The *Journal of Cotton Science 7:65–74 (2003)*
http://journal.cotton.org, © The Cotton Foundation 2003

ECONOMICS AND MARKETING

Assessing the Competitiveness of Indian Cotton Production: A Policy Analysis Matrix Approach

Samarendu Mohanty*, Cheng Fang, Jagadanand Chaudhary

ABSTRACT

In the next decade, India is likely to witness changes in its cotton and textile sectors as many of the constraints on production, marketing, and trade of cotton and textile products are set to be eliminated. Some of the internal constraints include export constraints on yarn, government fixing of cotton ginning and pressing fees, and subsidization of raw cotton production. Similarly, one of the most important external constraints includes export restrictions on textile products to developed markets through the Multifiber Arrangement. In light of these impending changes, this paper examines the efficiency of cotton production in five major producing states in India using a modified policy analysis matrix (PAM) approach. The results indicate that cotton is not efficiently produced in the second largest cotton producing state in the country. Without government interventions, it is likely that acreage in this state will move away from cotton to more profitable crops, such as sugarcane and groundnut. It is also concluded that cotton is not the most efficiently produced crop in the other four states; however, there is at least one crop in each state that is produced less efficiently than cotton. These findings suggest that Indian policies directed at maintaining the availability of cheap cotton for the handloom and textile sectors have induced major inefficiencies in the cotton sector.

This study is an application of a Policy Analysis Matrix (PAM) to assess the competitiveness of Indian cotton, which is produced under a complex set of policies including price supports, and various input subsidies such as fertilizer, power, irrigation, and credit. Since cotton is produced under a wide range of heterogeneous conditions in India, this study attempts to measure the competitiveness of cotton production by state. Interestingly, the results indicate the second largest cotton producing state in India, Maharashtra, does not have a comparative advantage in cotton. This is consistent with the standard Hechscher-Ohlin model that would predict that Maharashtra would have a comparative advantage in labor-intensive crops, such as groundnuts and sugarcane, because of its large labor endowment rather than in cotton, which is a more capital-intensive crop. In 1996-97, per hectare man-hours used for cotton were 866 compared with 1765 for sugarcane and 1066 for groundnut. These findings indicate that Indian policies directed at maintaining the availability of cheap cotton for the handloom and textile sectors have induced major allocative inefficiencies in the cotton sector and that significant improvements in productivity will have to take place for cotton to be competitive in states such as Maharashtra.

India is the third largest cotton producer in the world behind China and the United States, accounting for 25% of the world acreage but only 14% of world production (USDA 2001a). Despite historically being one of the largest cotton producers in the world, India has been more or less nonexistent on the world cotton market. Following a series of unilateral economic reforms undertaken by policy makers in the early 1990s, India has started to reemerge as a major player in the world cotton market accounting for an average of 6% of the world imports since 1999 and for 5% of all U.S. cotton sold in 2000 (USDA 2001b). During the calendar year 2001, India accounted for an extraordinary 11.2% of all U.S. cotton sold for exports. Although the policy reforms were primarily directed towards industry and the international trade regime, the reemergence of India as a cotton importer can be partly attributed to the reduction in input subsidies. More recently, the Government of India announced its in-

Samarendu Mohanty and Jagadanand Chaudhary, Department of Agricultural and Applied Economics, Texas Tech University, Lubbock, TX 79409; Cheng Fang, Economist, Food and Agriculture Organization, Rome, Italy.
*Corresponding author (sam.mohanty@ttu.edu)

tent to reform the cotton and textile sector(s), but specifics of what and when the reform would be done were not provided.

Despite ongoing government efforts to reform the cotton and textile sectors, severe external and internal constraints remain in place. One of the external constraints was imposed by the Multifibre Arrangement, which included import quotas in the developed European and North American markets in contravention of the General Agreement on Tariffs and Trade principles of open and non-discriminatory trade rules. The internal constraints are more important. They include a mandate to sustain the small-scale traditional handloom sector, export constraints on yarn, government fixing of cotton ginning and pressing fees, subsidization of raw cotton production, and an overvalued exchange rate, which held domestic producer prices below world prices.

During the next decade, both the internal government interventions and the external trade constraints originally imposed under the Multifibre Agreement will terminate. The Uruguay Round Agreement set a deadline of 2004 for returning textiles and apparel to disciplines of the World Trade Organization (WTO) that govern other commodities. India is also removing its own import restrictions in order to meet its WTO obligations, and some changes are likely for textile and cotton 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, it is important to examine the competitiveness of the Indian cotton sector. Brief descriptions of cotton production in India along with policies affecting cotton production are presented, followed by a description of the PAM technique. The third section provides a discussion of the data used and the modeling assumptions. The final section presents results with a discussion of the 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 based on climatic differences and regional heterogeneity in the availability of water and other natural resources that influence the mix of crops in various parts of the country. These regions are the Northern Region (Haryana, Punjab, and Rajasthan); the Central Region (Maharashtra, Gujarat, and Madhya Pradesh); and the Southern Region (Karnataka, Tamil Nadu, and Andhra Pradesh) (Figure 1). The Northern region is the primary producer of short and medium staple cotton and the southern states primarily grow long staples. The central region produces mostly medium and long staples.

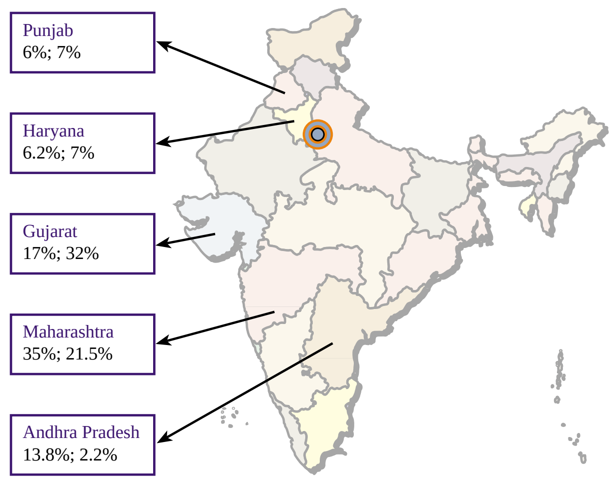

Figure 1. Cotton Producing States in India with area of production and national share of production in 98/99 (source www.theodora.com/maps).

In the last decade, cotton acreage in each of the regions has increased by nearly 2 million hectares from 1990 to 1997. Although the acreage in each of the regions grew in the last decade, the changes in yield have been erratic. For example, from1981 to 1994, growth in the northern and southern regions increased at an annual rate of 6.6 and 4.2%, respectively, compared with negative (–0.7%) growth in the central region (Chakraborty et al., 1999). Since then, yields in the northern region have declined significantly from 470 kg/ha in 1992 to an estimated 282 kg/ha in 2002/03. During the same period, yields in the other regions have been stable or rose slightly. Due to stagnant yield in the central region in the last decade, Maharashtra with 35% of the total cotton area only accounted for 21.5% of total production (Figure 1). Overall cotton yield throughout India is one of the lowest in the world mainly because of out-dated technology, inconsistent delivery of quality inputs, including seed and poor management practices. In addition, rising incidence of leaf curl virus and insect resistance to pesticides has also contributed to the low yields.

Cotton production policies in India have historically been oriented toward promoting and supporting the textile industry. The government announces a minimum support price for each variety of seed cotton (kapas) on the basis of recommendations from the Commission for Agricultural Costs and Prices. In all states except Maharashtra, where there is state monopoly procurement, the government run Cotton Corporation of India (CCI) is entrusted with market intervention operations in the event that prices fall below the minimum support price. In Maharashtra, cotton cultivators are prohibited from selling seed cotton to any buyer other than the Maharashtra State Cooperative Marketing Federation. With market prices above the minimum support level (on average 50 to 70% during 89/90 to 94/95), the role of the CCI in cotton procurement has declined substantially over the years. In order to compensate cotton farmers for low support prices, the Indian government has supplied inputs to the farmers at highly subsidized rates. The important production inputs that are subsidized by the government include fertilizer, power, and irrigation. Fertilizer subsidies, the largest input subsidy, have more than doubled in the last few years, increasing from 30 billion rupees in 1988/89 to 75 billion rupees in 1996/97.

Marketing of cottonseed and lint is done by three major groups: private traders, state level cooperatives, and the CCI. Of the three groups, private traders handle more than 70% of cottonseed and lint followed by cooperatives and the CCI. Normally, Indian farmers sell their cotton in the form of *kapas* or seed cotton mostly in a regulated market, which was established under the State Agricultural Product Markets Act (Chakraborty, 1999). The cheap cotton pricing policy is pursued at the border by announcing yearly export quotas for quantity and types of cotton lint depending on the local supply and demand. In addition, a minimum export price is also established to act as a disincentive to export.

MATERIALS AND METHODS

The PAM is a computational framework, developed by Monke and Pearson (1989) and augmented by Masters and Winter-Nelson (1995), for measuring input use efficiency in production, comparative advantage among commodities, 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 basic format of the PAM is a matrix of two-way accounting identities (Table 1).

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). Private profitability demonstrates the competitiveness of the agricultural system, given current technologies, prices for inputs and outputs, 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 scarce 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 that could have been utilized more efficiently in some other sector. In other words, the cost of domestic production exceeds the cost of imports, which indicates the sector cannot survive without government support at the margin. The third row of the matrix estimates the difference between the first and second rows. The difference between private and social values of revenues, costs, and profits can be explained by policy interventions.

Table 1. Policy analysis matrix[z] for measuring efficiency of using inputs in production, comparative advantage among crops, and the degree of government intervention

	Value of output	Value of input		Profit
		Tradable	Domestic factor	
Private prices	A	B	C	N
Social prices	D	E	F	O
Policy transfer	G	H	I	P

Private profit	**N=A–(B+C)**	**Input transfer**	**H=B–E**
Social profit	**O=D–(E+F)**	**Factor transfer**	**I=C–F**
Output transfer	**G=A–D**	**Net policy transfer**	**P=N–O**

[z]Developed by Monke and Pearson (1989).

The PAM framework can also be used to calculate important indicators for policy analysis. The nominal protection coefficient (NPC), a simple indicator of the incentives or disincentives in place, is defined as the ratio of domestic price to 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 the procurement price or the 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 the PAM include the effective protection coefficient (EPC) and domestic resource cost (DRC). EPC is the ratio of value added in private prices (A-B) to value added in social prices (D-E). An EPC value of greater than one indicates that government policies provide positive incentives to producers, while values less than one indicate that producers are not protected through policy interventions.

Domestic resource cost, the most useful indicator of the three, is 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 factors is socially profitable (DRC<1) or not (DRC>1). The DRC values are calculated for each commodity in each state. The commodities can be ranked according to the DRC values and this ranking is used as an indication of comparative advantage or disadvantage within that state. A state will have a comparative advantage in a given crop if the value of the DRC for that crop is lower than the DRC for other crops grown in that state. Although the DRC indicator is widely used in academic research, its primary use has been in applied works by the World Bank, the Food and Agriculture Organization, and the International Food Policy Research Institute to measure comparative advantage in developing countries. The DRC may be biased against activities that rely heavily on domestic nontraded factors such as land and labor. A good alternative to the DRC is the Social Cost/Benefit (SCB), which accounts for all costs (Fang and Beghin, 1999). The SCB is calculated as the ratio (E+F)/D. Land is a more restricted 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.

One of the main strengths of this approach is that it allows varying degrees of disaggregation. It also provides a straightforward analysis of policy-induced effects. Despite its strengths, the PAM approach has been criticized because of its static nature. Some do not consider the results to be realistic in a dynamic setting (Nelson and Pangabean, 1991). One of the ways to overcome this limitation is to conduct sensitivity analysis under various assumptions.

Data and modeling assumptions. The data requirements for constructing a PAM include yields, input requirements, and the market prices for inputs and outputs. Transportation costs, port charges, storage costs, production subsidy, import/export tariffs, and exchange rate are also required to calculate social prices. In this study, a 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% of cotton production in India and also represent the various types of cotton grown in India (Chakraborty et al., 1999). Most data are available from 2000 Cost of Cultivation of Principal Crops in India, published by the Ministry of Agriculture & Cooperation, Government of India. The survey is a comprehensive scheme for studying the cost of cultivation of principal crops that is based on a three-stage stratified random sampling design with tehsils (a group of villages) as the first stage unit, village/cluster of villages as the second stage unit, and holding (individual farm) as the third stage unit. Each state is demarcated into homogenous agroclimatic 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 nontradable 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 (a trademark product of Cotlook Limited, which represents 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% shelled basis CIF Rotterdam are used as the representative prices for rapeseed, cotton, sugar, and groundnut, respectively. These world prices are obtained from various commodity yearbooks published by USDA. The commodities and yearbooks were as follows: Cotton A-index prices from Cotton and Wool Yearbook (USDA, 2001c); feed prices from Feed Yearbook (USDA, 2001d); oilseed prices from Oil Yearbook (USDA, 2001e); rice price from Rice Yearbook (USDA, 2001f); and wheat prices from Wheat Yearbook (USDA, 2001g). The world prices are adjusted for transportation costs and marketing costs to be comparable with farm gate prices. For imported commodities, social prices at the farm gate are calculated by adding marketing costs to the respective CIF Mumbai prices (calculated by adding ocean freight charges to the FOB price) in domestic currency. Similarly, for exported commodities, social prices at the farm gate are calculated by subtracting marketing costs from the respective world reference price, converted to domestic currency. Freight rates from Gulf ports and Rotterdam are collected from Pursell and Gupta (1997) 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 (1997), marketing costs consist of an interest charge for two months at 18% 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 plus 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 only insignificant effects 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.

RESULTS

The summary results on protection coefficients on cotton in various states are reported in Table 2. The NPCO coefficients show that domestic cotton prices in Punjab, Maharashtra and Haryana were very close to one indicating that domestic prices in these three states were at par with their corresponding international reference prices. In Gujarat and Andhra Pradesh, NPCO values for cotton were lower than one. Similarly, cotton NPCI values of less than one in every case indicate that the government policies are reducing input costs for cotton in all the five states. NPCI values of less than one for all input and most output markets clearly show the government efforts to support the textile sectors by providing raw cotton at a cheaper price.

Since EPC recognizes that the full impact of a set of policies includes both output price enhancing (import tariffs) and cost reducing (input subsidies) effects, it is a more reliable indicator of the effective incentives than the NPC. The EPC nets out the impact of protection on inputs and outputs, and reveals the degree of protection accorded to the value added process in the production activity of the relevant commodity. The EPC values show there are significant differences in the degree of policy transfer for cotton across the major growing states (Table 2). Haryana and Maharshtra farmers enjoy a support of 13 and 6%, respectively, for their value added, whereas in the other three states, particularly Gujarat and Andhra Pradesh farmers face a net tax of near 40% 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, the DRC value for cotton is estimated to be 1.35 compared with 0.33 and 0.34 for sugarcane and groundnuts, respectively, suggesting that Maharashtra has a comparative advantage in producing sugarcane and groundnuts rather than cotton. Government cotton policies, however, have led to significant allocative inefficiency because much land in Maharashtra is still planted to cotton. Similarly, in Haryana, the DRC indicator for cotton is close to one and is the second largest behind rice of the four crops included in this study. DRC values for Haryana clearly indicate that it has a comparative advantage in producing wheat and groundnuts compared to cotton and rice. In Punjab, Gujarat and Andhra Pradesh, DRC values for cotton are found

Table 2. Protection coefficients for commodities in the major cotton producing states in India (1996/97)

State & Protection coeficient[z]	Wheat	Rice	Cotton	Groundnut	Rapeseed	Sugarcane
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

[z]NPCO = nominal protection coefficient of output; NPCI = nominal protection coefficient of input; EPC= effective protection coefficient.

to be lower than one, but not the lowest among the competing crops. In Punjab, the DRC value of wheat (0.41) is much lower than cotton (0.65), suggesting that the Punjab has a comparative advantage in producing wheat. But at the same time, the DRC value of rice is much larger than cotton, even higher than one, implying a definite comparative disadvantage relative to competing crops. Similar situations exist both in Gujarat and Andhra Pradesh, where DRC values for cotton are significantly lower than one, but not the lowest among the five crops. In both states, there is at least one crop with a DRC higher than one, suggesting that cotton is not produced inefficiently in these states. At the same time, cotton also does not have the greatest comparative advantage (highest ranking) in either state.

The rankings derived from DRC values are supported by the fact that identical rankings were obtained using the SCB values. The LSB indicators lead to similar rankings in every state except for Andhra Pradesh, where the commodity ranking based on LSB is different. Overall, the results suggest that cotton production in Maharashtra and Haryana is not competitive and will be seriously affected by the withdrawal of government support. Low cotton yields in Maharashtra, the lowest among the major cotton producing states, is the primary reason for the lack of competitiveness for cotton in that state. Despite these low yields, Maharashtra, still accounts for a large share of Indian cotton production by virtue of its large cotton area. Maharashtra accounts for 35% of total cotton acreage (largest in the country) and 22% of total production (second largest in the country). For cotton to be the most efficient, yield will have to rise by 170% in Maharashtra, 120% in Andhra Pradesh, 20% in Gujarat, 50% in Punjab and 180% in Haryana.

Based on these results, it seems clear that any unilateral or multilateral trade liberalization of the cotton sector in India will have serious implications

Table 3. Costs for cotton and other major crops in five states in India (1996-97)

Crop & Costs[z]	Punjab	Haryana	Maharashtra	Gujarat	Andhra Pradesh
Cotton					
DRC	0.65	0.96	1.35	0.55	0.78
SCB	0.72	0.97	1.27	0.60	0.82
LSB	7,141	11,017	2,281	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

[z]DRC = domestic resource cost; SCB = social cost benefit; LSB: SCB without land cost.

for Maharashtra agriculture with acreage being diverted from cotton to more profitable crops such as sugarcane and groundnut. Another important point is that cotton is not the most efficiently produced crop in the four major cotton growing states included in this study. This may imply that while cotton production in these states may not be seriously affected by either unilateral or multilateral market liberalization, any area diverted from less efficient crops (DRC>1) is likely to go to crops with greater comparative advantage than cotton.

Sensitivity analyses on comparative advantages. Following Yao (1997), sensitivity analyses are conducted to test whether the results would be substantially altered by changes in the underlying assumptions. In the first scenario, CIF cotton prices are increased by 20%. The results indicate that this change does not affect the comparative rankings. Similarly, rankings remain unchanged when CIF prices are reduced by 20%. For the state of Maharashtra, cotton prices would have to increase by more than 30% for the DRC value to go below

Table 4. Ranking of comparative advantage by crop in each state

State	Commodity	Costs[z]		
		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

[z]DRC = domestic resource cost; SCB = social cost benefit; LSB = SCB without land cost.

one and rise by more than 100% for cotton to become more competitive than sugarcane and groundnut. Similar exercises were conducted by changing prices of competing crops but the results remained more or less the same. For example, a 50% decline in either sugarcane or groundnut prices did not cause cotton to gain comparative advantage over these two crops in Maharashtra. In Haryana, a 30% increase in rice price would alter the comparative advantage in favor of rice over cotton.

Similar sensitivity analyses are conducted by changing farm gate prices up and down by 20%. These changes do not affect comparative ranking using DRC, SCB and LSB indicators. Protection coefficients, such as NPCI and EPC, change with a rise and fall in farm gate price, respectively. For states like Maharashtra and Haryana, a 20% decline in farm price causes the NPCI to fall below one. Even with a 20% rise in farm gate price, NPCI values in Andhra Pradesh and Gujarat remain below one.

Changes in the input prices can produce similar results. The inputs most likely to alter the comparative advantage in favor of cotton depend on the competing crops. For example, in Maharashtra, cost of irrigation is the variable likely to alter comparative advantage in favor of cotton over sugarcane. The sensitivity analyses results suggest that a 2000% increase in irrigation charges would alter the comparative advantage of sugarcane in favor of cotton. In addition, comparative rankings also remain unchanged by increasing or decreasing marketing and transportation costs by 50%.

Finally, we reexamined the stability of these rankings by increasing yield by 20%. Except in Gujarat, rankings remain unchanged with a 20% increase in cotton yield. For cotton to be the most efficient crop, yields will have to rise by 170% in Maharashtra, 120% in Andhra Pradesh, 20% in Gujarat, 50% in Punjab, and 180% in Haryana.

CONCLUSIONS

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, Maharashtra. Sugarcane and groundnut have significant comparative advantages in that state over cotton. In addition, the results also indicate that cotton is not the most efficiently produced crop in the other four states; however, there is at least one crop in each state that is less efficiently produced than cotton. Interestingly enough, in Punjab, Haryana, and Andhra Pradesh, the major grain producing states in India, rice is the least efficiently produced crop. In the remaining state, Gujarat, wheat is 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.

Since PAM is a static model, which cannot capture the potential changes in prices, costs and productivity, the rankings are subject to changes in the market condition. In order to overcome the limitation, a set of sensitivity analyses was conducted by changing farm gate prices, world prices, yields and cost structures (transportation, marketing and irrigation costs). Very large changes in either output or input prices are necessary to alter the results for Maharashtra. The comparative advantage results in other states can be altered by more modest changes in the input and output prices. The general conclusion from this analysis is that trade liberalization and domestic policy reforms that alter the current levels of effective protection may affect the acreage of crops produced in different regions of the country. Because the Indian agricultural sector is so large, even modest changes in the mix and location of different crops could cause important changes in trade patterns. For example, wheat acreage could expand in places such as the Punjab and Haryana at the expense of crops such as rice and cotton. If such tendencies held for India as a whole, cotton imports may increase. If the current mix of price policies translates into cotton that is cheaper than world prices, such a change that results in higher prices could harm all textile producers. Such costs would be more than offset by the gains from trade following the policy reforms, but it would be important to pay attention to the way in which these gains are distributed to avoid putting undue stress on particular Indian industries.

ACKNOWLEDGEMENTS

Supported by National Research Initiative grant # 99-35400-10256.

DISCLAIMER

The views expressed in this publication are those of the author(s) and do not necessarily reflect the views of the Food and Agriculture Organization of the United Nations.

REFERENCES

Chakraborty, K., D. Hudson, D. Ethridge, S. Misra, and G. Kar. 1999. An overview of the cotton and textile industries in India. College of Agricultural Sciences and Natural Resources Publication No. CER-99-55. Texas Tech University. Lubbock, TX.

Fang. C., and J. Beghin. 1999. Food self-sufficiency, comparative advantage, and agricultural trade: a policy analysis matrix for Chinese agriculture. Working Paper 99-WP 223. Center for Agricultural and Rural Development, Iowa State University, Ames, IA.

Directorate of Economics and Statistics, Ministry of Agriculture, Government of India. 2000. Comprehensive scheme for the study of cost of cultivation of principal crops in India. New Delhi, India.

Gulati. A., and T. Kelley. 2000. Trade liberalization & Indian agriculture. Oxford University Press, New Delhi, India.

Masters, W. A., and A. Winter-Nelson. 1995. Measuring the comparative advantage of agricultural activities: domestic resource costs and the social cost-benefit ratio. Am. J. Agric. Econ. 77: 243-50.

Monke, E. A., and S. R. Pearson. 1989. The policy analysis matrix for agricultural development. Cornell University Press, Ithaca and London.

Nelson, C.G. and M. Panggabean. 1991. The costs of Indonesian sugar policy: a policy analysis matrix approach. Am. J. Agric. Econ. 73: 703-12.

Pursell, G. and A. Gupta. 1997. Trade policies and incentives in Indian agriculture: methodology, background statistics and protection and incentive indicators, 1965-95. World Bank Background Paper No. 1, Sugar and Sugarcane. Washington, DC.

USDA. 2001(a). Production, supply and distribution (PSD) database [Online]. Available at http://www.ers.usda.gov/data/sdp/view.asp?f=international/93002/ (verified August 20, 2003).

USDA. 2001(b). Foreign agricultural trade of the United States (FATUS) database [Online]. Available at http://www.ers.usda.gov/data/fatus/ (verified August 20, 2003).

USDA - Economic Research Service. 2001(c). Cotton and wool yearbook, ERS-CWS-2001. U.S. Gov. Print. Office, Washington, DC.

USDA - Economic Research Service. 2001(d). Feed situation and outlook yearbook, FDS-2001. U.S. Gov. Print. Office, Washington, DC.

USDA - Economic Research Service. 2001(e). Oil crops yearbook, ERS-OCS-2001. U.S. Gov. Print. Office, Washington, DC.

USDA - Economic Research Service. 2001(f). Rice yearbook, ERS-RCS-2001. U.S. Gov. Print. Office, Washington, DC.

USDA - Economic Research Service. 2001(g). Wheat yearbook, ERS-WHS-2001. U.S. Gov. Print. Office, Washington, DC.

Yao, S. 1997. Comparative advantages and crop diversification: a policy analysis matrix for Thai agriculture. J. Agric. Econ. 48: 211-222.