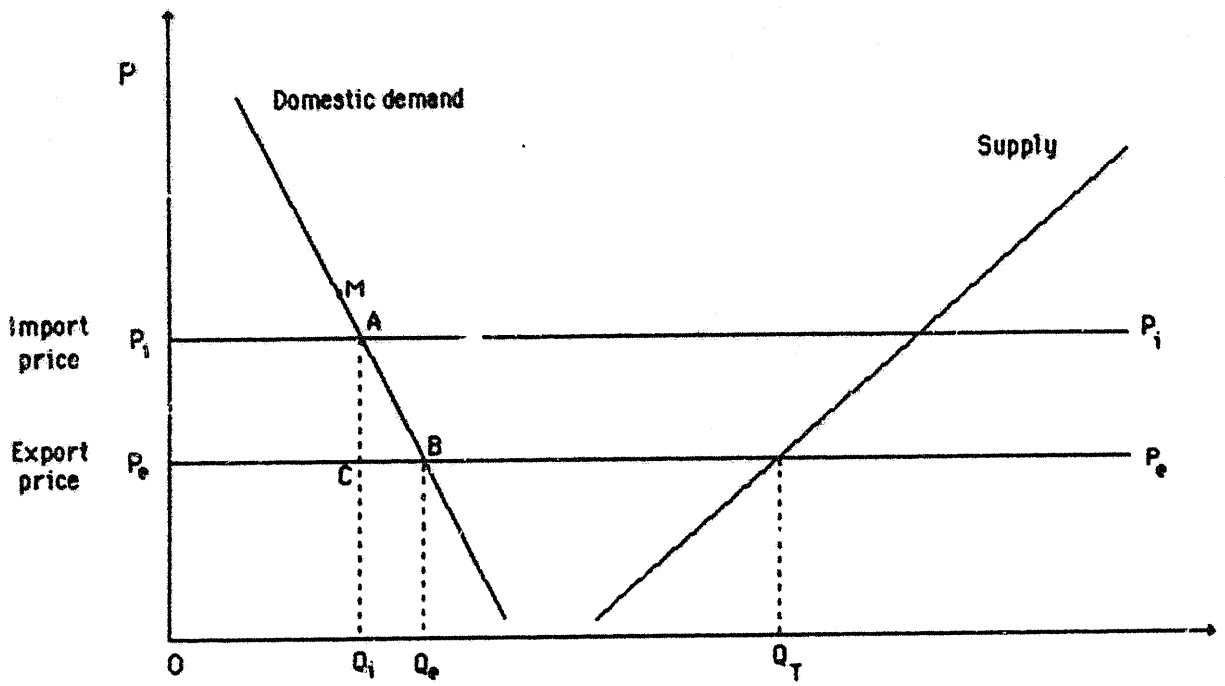


Figure 2 Supply and Demand in the Australian Cotton Industry.

The cotton demand equation is specified as

$$Q_d = f(PC, PP, EFAS)$$

where Q_d = domestic demand for raw cotton

PC = price of raw cotton

PP = Australian price of polyester

$EFAS$ = Index of effective rate of assistance to the
Australian textile industry.

4.2 Supply

A general cotton supply response model can be considered to be

$$Q_{t^*} = f(P_{t^*}, Z_{t-1}, \dots, Z_{nt})$$

where Q_{t^*} = planned output in period t

P_{t^*} = expected price in period t

$Z_{1t} \dots Z_{nt}$ = relevant supply shift variables.

The supply functions will be estimated using a Nerlovian adaptive expectations price specification in which expected price is a weighted average of past prices. A trend variable is included to account for technological change. A sorghum price variable to model alternative crops and a fertiliser price variable to model input costs are also included.

5. Model Results

The model results are presented in Table 3. In general the results appear acceptable. The adjusted R^2 value for the domestic demand equation is very low and indicates that the equation explains only slightly more than 55 per cent of the variation in domestic consumption of Australian cotton. However, it is probably the best that could have been obtained, given the erratic trends in the domestic consumption of raw cotton as shown in figure 1. In the supply functions the sorghum and fertiliser price variables and the time trend variable were not significant and entered the equations with the wrong signs.

Table 3

Model Results

Domestic demand

$$DCC = 23.11 - 0.05 PCA + 0.08 EFAS - 4.75 DC$$

(2.19) (0.10) (0.06) (1.93)

$$R^2 = 0.60 \quad DW = 2.27 \quad F = 8.20$$

Supply

| Equation | Regression Coefficients | | | R ² | F | h | β |
|----------|-------------------------|----------------|----------------|----------------|------|-----|------------------|
| | Intercept | Lagged price | Lagged supply | | | | |
| NSW | -2.83 (10.30) | 0.15 (0.26) | 0.92 (0.11) | 0.80 | 31.0 | (a) | 0.076 (0.327) |
| QLD | -0.68 (1.55) | 0.04 (0.04) | 0.91 (0.20) | 0.928 | 87.2 | (a) | 0.087 (0.197) |

(a) Durbin's h-statistic could not be calculated. The alternative method outlined in Doran and Guise (1984, p215) indicated no autocorrelation.

5.1 Elasticities

Elasticities are extremely important in many forms of agricultural policy analysis. For example, a knowledge of elasticities is very important in evaluating the social cost of various types of agricultural programs. The own-price elasticity of demand was estimated from the domestic demand equation to be -0.32. Elasticities of supply for New South Wales and Queensland are estimated from the supply equations, with both short-run and long-run estimates derived from the adaptive expectations model. The supply elasticities are shown in table 5 together, for the purpose of comparison, with the estimates by Mues and Simmons (1988a).

Table 5

Cotton Supply Elasticities

| | <u>Short Run</u> | <u>Long Run</u> |
|-----------------|------------------|-----------------|
| New South Wales | 0.23 | 3.03 |
| Queensland | 0.24 | 2.72 |
| Australia (a) | 0.59 | 2.46 |

(a) Derived by Mues and Simmons (1988a)

The supply curves for New South Wales and Queensland were aggregated to give a weighted average short-run elasticity for Australia. This was used to calculate a short-run supply elasticity for each year of the study period. This is shown in Table 6.

Table 6

Short-Run Price Elasticities of Cotton Supply: Australia,
1986-69 to 1985-86

| Year | Elasticity |
|---------|------------|
| 1968-69 | 0.04 |
| 1969-70 | 0.26 |
| 1970-71 | 0.36 |
| 1971-72 | 0.15 |
| 1972-73 | 0.29 |
| 1973-74 | 0.23 |
| 1974-75 | 0.22 |
| 1975-76 | 0.36 |
| 1976-77 | 0.33 |
| 1977-78 | 0.38 |
| 1978-79 | 0.27 |
| 1979-80 | 0.19 |
| 1980-81 | 0.18 |
| 1981-82 | 0.15 |
| 1982-83 | 0.19 |
| 1983-84 | 0.14 |
| 1984-85 | 0.09 |
| 1985-86 | 0.09 |

6. Some Policy Implications

In this study the estimated supply and demand elasticities are used to evaluate the cost of the domestic marketing arrangements. The negative own-price elasticity of demand implies that over the study period the cotton industry was operating in the inelastic portion of the domestic demand curve and the industry's marginal revenue was negative as illustrated in Figure 2.

Marginal revenue, price and elasticity are related through the formula

$$MR = P(1 + \frac{1}{\eta})$$

where MR is marginal revenue, P is price and η is the elasticity of demand. Since when demand is inelastic an increase in price leads to an increase in total revenue (Koutsoyiannis 1979, p.53), the domestic marketing arrangements have served to increase the total revenue of the cotton industry. The size of these producer transfers is shown in Table 7 and over the 18 year period 1968-69 and 1985-86, these amounted to \$108.9 million.

However, the size of these financial transfers is not necessarily indicative of the social cost of the domestic marketing arrangements which, in their effects, are similar to production quotas. Wallace (1962) showed that the social cost of a quota can be calculated by the formula

$$SC = \frac{1}{2} PQ \eta r^2 (1 + \frac{E}{\epsilon})$$

where PQ is the value of output under competitive conditions, E is the elasticity of demand, r^2 is the percentage increase in the administered price over the competitive price and ϵ is the elasticity of supply. The social costs will increase as the elasticity of supply ϵ decreases, and vice versa. Estimates of the social cost were calculated using the short run supply elasticities. These amounted to \$25.1 million. The social costs in each year of the period are shown in Table 7.

Table 7

Cost of the Domestic Raw Cotton Marketing Arrangements,
1968-69 to 1985-86

| Year | Producer transfers | Social cost(a) | Gross value of production (GVP) | Cost as a proportion of GVP |
|---------|--------------------|----------------|---------------------------------|-----------------------------|
| | \$M | \$M | \$M | % |
| 1968-69 | 2.1 | 0.1 | 20.8 | 0.5 |
| 1969-70 | 3.6 | 0.1 | 19.3 | 0.5 |
| 1970-71 | 4.3 | 0.1 | 13.3 | 0.7 |
| 1971-72 | 1.5 | 0.0 (p) | 30.1 | 0.0 |
| 1972-73 | 5.2 | 0.2 | 32.6 | 0.6 |
| 1973-74 | 14.5 | 4.2 | 26.6 | 15.8 |
| 1974-75 | 3.9 | 0.3 | 29.3 | 1.0 |
| 1975-76 | 10.1 | 1.3 | 37.5 | 3.5 |
| 1976-77 | 6.3 | 1.2 | 39.8 | 3.0 |
| 1977-78 | 4.1 | 0.4 | 61.2 | 0.6 |
| 1978-79 | 6.7 | 1.1 | 76.0 | 1.4 |
| 1979-80 | 7.9 | 1.9 | 135.3 | 1.4 |
| 1980-81 | 6.8 | 1.4 | 147.0 | 0.9 |
| 1981-82 | 3.1 | 0.3 | 182.0 | 0.2 |
| 1982-83 | 8.1 | 3.4 | 108.0 | 3.1 |
| 1983-84 | 10.7 | 5.0 | 269.0 | 1.8 |
| 1984-85 | 6.8 | 3.9 | 330.0 | 1.2 |
| 1985-86 | 3.2 | 0.3 | 290.0 | 0.1 |
| Total | 108.9 | 25.2 | 1847.8 | 1.4 |

(p) Less than \$0.1 million.

(a) Calculated using the supply elasticities in Table 6.1.

7. Conclusion

This paper has examined the trends in the demand for and supply of Australian raw cotton over the period 1968-69 to 1985-86. Domestic demand was found to be relatively inelastic and supply was inelastic in the short run but elastic in the long run. The cost of the domestic marketing arrangements over the period 1968-69 to 1985-86 was estimated to be \$25 million.

The study showed that while the industry has been operating in the inelastic portion of its domestic demand curve, the marketing arrangements have had the effect of taking the industry further up its marginal revenue curve towards the point of zero marginal revenue.

Given that the industry was still operating in the region of negative marginal revenue, even with the price raising effects of the domestic marketing arrangements, there is scope for further price rises until the industry is operating at the point of zero marginal revenue and revenue from the domestic market is being maximised. This implies that the economic feasibility of some form of statutory two price scheme could be investigated.

However, it should be noted that while such a scheme may result in revenue from the domestic market being maximised, the overall financial gain to the cotton industry would be small because only a small proportion of total output is sold on the domestic market. In addition, the wider economic cost of such a policy in the form of higher input costs for the domestic textile industry would need to be taken into account when assessing the total impact of such a policy.

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