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ASSESSING COMPETITIVENESS OF INDIAN COTTON PRODUCTION: A POLICY ANALYSIS MATRIX

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Abstract

This paper uses a policy analysis matrix (PAM) approach to assess the comparative advantage of cotton in India. The results indicate that that cotton is not efficiently produced in the second largest cotton producing state in the country. Without government interventions, it is likely that area will move away from cotton to more profitable crops such as sugarcane and groundnut. Under this scenario, India might emerge as major cotton importer to meet the growing domestic demand.

Introduction

India is the third largest cotton producer in the world behind China and the United States, accounting for 25 percent of the world area but only14 percent of the world production. Despite being one of the largest cotton producers in the world, historically, India has been more or less nonexistent in the world cotton market. However, in the recent years, India has reemerged as a major player in the world cotton market accounting for an average of 6 percent of world imports since 1999 and accounted for 5 percent of all U.S. cotton sold in 2000. During the first 4 months of marketing year 2001, India accounted for an extraordinary 9 percent of all U.S. cotton sold for export. India's reemergence as a cotton importer can be partly attributed to the series of economic reforms undertaken by Indian policy makers in the early 90s. The policies were targeted primarily at industry and the international trade regime, affecting agriculture only indirectly through reductions in input subsidies. More recently, Government of India (GOI) announced its intent to reform the cotton and textile sector but there were no specifics as to what would be done or when.

Severe external and internal constraints remain in place despite ongoing GOI efforts in reforming cotton and textile sectors. One of the external constraints were imposed by the Multifibre Arrangement (MFA), import quotas by developed European and North American importers in contravention of the General Agreement on Tariffs and Trade (GATT) principles of open and non-discriminatory trade rules. But more importantly, internal constraints include a mandate to sustain the small-scale traditional handloom sector, export constraints on yarn and government fixing of cotton ginning and pressing fees, subsidization of raw cotton production, and an overvalued exchange rate, that held domestic producer prices well below world prices.

During the next decade, both state intervention and the external trade constraints originally imposed under the MFA will fall, as the Uruguay Round Agreement's 2004 deadline approaches for returning textiles and apparel to the World Trade Organization (WTO) disciplines that govern the rest of world trade. India is also removing its own import restrictions in order to meet its WTO obligations, and profound changes are likely in store for cotton and textile production in both India and the rest of the world as this wave of unilateral and multilateral liberalization overturns long-established patterns of production and trade.

In light of these forthcoming external and internal changes, likely to be significantly affecting Indian cotton sector, this paper proposes to examine the competitiveness of Indian cotton using a modified Policy Analysis Matrix (PAM). In the following section, a brief description of the cotton production in India along with policy affecting cotton production is presented. In the next section, PAM technique is presented. The third section provides a discussion on data used and modeling assumptions. The final section presents results with a discussion on implications of the findings.

Indian Cotton Production and Policy

Indian cotton production has been concentrated in the western half of the country and can be broadly divided into three major regions primarily based on climatic differences and regional heterogeneity on availability of water and other natural resources that influence the mix of crops in various parts of country. It includes the Northern Region (Haryana, Punjab, and Rajasthan); the Central Region (Maharashtra, Gujarat, and Madhya Pradesh); and (iii) the Southern Region (Karnataka, Tamil Nadu, and Andhra Pradesh). Northern region is the primary producer of short and medium staples and southerners primarily grow long staples. The central region produces mostly medium and long staples.

In the last decade, cotton area in each of the region has increased significantly with total area increasing by nearly 2 million hectares during the period 1990 to 1997. Although area in each of the region grew in the last decade the yield has grown in a disproportionate manner. For example, between the periods of 1981 to 1994, yields in the northern and southern regions grew at a rapid rate of 6.6 and 4.2 percent respectively as compared to negative (–0.7) growth in the central region (Chakrabarty, 1999). The major reason for the yield increases in both north and south regions may be due to adoption of improved varieties and irrigated production whereas central region, particularly in Maharashtra, has witnessed more or less no growth in yield because of use of low yielding varieties and largely rainfed area. Overall cotton yield in India is one of the lowest in the world mainly due to lack of irrigation, limited supplies of quality seeds and poor management practices.

Marketing of both cottonseed and lint is done by three major groups, the private traders, state level cooperatives and Cotton Corporation of India (CCI). Of the three groups, private traders handle more than 70 percent of cottonseed and lint followed by cooperatives and CCI. Normally, Indian farmers sell their cotton in the form of *kapas* or seed cotton mostly to a regulated market, which was established under the State Agricultural Product Markets Act (Chakrabarty, 1999).

The government annually establishes a minimum support prices for various cotton varieties on the basis of recommendations from the Commission for Agricultural Costs and Prices. The government run CCI is entrusted with market intervention operations in the events of price fall below minimum support price in all states except Maharashtra, where there is state monopoly procurement. In Maharashtra, cotton cultivators are prohibited from selling seed cotton to any buyer other than Maharashtra State Cooperative Marketing Federation.

To ensure textile manufacturers an adequate supply of cheap raw cotton, the GOI has implemented policies ranging from input subsidization to export controls. GOI sets yearly export quotas for quantity and types of cotton lint exports depending on local supply and demand situation and a minimum export price to act as a disincentive to export. On the domestic front, cheap cotton pricing policy is pursued by subsidizing major production inputs such as fertilizers (nitrogenous and phosphatic), irrigation, and power.

The Policy Analysis Matrix (PAM) and Measures of Comparative Advantages

The PAM is computational framework, developed by Monke and Pearson (1987) and augmented by Masters and Winter-Nelson (1995), for measuring input use efficiency in production, comparative advantage and the degree of government interventions. The basis of the PAM is a set of profit and loss identities that are familiar to any businessman (Nelson and Panggabean, 1991). The primary strength of the PAM is that it allows varying level of desegregations and makes the analysis of policy-induced transfer straightforward. Along with strength, PAM also suffers some weaknesses, one of which is the assumption of fixed input-output coefficients.

The basic format of the PAM as shown in Table 1 is a two-way accounting identities.

The data in the first row provide a measure of private profitability (N), defined as the difference between observed revenue (A) and costs (B+C). The private profitability demonstrates the competitiveness of the agricultural system, given current technologies, prices for input and output, and policy. The second row of the matrix calculates the social profit that reflects social opportunity costs. Social profits measure efficiency and provide a measure of comparative advantage. In addition, comparison of private and social profits provides a measure of efficiency. A positive social profit indicates that the country uses scare resources efficiently and has a static comparative advantage in the production of that commodity at the margin. Similarly, negative social profits suggest that the sector is wasting resources, which could have been utilized more efficiently in some other sector. In other words, the cost of domestic production exceeds the cost of imports suggesting that the sector cannot survive without government support at the margin. The third row of the matrix estimates the difference between first and second rows. The differences between private and social valuations of revenues, costs and profit can be explained by the effects of policy interventions.

The PAM framework also enables to calculate important indicators for policy analysis. Nominal protection coefficient (NPC), a simple indicator of the incentives or disincentives in place, is defined as the ratio of domestic price with a comparable world (social) price. NPC can be calculated for both output (NPCO) and input (NPCI). The domestic price used in this computation could be either procurement price or farm gate price while the world reference price is the international price adjusted for transportation, marketing and processing costs. The other two indicators that can be calculated from PAM include the effective protection coefficient (EPC) and domestic resource cost (DRC). EPC is a ratio of value added in private prices (A–B) to value added in social prices (E–F). An EPC value of greater than one suggests that government policies provide incentive to producers and less than one indicates that producers are not protected through policy interventions.

DRC, the most useful indicator of all the three, used to compare the relative efficiency or comparative advantage between agricultural commodities and is defined as the shadow value of nontradable factor inputs used in an activity per unit of tradable value added (F/(D-E)). The DRC indicates whether the use of domestic factor is socially profitable (DRC<1) or not (DRC>1). Although the DRC indicator is widely used in academic research, its primary use has been in applied works by World Bank, Food and Agriculture Organization, International Food Policy Research Institute in the developing countries to measure comparative advantage. However, DRC may be biased against activities that rely heavily on domestic nontraded factors such as land and labor. A good alternative for the DRC is the SCB, which accounts for all costs (Fang and Beghin, 1999). The SCB is calculated as the ratio of (E+F)/D. Land is a more restricted factor than other domestic factors in India's crop production. Therefore another indicator, the SCB without land-cost (LSB) is used to measure the return to this fixed factor. Higher values of SCB and LSB suggest stronger competitiveness.

Data and Modeling Assumptions

The data requirements for constructing a PAM include yields, input requirements, and the market prices for inputs and outputs. Additional data such as transportation costs, port charges, storage costs; production subsidy, import/export tariffs and exchange rate are also required to calculate social prices. In this study, PAM will be compiled for cotton and its competing crops in five major cotton-producing states for 1996/97. These five states account for more than 85 percent of India's and cotton production and also represent various types of cotton grown in India. Most data are available from 2000 Cost of Cultivation of Principal Crops in India, published by Ministry of Agriculture & Cooperation, Government of India. The survey is a comprehensive scheme for studying the cost of cultivation of principal crops. The design of survey is a three-stage stratified random sampling design with tehsils as the first stage unit, village/cluster of villages as the second stage unit and holding as the third and ultimate stage unit. Each state is demarcated into homogenous agro-climatic zones based on cropping pattern, soil types, rainfall, etc. The primary sampling units are selected in each zone with probability proportional to the area under the selected crops.

The most difficult tasks for constructing a PAM are estimating social prices for outputs and inputs and decomposing inputs into their tradable and non-tradable components (Yao, 1997). For computing social prices for various commodities including both outputs and inputs, world prices are used as the reference prices in the study. The U.S. FOB Gulf prices are used as reference prices for wheat, corn, and sorghum. The canola cash price, Vancouver, cotton A-index CIF Northern Europe (An average of the cheapest five types of cotton offered in the European market), raw sugar price FOB Caribbean and U.S. runner, 40 to 50 percent shelled basis CIF Rotterdam are used at the representative prices for rapeseed, cotton, sugar, and groundnut respectively. These world prices are obtained from various commodity yearbooks published by USDA. The world prices are adjusted for transportation costs and marketing costs to be compared at the farm gate. For imported commodities, social prices at the farm gate are calculated by adding marketing costs from the respective CIF Mumbai prices (Calculated by adding ocean freight charge to the FOB price) in domestic currency. Similarly, for exported commodities, social prices at the farm gate are calculated by adding marketing cost from the respective world reference price in domestic currency, converted to domestic currency. Freight rates from Gulf and Rotterdam are collected from Pursell and Gupta (2001) and added to the FOB Gulf and CIF Rotterdam prices. These prices are converted to domestic currencies using market exchange rates and finally, marketing costs are added to compare with farm gate prices. Following Pursell and Gupta (2001), marketing costs consist of an interest charge for two months at an 18 percent rate applied to the CIF prices plus Re 10 per metric ton to represent other marketing expenses. Similar procedures are used for calculating input shadow prices for fertilizers and pesticides.

Following Gulati and Kelley (2000), the social valuation of land is calculated as the ratio of net returns to land to average of NPCOs of competing crops. Net returns to land is calculated as the gross value of output-cost of production + rental value of owned land. Another important component of this analysis is the disaggregation of nontraded and traded inputs. Based on Monke and Pearson (1989), who suggested that decomposing all input costs is a tedious task and has very insignificant effect on results, some inputs such as land, labor, farm capital depreciation, animal power and manure are assumed to be totally nontradable. Once the inputs are disaggregated into tradable and nontradable components, PAMs are constructed for cotton and its competing crops in each of the five states.

Interpretations of PAM Indicators

The summary results on protection coefficients on cotton in various states are reported in Tables 2. The NPCO coefficients show that domestic prices in two out of five states (Maharashtra and Haryana) have remained above their corresponding international reference prices. Of the three states, NPC in Punjab is very close to one suggesting that domestic price is slightly below the international price whereas in other two states (Gujarat and Andhra Pradesh) NPCs are much lower than one. Similarly, NPCI values of less than one in all cases suggest that the government policies are reducing input costs for cotton in all the five states. NPC values of less than one both in the all input and most output markets clearly indicate the government efforts to support the textile sectors by providing raw cotton at a cheaper price.

The EPC is more reliable indicator of effective incentive than the NPC, as the former presumes free trade of both inputs and outputs. The EPC nets out the impact of protection on inputs and outputs, and reveals the degree of protection accorded to the value addition process in the production activity of the relevant commodity. The EPC values in Table 1 show that there is significant difference in the degree of policy transfer for cotton across major growing states. Both Haryana and Maharshtra farmers enjoy a support of 12 and 6 percent respectively for their value added whereas other three states, particularly Gujarat and Andhra Pradesh farmers face a net tax of around 40 percent on their value added.

The other PAM indicators such as DRC, SCB and LSB for cotton and competing crops in each state are reported in Table 3 and their rankings in each state are reported in Table 4. These indicators reaffirm the conclusions reached with the protection coefficients earlier. For high protection states like Maharashtra and Haryana, DRC values for cotton are much larger than their respective competing crops. In Maharashtra, DRC value for cotton is estimated to be 1.19 as compared to 0.33 and 0.34 for sugarcane and groundnut respectively suggesting that Maharashtra has significant comparative advantage in producing sugarcane and groundnut but government policies on cotton has led to significant allocative inefficiency. Similarly, in Haryana, DRC indicator for cotton is close to one, which is the second largest behind rice out of four crops included in this study. DRC values for Haryana clearly indicate that it has a definite comparative advantage in producing wheat and groundnut as compared to cotton and rice. In other three states (Punjab, Gujarat and Andhra Pradesh) DRC values for cotton are found to be lower than one, but not the lowest among the competing crops. In Punjab, DRC value of wheat (0.41) is much lower than cotton (0.65), suggesting that it has obvious comparative advantage in producing wheat. But at the same time, DRC value of rice is much larger than cotton, even higher than one, implying a definite comparative disadvantage over its competing crops. Similar situations exist both in Gujarat and Andhra Pradesh, where DRC of cotton are significantly lower than one but not the lowest among their rival crops. In both the states, there is at least one crop with DRC higher than one, suggesting that cotton is not produced inefficiently in both these states but at the same time, it is also not the crop, which has the most comparative advantage in either state.

The rankings using DRC values are further strengthened by finding exactly similar ranking using the SCB values. However, the LSB indicators provide similar ranking in four out of five states with the exception of Andhra Pradesh where it slightly changes the commodity ranking.

Overall, the results suggest that the cotton production in Maharashtra is not competitive at all and will be seriously affected without government support. Low cotton yield in Maharashtra, the lowest among major cotton producing states, is the primary reason for the lack of competitiveness for cotton in the state. To further illustrate this point, Andhra Pradesh and Gujarat cotton yields are around 350 and 240 percent higher than that of Maharashtra. Even with such low yield, Maharashtra, still accounts for 22 percent of Indian cotton production by virtue of its large cotton area. In terms of share, Maharashtra accounts for 35 percent of total cotton area (largest in the country) and 22 percent of total production (second largest in the country).

Therefore, any unilateral or multilateral trade liberalizations of cotton sector in India may have serious implications for Maharashtra agriculture with area being diverted from cotton to more profitable crops such as sugarcane and groundnut. Another important point to note that cotton is not the most efficiently produced crop in any of the other four major cotton growing states included in this study. This may imply that in the face of either unilateral or multilateral liberalizations, cotton production in these states many not be seriously affected but at the same time most area diverted from less efficient crops (DRC>1) is likely to go to those crops with higher comparative advantage than cotton.

Conclusion

This study is an application of a policy analysis matrix (PAM) for cotton and its competing crops in five major cotton-producing states in India. The PAM indicators suggest that cotton is not efficiently produced in the second largest cotton producing state in the country, i.e. Maharashtra. Sugarcane and groundnut have significant comparative advantage in the state over cotton. In addition, the results also suggest that cotton is not the most efficiently produced crop in the other four states; however, there is at least one crop in each state which is less effectively produced than cotton. Interestingly enough, in three out of four states namely Punjab, Haryana, and Andhra Pradesh, the major grain producing states in India, rice is found to be the least efficiently produced crop. In the remaining state, Gujarat, wheat is found to be the least efficiently produced crop. These results are consistent with the government policies of achieving food security in grain through high procurement price and heavy subsidization of inputs.

As the PAM is a static model, which cannot capture the potential changes in prices and productivity, these results are subject to change with market conditions. For example, changes in either international prices or parity prices of tradable inputs can change the values of DRCs for different crop and in turn affect the rankings.

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Table 1. Policy Analysis Matrix

		Value of input		
	Value of output	**Tradable**	**Domestic Factor**	**Profit**
Private Prices	A	B	C	N
Social prices	D	E	F	O
Policy Transfer	G	H	I	P

Source: Monke and Pearson

Private profit: N=A−(B+C)

Social profit: O=D−(E+F)

Output transfer: G=A−D

Input transfer: H=B−E

Factor transfer: I=C−F

Net policy transfer: P=N−O

Table 2. Summary Results of the Protection Coefficients in Major Cotton Producing States in India (1996/97).

		Wheat	**Rice**	**Cotton**	**Groundnut**	**R.seed**	**Corn**	**Sugar cane**
Punjab	NPCO	0.70	1.21	0.91				
	NPCI	0.72	0.69	0.88				
	EPC	0.70	1.34	0.92				
Haryana	NPCO	0.73	1.57	1.09		0.85		
	NPCI	0.72	0.69	0.81		0.69		
	EPC	0.72	1.88	1.13		0.87		
Maharashtra	NPCO			1.01	0.51			0.43
	NPCI			0.81	0.94			0.73
	EPC			1.06	0.45			0.41
Gujarat	NPCO	1.11		0.67	0.52	0.80		
	NPCI	0.78		0.85	0.93	0.68		
	EPC	1.17		0.64	0.46	0.81		
Andhra Pradesh	NPCO		1.45	0.63	0.44			0.47
	NPCI		0.75	0.85	0.91			0.74
	EPC		1.71	0.57	0.37			0.45

Table 3. Results of the State wise Indicators for Cotton and its Competing Crops (1996/97)

		Punjab	**Haryana**	**Maharashtra**	**Gujarat**	**Andhra Pradesh**
Cotton	DRC	0.65	0.96	1.19	0.55	0.78
	SCB	0.72	0.97	1.15	0.60	0.82
	LSB	7,141	11,017	3,544	15,781	19,265
Wheat	DRC	0.41	0.39		1.12	
	SCB	0.49	0.46		1.10	
	LSB	23,634	21,356		8,547	
Sugarcane	DRC			0.33		0.46
	SCB			0.37		0.49
	LSB			58,304		67,283
Rapeseed	DRC		0.44		0.88	
	SCB		0.47		0.89	
	LSB		14,124		13,291	
Rice	DRC	0.91	1.37			1.42
	SCB	0.93	1.24			1.3
	LSB	7103	91			841
Corn	DRC					0.36
	SCB					0.44
	LSB					10,698
Groundnut	DRC			0.34	0.44	0.27
	SCB			0.41	0.51	0.36
	LSB			16,461	20,223	16,182

Table 4. Comparative Advantage Ranking By Crop

State	Commodity	DRC	SCB	LSB
Punjab	Wheat	1	1	1
	Cotton	2	2	2
	Rice	3	3	3
Haryana	Wheat	1	1	1
	Rapeseed	2	2	2
	Cotton	3	3	3
	Rice	4	4	4
Maharashtra	Sugarcane	1	1	1
	Groundnut	2	2	2
	Cotton	3	3	3
Gujarat	Groundnut	1	1	1
	Cotton	2	2	2
	Rapeseed	3	3	3
	Wheat	4	4	4
Andhra Pradesh	Groundnut	1	1	3
	Corn	2	2	4
	Sugarcane	3	3	1
	Cotton	4	4	2
	Rice	5	5	3