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Income Distributional Impacts of Trade Policies in a Multi-Market Framework: A Case in Pakistan

Darren Hudson and Don Ethridge

ABSTRACT

The impacts of using export taxes as a price control in a multi-market framework are explored using the cotton and yarn sectors in Pakistan as examples. Results show that the export tax on cotton increased domestic consumption and decreased exports of cotton in Pakistan, transferring income from cotton producers to yarn spinners and the government. There was a social loss to Pakistan in the cotton sector. The export tax on cotton increased domestic yarn production, consumption, exports, and incomes of yarn spinners, but resulted in a large transfer (social loss) out of the yarn sector.

Key Words: *cotton, export tax, simultaneous equations, simulation, policy.*

The use of price controls as policy tools by government has a long history. *Price controls*, by definition, are overt actions taken by governments to hold the price of goods or services either below or above equilibrium levels. Related literature outlines the general implications of ceiling price controls as reduced output, income transfers, rent-seeking behavior, and, occasionally, black markets (Deacon and Sonstelie; Kruger; Devarajan, Jones, and Romer). Price controls can take different forms and can be placed at different points in the value chain (MacAvoy and Pindyk). The control need not be direct; the essential ele-

ment is that some action taken by the government has the effect of either suppressing or enhancing the price below or above equilibrium levels.

Some developing countries have used price controls as a policy tool (Kapadia; Deacon and Sonstelie). Most developing countries' economies are based primarily on raw product production and exports, but they are attempting to develop their processing industries. Thus some of these developing countries see controlling the price of a raw material as a means of conferring a competitive advantage on their domestic industries (Anderson; Townsend and Guitchounts). One way of achieving control over price without directly setting price is the collection of a variable levy tax on the export of a raw product. This export tax serves to shield the internal price from global forces and holds the internal price below world price levels by the amount equal to the tax.

The popularity of the export tax on raw products in developing countries is based on two key elements. First, the export tax serves

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to suppress the internal price of the raw product to the benefit of domestic processors. This is perceived by governments as increasing the profit potential of their industrial sectors, thus increasing their development potential. Decreased input price also implies increased industrial output, meaning increased demand for labor and value-added production. For those processed or semi-processed goods that are exported, there is the potential for acquiring a larger quantity of foreign exchange, which allows importation of capital and other investment goods (Anderson).

The second reason for the popularity of the export tax on raw products is that the tax increases tax revenue for the government. This motivation is important because many of these governments undertake social and other programs. This process of "surplus extraction" (Adelman) through taxation of raw product production appears quite different from industrialized economies where "surplus creation" through subsidization has been common this century. However, as Cline notes, raw product producers in developing countries are usually not well organized and have little input into or control over the process of implementing these policies.

The general implications of price controls are well understood. There is also a body of literature dealing with optimal export taxes for countries facing downward-sloping export demand functions (Houck; Allen, Dodge, and Schmitz; Levy). The premise of the optimal export tax literature is that there may exist some "optimal" level of an export tax that maximizes social welfare while minimizing distortions. There are potential motivations for such a tax in the "optimal tax" context. For example, governments may wish to maintain employment levels (Krugman and Obstfeld). However, there is much debate about the "first-best" versus "second-best" intervention strategies. That is, the "first-best" strategy in terms of social welfare would minimize market distortions as a result of the policy employed. However, "first-best" intervention often incurs transparent social costs that may not be politically palatable. Thus, these governments are forced to use "second-best" strate-

gies that necessarily create more market distortions. There is also some literature which deals with the related issue of export subsidies (e.g., Paarlberg; Bohman, Carter, and Dorfman; Brander and Spencer). Most of this literature, however, does not deal with the effects of trade interventions in a multi-market-level context.

Multi-market systems where one raw product is a primary input into the processing sector are common, e.g., cotton/textiles, milk/dairy products, cane/sugar, and many different food items. Increased globalization has accentuated the linkages between markets. Understanding consequences of price controls (through export taxes) across interconnected markets is important because they may distort allocation of commodities between domestic and trade markets, thus affecting global trade flows. This understanding is particularly relevant to producers and policy-makers in the United States when the commodity under question is of relevance to the domestic economy. The objective of this paper is to examine the impacts of an export tax on welfare in a multi-market framework. The term *distributional impacts* refers to the partial equilibrium welfare impacts in this paper, which should not to be confused with the general equilibrium impacts of the policy.

Cotton Price Policy in Pakistan

Pakistan provides a good example of the export tax situation above. Pakistan is a prominent producer of cotton (around the fourth largest producer annually), planting approximately 3 million hectares (over 6.5 million acres) per year. Export earnings from cotton and its value-added products (yarn, cloth, apparel, etc.) amounted to 68 percent of the total value of Pakistan's exports during 1991–1992 (Quershi). Pakistan is consistently ranked in the top five in the world in terms of cotton production and consumption [International Cotton Advisory Committee (ICAC), 1995]. The textile sector (primarily cotton yarn) employs about 35 percent of the industrial labor force. Thus, cotton and yarn production are important to the Pakistani economy. An un-

derstanding of the impacts of policies on these sectors becomes particularly important given their relative size domestically and internationally.

Pakistan has maintained a price support system for cotton, but market prices have been well above support levels for some time (ICAC, 1992). Import and export quotas, as well as some input subsidies, have also been used (Ender). From 1988 to 1995, the Government of Pakistan used a variable levy on cotton fiber exports, based on a “two-price” system to influence or control internal cotton prices and exports (Townsend and Guitch-ounts).

The “two-price” system used two prices set by a government committee. The first was a “benchmark price,” which was not derived from the market but was used in the calculation of the export tax. The benchmark was set periodically (usually annually). The second price was the Minimum Export Price (MEP), which was (1) set daily by a government committee, (2) higher than the benchmark price, and (3) highly correlated with daily average world offer prices (Townsend and Guitch-ounts). The purpose of the MEP was to create a minimum price at which cotton could be exported that “mirrored” world prices. The variable levy export tax was collected on all exports by collecting the difference between the MEP (variable price) and the benchmark (fixed price).

This export tax had direct effects on prices, with an average difference between internal and international market prices for raw cotton of 20.6 US¢/lb over the 1988–1991 period (ICAC, 1992). This provided the spinning industry in Pakistan with cost savings of 24 percent in the purchase of raw materials (cotton), resulting in a total variable cost savings of 12–15 percent (ICAC, 1992) (the cost of cotton represents about 50 percent of the total variable cost of yarn production). An advantage of this magnitude could be decisive in a high-volume/low-margin industry such as the production of cotton yarn (Asian Development Bank).

This policy has had several implications for the cotton fiber and yarn production industries.

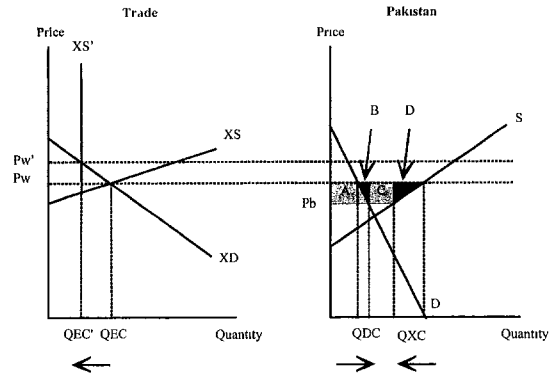


Figure 1. International Trade Market for Cotton Fiber in Pakistan

First, the export tax on cotton fiber reduced cotton fiber exports substantially after 1988 (from 602,930 metric tons in 1988 to 56,880 metric tons in 1993). Additionally, the cost advantage given to yarn spinners by the implementation of the export tax policy increased yarn production significantly (ICAC, 1995). Thus it appears that the objective of suppressing the price of raw cotton to stimulate the production of value-added products was achieved. Some prior conceptualization of the export tax situation has been performed, leading to some general expected relationships (Asian Development Bank). However, no quantification of the distributional economic impacts of that policy has been conducted.

Analytical Framework

To simplify the conceptualization of the effects of these policies on Pakistan’s cotton sector, markets are assumed to be competitive domestically and exchange rate effects and transportation costs are ignored. Pakistan is assumed to be a large-country exporter given its relative size in world cotton and yarn production and exports cited earlier. Given domestic and international markets, the world price of cotton before the tax is equal to P_w (Figure 1). Domestic consumption is Q_{DC} ,¹ domestic

¹ The notation used here is the following: The first letter ‘Q’ denotes the quantity, ‘D’ denotes domestic consumption, and ‘C’ refers to cotton. A second letter of ‘X’ refers to domestic production and ‘E’ refers to exports. A third letter of ‘Y’ denotes yarn. This notation is used in the figures and estimated equations.

production QXC, and exports are QEC. Assuming that the Government of Pakistan implements an export tax with the benchmark price at P_b and the MEP is set at the world price [if the benchmark is set below the internal (no trade) market price, exports are not likely because exporters must pay the full difference between the MEP and benchmark regardless of the level of prices].

Exports are not likely above the benchmark price because exporters must pay the full difference between the MEP and benchmark prices as a tax. This forces the excess supply function to become perfectly inelastic at that point. The result is reduced exports and a higher world price. The relevant price to the producer becomes the benchmark price rather than the world price (MEP), thus lowering domestic production. The relevant price to domestic consumers (primarily yarn spinners) also becomes the benchmark, thus increasing domestic consumption. Therefore, the policy has the effect of decreasing domestic production, increasing domestic consumption, and decreasing exports in the cotton market. The lower effective price increases consumer surplus (yarn spinners) by Area A and decreases producer surplus by $A + B + C + D$. Area C is captured by the government as a tax on exports. Area $B + D$ represents a loss to Pakistan's cotton sector in the form of a transfer. At least some of this transfer accrues to cotton producers in the rest of the world in the form of higher prices.

The export tax shifts the supply function for yarn (S to S' in Figure 2) because it lowers the effective price of cotton to the spinner (lowers input cost). The result is a shift in excess supply of yarn, lower world yarn price, and increased exports of yarn from Pakistan. The policy also increases Pakistan's production and consumption of yarn. Consumer surplus increases by Area A (Figure 2) due to lower world price. Higher yarn producer incomes (Area $C + D - A - B$ in Figure 2) are tempered by the lower world yarn prices. Area B represents a social loss to Pakistan's yarn sector, which is transferred to consumers in the rest of the world.

Just and Hueth show that the expected

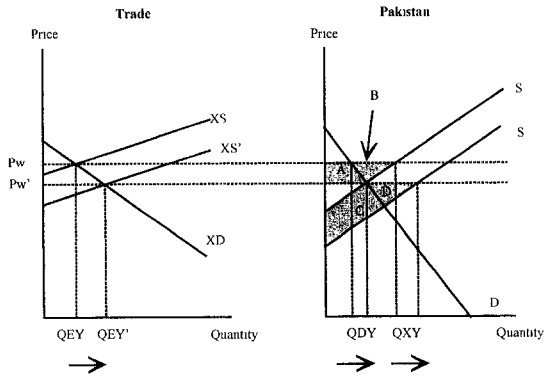


Figure 2. International Trade Market for Cotton Yarn in Pakistan, With and Without Export Tax on Cotton Fiber

change in consumer surplus in the cotton fiber sector should be approximately equal to the change in producer surplus in the yarn sector. That is, any measured effect on the consumers of cotton in the cotton sector should equal the measured effect on the producers in the yarn market (spinners). This result is dependent on the assumption of monotonical price transformation between sectors, which may or may not be the case in these sectors in Pakistan. Additionally, the Just and Hueth analysis was made in the context of a closed economy.

Model and Estimation

Econometric Model

An econometric model is developed to estimate the demand and supply relationships for the cotton and yarn sectors in Pakistan. Area and yield response functions for cotton were constructed similar to the formulation used by Evans and Bell. The area of cotton (AR_t) in thousands of hectares is specified as:

$$(1) \quad AR_t = f(PIC_{t-1}, RS_{t-1}, \epsilon_t),$$

where PIC_{t-1} is the relevant price of cotton to the producer (in rupees/40 kgs) at time $t - 1$, RS_{t-1} is the ratio of the per-hectare revenue of cotton to the revenue of sugarcane (the primary competitive crop) per hectare in the previous period, and ϵ is the stochastic error term.

The per-hectare yield of cotton (YLD_t) function is specified as:

$$(2) \quad YLD_t = g(PIC_t, TR_t, DRAT_t, \epsilon_t),$$

where PIC_t is the relevant² price (benchmark or internal, as above) of cotton (rupees/40 kgs) at time t , TP_t is total production cost (rupees) of cotton per hectare, $DRAT_t$ is the departure of rainfall from the period average (mm per year), and ϵ is the error term. The $DRAT$ variable is used to account for the sensitivity of cotton yield to rainfall.

Total production (QXC_t), then, is defined as equation 1 multiplied by equation 2:

$$(3) \quad QXC_t \equiv AR_t \cdot YLD_t,$$

Total cotton production (QXC_t) is considered exogenous to the simultaneous system discussed below. That is, equations 1 and 2 are estimated using Ordinary Least Squares (OLS). The predicted values for QXC_t arising from the estimated parameters in equations 1 and 2 are then used in the simultaneous system as an exogenous variable. Thus, supply is assumed exogenous, but an estimated production equation is available for policy simulation.

The simultaneous system begins with the domestic consumption of cotton (QDC_t) in thousands ('000) of metric tons, which is specified as:

$$(4) \quad QDC_t = h_1(PIC_t, QXY_{t-1}, PP_t, u_1),$$

where PIC_t is the relevant internal price of cotton lint (rupees/40 kgs) at time t , QXY_{t-1} is the domestic production of cotton yarn (millions of metric tons) at time $t - 1$, PP_t is the

price of polyester (\$US/lb) at time t , and u_1 is the stochastic error term. The variable QXY_{t-1} is used to represent expected yarn production in the current period (static expectations) and PP_t is used to represent the price of a competitive fiber for cotton. The domestic consumption is linked to the rest of the system through the internal price of cotton.

The Minimum Export Price (MEP), which was set by a Government committee, was designed to reflect the world price so that the export tax acted as a variable levy. However, one of the primary goals of this two-price system (export tax) was to reserve domestic cotton production for domestic consumption and then export the residual. The export price of cotton is explicitly modeled to bring this bureaucratic decision-making process into the system. The export price of cotton lint in Pakistan (in rupees/metric ton) is specified as:

$$(5) \quad PEC_t = h_2(CBI_t, QDC_t, u_2),$$

where PEC_t is the higher of the average export price or the MEP at time t , CBI_t is the Cotlook "B" world index average offer price of cotton (in US¢/lb) at time t , and u_2 is the error term. As domestic consumption of cotton (QDC) increases, it is expected that the Government of Pakistan will increase export prices (that is, increase the export tax through the MEP) in order to reserve a larger portion of domestic production for domestic consumption (decrease exports).

Equation 5 enters into the final two estimated equations in the cotton sector in the following manner. The first is the stocks of cotton (QSC_t) in '000 metric tons, which is specified as:

$$(6) \quad QSC_t = h_3(PEC_t, QXC_t, QSC_{t-1}, QXY_{t-1}, u_3),$$

where QSC_{t-1} is the quantity of cotton stocks at the end of the period and u_3 is the error term. The variable QXY_{t-1} is used to represent the anticipated level of "operational stocks" needed to run yarn mills through the year. As the export price increases (the tax increases), more cotton is expected to be diverted to current consumption. Thus the sign of the coefficient for PEC_t is expected to be negative.

² The relevant price was either the internal price or benchmark price, whichever was higher as shown in Figure 1. Because the benchmark price is expressed in lint rather than seed cotton terms, it was converted to seed cotton price assuming a 35% gin turnout rate. The simple expectations approach used here is naïve. However, producers in Pakistan have limited access to information and prices paid to growers are bureaucratically determined. Based on the limited available data, it was determined that the naïve model was likely to be the most representative. However, this assumption is a limitation.

The final equation for the cotton sector is the export equation (QEC_t), which is specified as:

$$(7) \quad QEC_t = h_4(PEC_t, IMP_{c,t}, QXC_t, ER_t, u_4),$$

where QEC_t is the exports of cotton (in '000 metric tons) at time t , $IMP_{c,t}$ is the total imports of cotton in '000 metric tons by countries that import cotton from Pakistan, ER_t is the rupee/dollar exchange rate, and u_4 is the error term. The total imports of cotton by other countries is used to represent the general demand for imports by importing countries. As the quantity of general import demand increases, the quantity of exports from Pakistan is expected to increase. As the exchange rate increases (the rupee devalues), exports are expected to increase. The design of the export tax policy suggests that exports are a residual after all domestic consumption has been satisfied. The size of the residual is partially determined by the level of cotton production. As the quantity of cotton produced in Pakistan increases, exports are expected to increase as well.

Because the Government of Pakistan attempts to reserve domestic production for domestic consumption with the residual available for export, the closing identity for the cotton sector is expressed as:

$$(8) \quad QEC_t \equiv QXC_t - QDC_t + QSC_{t-1} + IMC_t - QSC_t,$$

where IMC_t is the imports of cotton by Pakistan at time t . Imports of cotton were considered exogenous to this system because they were effectively zero and only allowed for special uses.

The yarn portion of the system centers around the price of cotton yarn (there was no difference between internal and external prices). The production of cotton yarn (QXY_t) in millions of metric tons is specified as:

$$(9) \quad QXY_t = h_5(PY_t, PIC_t, PP_t, QXY_{t-1}, u_5),$$

where PY_t is the price of cotton yarn (in rupees/metric ton) at time t and u_5 is the error

term. The internal price of cotton (PIC_t) links the yarn and cotton sectors. The domestic consumption of cotton yarn (QDY_t) in millions of metric tons is specified as:

$$(10) \quad QDY_t = h_6(PY_t, PP_t, QXF_{t-1}, u_6),$$

where QXF_{t-1} is the domestic production of cotton fabrics at time $t - 1$ and u_6 is the error term. The previous period's production of cotton fabric is used to represent expected fabric production. The fabric sector in Pakistan is relatively small, so it was not explicitly modeled.

Stocks of cotton yarn (QSY_t) in millions of metric tons is specified as:

$$(11) \quad QSY_t = h_7(PY_t, QSY_{t-1}, QXY_t, u_7),$$

where QSY_{t-1} is the stocks of cotton yarn at time $t - 1$ and u_7 is the error term. The exports of cotton yarn (QEY_t) in millions of metric tons is specified as:

$$(12) \quad QEY_t = h_8(PY_t, IMP_{y,t}, Mills_t, u_8),$$

where $IMP_{y,t}$ is the total imports of cotton yarn (in millions of metric tons) by countries that import yarn from Pakistan at time t , $Mills_t$ is the number of mills producing cotton yarn at time t , and u_8 is the error term. The Mills variable is used to represent the productive capacity of Pakistan. It is hypothesized that the productive capacity lends support to exports by boosting importers' confidence that Pakistan could fill their orders. The closing identity for the yarn sector is represented by:

$$(13) \quad QDY_t \equiv QXY_t - QSY_t + QSY_{t-1} - QEY_t + IMY_t.$$

The system of simultaneous equations is estimated using two-stage least squares (2SLS) and three-stage least squares (3SLS).³

³ The 3SLS estimates showed some small differences from the 2SLS estimates, indicating some potential contemporaneous correlation of error terms across equations. Therefore, the 3SLS estimates are presented because those parameters are known to be more efficient. The Statistical Analysis Software (SAS) was used in all estimations.

All equations are estimated using linear and additive forms. Models results are evaluated using Theil's U_2 , turning points, and the root mean percentage error.

Simulation

Simulation is used to estimate the distributional impacts associated with the export tax policy. This is accomplished by calculating the relevant areas from Figures 1 and 2 discussed above (although some of the calculations do not follow the standard geometric calculation of the areas). The change in consumer surplus in the cotton market (ΔCS_c) is given by:

$$(14) \quad \Delta CS_c = \frac{1}{2}[(QDC_{PEC^*} + QDC_{PIC^*}) \cdot 1000 \\ \times (PEC^* - PIC^*)],$$

where QDC_{PEC^*} is the predicted domestic consumption of cotton at the average export price (converted to rupees/40 kgs) before the implementation of the exports tax (PEC^*) and QDC_{PIC^*} is predicted domestic consumption at the average internal price of cotton after the implementation of the export tax (PIC^*). This sum is multiplied by 1000 to bring it into terms of metric tons, and then multiplied by the difference between prices in terms of rupees per metric ton. This calculation accounts for Area A in Figure 1. Change in producer surplus is calculated in a similar fashion.

The change in tax revenue (ΔTR) is calculated as:

$$(15) \quad \Delta TR = (QXC_{PIC^*} - QDC_{PIC^*}) \cdot 1000 \\ \times (PEC^{**} - PIC^*),$$

where QXC_{PIC^*} is the predicted quantity of cotton produced at the average internal price of cotton after implementation of the export tax (PIC^*) and PEC^{**} is the average export price of cotton after implementation of the export tax. This reflects Area C in Figure 1. Finally, the transfer (social loss), which is Area B + D in Figure 1, is calculated residually. That is, the transfer is given by $\Delta PS + \Delta CS + \Delta TR$, where ΔPS is negative.

The calculation of producer and consumer surplus and transfers in the yarn sector is complicated by the shifting of the yarn supply function in Figure 2. Thus the standard geometric measurements are not used for the change in producer surplus in the yarn market, which is measured as:

$$(16) \quad \Delta PS_y = (QXY_{After} - QXY_{Before}) \cdot 1000 \\ \times (PY^* - PY^{**}),$$

where QXY_{After} is the predicted quantity of domestic yarn production after the implementation of the export tax [that is, with the price of cotton (PIC^*) and yarn (PY^{**}) at average levels after the export tax], PY^* is the average price of yarn before implementation of the export tax, and PY^{**} is the average price of yarn after the implementation of the export tax. The variable QXY_{Before} is estimated with average prices (cotton and yarn) before the implementation of the export tax.

The change in consumer in the yarn market (ΔCS_y) is calculated in a more traditional manner:

$$(17) \quad \Delta CS_y = \frac{1}{2}[(QDY_{PY^*} - QDY_{PY^{**}}) \cdot 1000 \\ \times (PY^* - PY^{**})],$$

where QDY_{PY^*} is the predicted quantity of domestic yarn consumption at PY^* . This gives Area A in Figure 2. Area B in Figure 2 represents the transfer (social loss) in the yarn sector, which is given by:

$$(18) \quad \text{Transfer} = \frac{1}{2}[(QXY_{Before} - QDY_{PY^*}) \\ + (QXY^* - QDY_{PY^{**}}) \cdot 1000 \\ \times (PY^* - PY^{**})],$$

where QXY^* is the predicted value of domestic yarn production at the average pre-tax price of cotton and the average price of yarn after the implementation of the export tax. The change in producer surplus in the yarn market should be approximately equal to the change in consumer surplus in the cotton market (Just and Hueth). Both were calculated for compar-

ison, but only the change in consumer surplus in the cotton market was used to estimate the total welfare effect to avoid double-counting.⁴

A complete data set for analysis was available for 1971–1993. Data on cotton consumption, production, stocks, exports, and fabric production were obtained from *Documents of the ICAC on CD-ROM* (ICAC, 1995). The remainder of the cotton and yarn data were obtained from *Cotistics* (Pakistan Central Cotton Committee). Where available, data were cross-checked for consistency. Gross Domestic Product, prices for competing crops, and data on the number and type of textile mills in Pakistan were obtained from *Economic Survey* (Government of Pakistan). Production costs for raw cotton fiber were obtained from the *Survey of Costs of Production* (ICAC, Various Issues). Data on polyester prices were obtained from Cotlook, Ltd., and from the *Cotton and Wool Situation and Outlook Yearbook* (U.S. Dept. of Ag.).

Results

The structural models generally followed the data well (Tables 1 and 2). The signs of the variables were generally consistent with *a priori* expectations or were not statistically significant. The only exception to this was the price of polyester in the domestic consumption of cotton yarn (QDY) equation (Table 2). Ordinarily, as the price of polyester increases, the consumption of cotton yarn would be expected to increase. However, cotton yarn is the predominant type of yarn used in Pakistan. The coefficient, however, is only marginally significant. The performance of the models should be considered in light of the aggregated and annual nature of the data.

Table 3 shows a summary of the distributional impacts of the two-price policy (export tax) between cotton producers and consumers and yarn producers and consumers. The esti-

mated change in producer surplus in the cotton sector is –16.5 billion rupees (\$546,805,842 at 1993 exchange rates) annually, which represents about 79 percent of the annual average value of cotton production. This loss seems large, but it is logical given the magnitude of the difference between internal and international prices.

The estimated change in consumer surplus in the cotton market is 4.9 billion rupees (\$160,987,545), or about 60 percent of the annual average value of cotton consumption. The large reduction in cotton price resulted in a large increase in cotton consumption, giving the large percentage effect. The average change in tax revenue is estimated to be 2.4 billion rupees (\$78,879,364) or about 11 percent of the average annual value of cotton production. While not large in percentage terms, the tax did generate a substantial intake for the Government of Pakistan.

The residual, or 9.3 billion rupees (\$306,938,932) per year, represents a social loss to Pakistan. Part of this is transferred to cotton producers in the rest of the world in the form of higher prices and reduced export competition.⁵ This estimate represents an upper-bound of the level of loss because of the partial-equilibrium nature of the model. Land diverted from cotton production would likely be planted to other crops, but the returns from these crops would not be expected to be as high as for cotton. Thus any gains made by the shifting of land would not be expected to fully offset the estimated loss found here.

The change in producer surplus in the yarn market is estimated to be 4.7 billion rupees (\$156,577,525) per year, which is close to the change in consumer surplus in the cotton market. This is consistent with the *a priori* expectations of Just and Hueth. The change in consumer surplus in the yarn market is estimated to be 969.5 million rupees (\$32,140,159) per year, or about 57 percent of the annual average value of yarn production. The raw value of the effect is much smaller than the others because

⁴ The choice of which measure to use is arbitrary if the assumptions laid out by Just and Hueth hold. The consumer surplus measure in the cotton market was chosen in this case because it is the most directly affected.

⁵ Note that producers in Pakistan cannot benefit from the higher world price because the internal price is shielded from the world price through the export tax.

Table 1. Results of Structural Equation Estimation—Cotton Sector, 1971–1993

Independent Variable	Dependent Variable					
	AR ^a	Yield	QDC	PEC	QSC	QEC
Intercept	1526.3* (104.64) ^b	214.1* (48.50)	1210.73* (427.94)	-5033.78* (2858.66)	20.18 (42.43)	-416.08* (146.01)
PIC		1.53 (0.49)	-3.09* (0.93)			
PP			-2.31 (2.82)			
QXY _{t-1}			2.56* (0.39)		0.06 (0.10)	
CBI				172.34* (37.85)		
QDC				17.36* (1.58)		
PEC					-0.005* (0.002)	-0.03* (0.005)
QXC					0.32* (0.04)	0.30* (0.07)
QSC _{t-1}					-0.15 (0.12)	
IMP _{c,t}						0.23* (0.06)
ER						6.26 (7.74)
TP		-0.02 (0.02)				
PIC _{t-1}	3.37* (0.51)					
DRAT		-0.47* (0.15)				
RS _{t-1}	965.28 (787.24)					
R ²	0.83	0.63	0.93	0.89	0.79	0.84
U ₂ ^c			0.85	0.51	0.41	0.48
RMPE ^d	7%	22.1%	14%	14%	26%	34%

* Statistically significant from zero at the 5% level.

^a The abbreviations are as follows: AR = area, QDC = domestic cotton consumption, PEC = cotton export price, QSC = stocks of cotton, QEC = cotton exports, PIC = internal cotton price, PP = polyester price, QXY = domestic production of cotton yarn, CBI = Cotlook B Index (index of world cotton offer prices), QXC = domestic cotton production, IMP = total cotton imports by countries importing cotton from Pakistan, ER = rupee/dollar exchange rate, TP = total cotton production cost, DRAT = the departure of annual rainfall from average, and RS = the ratio of cotton returns per acre to sugarcane returns per acre.

^b numbers in parentheses are asymptotic standard errors.

^c Theil's U₂ statistic.

^d Root Mean Percentage Error.

of the relatively small share of domestic production that is consumed domestically.

The transfer out of the yarn sector (social loss) is estimated to be -12.4 billion rupees (\$411,724,809) per year. The magnitude of this

transfer is not surprising given that most of Pakistan's yarn production is exported. That is, if the two-price policy (export tax) caused income to be transferred from cotton producers to yarn spinners and most of yarn production is export-

Table 2. Results of Structural Equation Estimation—Yarn Sector, 1971–1993

Independent Variable	Dependent Variable			
	QXY ^a	QDY	QSY	QEY
Intercept	342.96 (251.23) ^b	80.37 (10.81)	310.36* (105.51)	-244.21* (22.82)
PY	-0.001 (0.001)	-0.001** (0.0003)	-0.02* (0.006)	-0.002* (0.001)
PIC	-1.18* (0.54)			
PP	0.79 (1.59)	-0.33** (0.16)		
QXY _{t-1}	1.58* (0.25)			
QXF _{t-1}		0.01 (0.02)		
QSY _{t-1}			-1.01* (0.24)	
QXY			1.55* (0.33)	
IMP _{y,t}				0.09* (0.04)
Mills				1.76* (0.30)
ER				7.09* (3.01)
R ²	0.96	0.47	0.67	0.97
U ₂ ^c	0.57	0.64	0.51	0.60
RMPE ^d	10.4%	13.8%	33.6%	11.2%

* Statistically significant at the 5% level of significance.

** Statistically significant at the 10% level of significance.

^a The abbreviations are as follows: QXY = domestic production of cotton yarn, QDY = domestic consumption of cotton yarn, QSY = stocks of cotton yarn, QEY = exports of cotton yarn, PY = price of cotton yarn, PIC = internal price of cotton, PP = polyester price, QXF = domestic production of cotton fabric, IMP = total imports of cotton yarn by countries that import cotton yarn from Pakistan, Mills = number of mills spinning cotton yarn in Pakistan, ER = rupee/dollar exchange rate.

^b Numbers in parentheses are asymptotic standard errors.

^c Theil's U₂ statistic.

^d Root Mean Percentage Error.

ed, it would be logical that a large proportion of that transfer would be transferred out with the yarn exports. Again, the partial equilibrium nature of the model prevents an accounting for the location of the transfer. However, it appears logical to assume that a large share of the transfer from the yarn sector is going to yarn consumers around the world. Summing the transfers and avoiding double-counting, the aggregate impact is estimated to be -20,708,160,052 rupees (-\$686,523,583) per year. This represents about 0.2 percent of Pakistan's average GDP over the 1988–1993 period.

When export taxes are applied, the issue of an optimal export tax arises. The optimal tax in this case was calculated by maximizing the difference between tax revenue generated from the tax and net social losses as a results of the tax. The actual tax was 15,087 rupees per metric ton (\$0.23/lb). The optimal tax rate was calculated to be 2,553 rupees per metric ton (\$0.04/lb). This suggests that Pakistan was not pursuing an optimal tax policy. Rather, it appears that Pakistan was attempting to maximize the size of the subsidy to yarn spinners.

To summarize, the export tax had the effect

Table 3. Summary of the Estimated Effects of the Export Tax on Raw Cotton Fiber in Pakistan on Sector Incomes

Sector	Estimated Effects	
	Rupees	Dollars ^a
Change in:		
Cotton		
Producer Surplus	-16,493,742,054	-546,805,842
Consumer Surplus	4,855,996,114	160,987,545
Tax Revenue	2,379,301,370	78,879,364
Transfer	-9,258,444,570	-306,938,932
Yarn		
Producer Surplus ^b	4,722,973,152	156,577,525
Consumer Surplus	969,469,324	8,780,048
Transfer	-12,419,184,806	-411,724,809
Net Effect	-20,708,160,052	-686,523,583

^a Converted to \$US using 1993 exchange rates.

^b Not used in calculation of net effect.

of reducing cotton producer income due to (1) lower price and (2) reduced production. This is consistent with the expectations alluded to by the Asian Development Bank. A large portion of that transfer went to yarn spinners (cotton consumers) in Pakistan, but some income was transferred out of the cotton sector to the rest of the world. This implies that the export tax achieved the objective of reserving domestic cotton production for domestic consumption (and transferring income to yarn spinners) which led to increased production of yarn. However, the results from the yarn market indicate that a large transfer out of this sector occurred. This is not to say that yarn spinners did not benefit from this policy. Rather, a large portion of the total benefit was transferred out of the yarn sector while producers and consumers of yarn in Pakistan received the other portion.

Conclusions

The first conclusion that can be offered is that for Pakistan the export tax on cotton has had income distributional consequences in markets other than where it was placed. The obvious linkages between supply and demand relationships transmits the effects of the export tax through different market levels. The magni-

tude of the effects is an empirical question, which depends on the price elasticities of supply and demand at different market levels. What is clear, however, is that consideration of the economic impacts of an export tax on one market level is incomplete without consideration of the "spillover" effects on other market levels.

This reinforces the notion that if the Government of Pakistan intended to subsidize the yarn sector, it would have been better served to follow the "first-best" policy of direct subsidization rather than the "second-best" policy of indirect subsidization. In addition, the disparity between the optimal and actual taxes suggests that the optimal, least distorting policy was not being followed. Many factors should be considered when evaluating these types of policies. For example, Pakistan may have been willing to forgo the large transfer found here in order to maintain a given level of industrial sector (yarn mills) employment. An increased need for tax revenue may have driven the Government of Pakistan to implement such a policy purely as a revenue-generating device with little regard to the distributional consequences. Nevertheless, *ex ante* consideration of the consequences of trade policy is warranted.

In a more general sense, the export tax be-

haves as a price control with its requisite implications for production and consumption. However, in a multi-market framework where the final good is an intermediate (semi-processed) good used primarily for export, this study suggests that the economic transfers that occur are passed on to the importers of that good. Thus, a price control on a product that is not fully consumed domestically in its final form results in transfers of wealth outside the economy. The implication of this finding is that the economic impacts of a price control depend to some extent on the market channels through which the controlled good passes, which supports the findings of others such as MacAvoy and Pindyk for other commodities.

Finally, this study suggests the questioning of the ability of government policy to create competitive advantage for domestic industries. That is, the export tax on raw cotton certainly gave yarn spinners in Pakistan a competitive advantage in yarn production in the short-run, which manifested itself in Pakistan's ability to capture a large world market share in yarns ($\frac{1}{3}$ of world trade by 1993). However, the results of this study show that this export tax on cotton also caused large transfers out of that market which may have damaged its long-term position in the global market for cotton yarn.

The lack of a global supply/demand model for cotton and textiles limits the conclusions that can be drawn about the impacts of this policy on other countries. However, it seems apparent that the export tax on cotton fiber in Pakistan raised world prices to the benefit of cotton producers around the world, of which the United States is one of the most prominent. At the same time, the export tax on cotton lowered world yarn prices, which has negative consequences for large yarn producers (again, the U.S. fits into this category). These results highlight the need for a global cotton and textile model through which the impacts of these policies can be assessed.

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