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The optimal tax on antebellum US cotton exports

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Abstract

The US produced about 80% of the world's cotton in the decades prior to the Civil War. How much monopoly power did the US possess in the world cotton market and what would have been the effect of an optimal export tax? This paper estimates the elasticity of foreign demand for US cotton exports and uses the elasticity in a simple partial equilibrium model to calculate the optimal export tax and its effect on prices, trade, and welfare. The results indicate that the export demand elasticity for US cotton was about −1.7 and that the optimal export tax of about 50% would have raised US welfare by about $10 million, about 0.3% of US GDP or about 1% of the South's GDP.

Keywords: Optimal export tax; Cotton; Export demand

JEL classification: Q170; F130; N510

1. Introduction

The theory of trade and welfare suggests that taxes on trade are a first-best policy intervention only in cases where a country has international market power (Bhagwati, 1971). Yet there is little empirical evidence on the size and gains from an optimal tax on exports or imports.[1] The antebellum US, which produced about

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[1]Virtually all of the evidence on the terms of trade effects of tariffs is computationally generated using general equilibrium models. But Brown (1987) warns that strong terms of trade effects are often built into these models when they employ the Armington assumption (that products are differentiated by country of origin).

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80% of the world's cotton (most of which was exported), is often cited as the quintessential example of a 'large' country that could improve its terms of trade and welfare through trade restrictions.[2] But exactly how much monopoly power did the US possess in the world cotton market?

This classic question can be answered with an estimate of the elasticity of export demand for US cotton. This paper estimates this elasticity and uses it in a simple partial equilibrium model to calculate the optimal export tax and its effects on prices, trade, and welfare. Pope (1972), James (1978, 1981), and Harley (1992) also examined US trade during this period using computable general equilibrium models, but did not estimate or make direct use of this elasticity, making it difficult to assess whether their simulations accurately capture the degree of America's market power. The advantage of an empirical assessment of America's dominant position in world cotton markets is that the extent of market power is determined by the data rather than by imposed parameters, no matter how plausible they may be. The method employed here relies on a precise statement of the elasticity of export demand and a general method of estimating the key parameters to that elasticity. The approach is more transparent than that of a computable general equilibrium model and will lend insight into a longstanding historical question and a contentious trade policy issue around the time of the Civil War.[3]

After discussing the antebellum cotton market and the factors that determine the elasticity of export demand for US cotton, this paper estimates an almost ideal demand system for cotton consumed by the UK, the principal source of cotton demand during this period. This system takes explicit account of the prices and availability of alternative sources of cotton supply and yields an estimate of the foreign demand elasticity. The elasticity is then used to determine the optimal export tax on cotton and, in the context of a simple partial equilibrium model, the welfare effects of such a tax.

Available evidence suggests that US cotton was an imperfect substitute for that grown elsewhere and that the elasticity of export supply from other regions was probably inelastic. Yet the elasticity of export demand facing the US is still estimated to be somewhat elastic, at around -1.7. The resulting optimal export

[2] For example, Metzler (1949) motivated his seminal paper on tariffs and income distribution by discussing cotton exports from the pre-Civil War US. Metzler showed how an import tariff imposed by a country facing inelastic foreign demand might lead to a fall in the domestic (tariff-inclusive) price of the imported good. The condition for the Metzler paradox is that $\eta < 1 - k$, where η is the (positive) elasticity of foreign export demand and k is the domestic marginal propensity to import. See also Jones (1974). The results of this paper suggest that foreign demand for US cotton was sufficiently elastic to make a Metzler paradox implausible.

[3] Although the optimal export tax may seem moot in view of the constitutional prohibition of export taxes, such taxes were actually a live political issue around this time: the Confederacy imposed an export tax on cotton to raise revenue, and Northern members of Congress led an effort to repeal the constitutional provision immediately following the Civil War.

tax is calculated to be somewhere between 45 and 55%, but would have raised US welfare by only about $10 million, roughly 0.3% of US GDP or 1% of the South's GDP. These results suggest that the optimal export tax does not necessarily ensure substantial welfare gains—even for countries that are clearly dominant producers in certain commodities.[4]

2. The antebellum world cotton market and optimal trade taxes

In the decades prior to the Civil War, the US was by far the world's most important source of cotton. As Table 1 indicates, the US accounted for about 80% of the world's cotton production between 1820 and 1860, with Brazil, India, Egypt, and a few other countries supplying the remainder. Cotton was America's leading export throughout the entire nineteenth century, comprising over half of all exports in the antebellum period, and nearly 40% of exports as late as 1890 (US Bureau of the Census, 1975, series U-276, U-191). About three quarters of the cotton crop was exported, almost all to the UK.

Cotton was the critical raw material behind the rapidly expanding textile industry in the UK and Europe, which imported all of their cotton consumption. As the industry grew, British textile producers became increasingly uncomfortable with their dependence on American supplies. ''The great and increasing preponderance of America in the production of cotton was a matter of deep concern to British economic and political leaders, a concern that was intensified by every crop shortage in America, increasing as the shadow of sectional conflict grew deeper,'' writes Gray (1932, p. 694). As a result, British merchants sought to encourage the development of cotton production in other countries, particularly India. The Cotton Supply Association was formed in 1857 to coordinate this effort,

Table 1
Sources of antebellum world cotton supply and demand, 1831–1860 (percentage distribution)

	Sources of supply					Sources of consumption		
	US	Brazil	West Indies	East Indies	Egypt	UK	Continental Europe	US
1831–35	80.1	6.0	1.9	6.7	5.2	58.3	28.1	13.6
1836–40	82.4	3.6	1.9	7.9	4.2	57.0	29.3	13.6
1841–45	86.7	2.0	1.0	7.7	2.5	55.3	28.4	16.2
1846–50	86.8	2.1	0.6	7.8	2.6	51.3	27.0	21.6
1851–55	84.6	1.8	0.4	9.0	4.0	50.6	30.4	19.0
1856–60	84.5	1.4	0.4	10.8	2.9	49.0	32.4	18.6

Source: US Department of Treasury, Bureau of Statistics (1895), p. 304.

[4]The ratio of exports to GNP was about 9% in 1859, so this result is only partly due to the lack of importance of trade in the antebellum American economy.

but was only marginally successful in reducing the country's reliance on cotton imported from the US.

The degree of US market power in cotton is best indicated by the price elasticity of export demand for American cotton. The optimal export tax is simply the reciprocal of that elasticity. Fig. 1 illustrates the potential gains from such an export tax. In the absence of a private agreement to restrict exports, perfectly competitive domestic producers of cotton would sell the quantity of exports (Q_1) where the marginal cost of export supply equals the world price (P_1). The optimal quantity of cotton exports, however, is determined by the point at which the marginal cost of export supply equals the marginal revenue from cotton exports, i.e., the quantity Q_2 which would be sold at the world price P_2. The government could ensure that this quantity of cotton is exported by imposing a tax such that the price received by domestic producers—which would be the world price net of the tax, i.e., $P_2(1-\tau)$—equals marginal cost at the quantity Q_2.

The formula for the optimal export tax follows from this approach. The marginal revenue from cotton exports can be expressed as $P^*(1-1/\eta_{US})$, where P^* is the world price and η_{US} is the (positive) elasticity of demand for the country's exports. The domestic price of cotton (P) is the world price net of the export tax: $P = P^*(1-\tau)$. Equating marginal revenue to the domestic price yields the formula for the optimal export tax as $\tau = 1/\eta_{US}$.

The demand for cotton exports from the US is simply the world's residual demand for cotton, which is demand in the UK and Europe minus supply from other cotton producers. After manipulating this identity, the following expression can be derived for the elasticity of export demand for US cotton (see, e.g., Van Duyne, 1975):

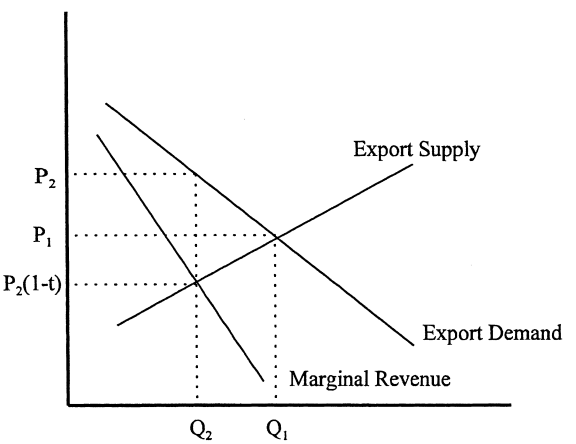

Fig. 1. The export market in partial equilibrium.

$$\eta_{US} = \frac{\varepsilon[(1-s)\sigma + s\eta] + \sigma\eta}{s(\sigma - \eta) + \eta + \varepsilon} \tag{1}$$

where η_{US} is the elasticity of export demand facing the US, η is the price elasticity of foreign demand for US cotton, ε is the elasticity of export supply from other cotton-producing countries, s is the US share of the world market, and σ is the elasticity of substitution (in consumption) between American and foreign varieties of cotton (reflecting the degree of product differentiation).

As this expression makes clear, it is important to distinguish between the elasticity of foreign demand for cotton (in other countries) and the elasticity of export demand for cotton (facing the US). The elasticity of export demand is larger (i) the greater is the elasticity of foreign demand for the commodity in general, (ii) the greater is the elasticity of substitution between the products from different source countries, (iii) the greater is the elasticity of export supply from other source countries, and (iv) the smaller is the US share of the world market. This formula is more familiar in the case of homogeneous products, i.e., when the elasticity of substitution approaches infinity:

$$\lim_{\sigma \to \infty} \eta_{US} = \frac{\eta}{s} + \frac{(1-s)}{s}\varepsilon$$

In the absence of a competitive supply response from foreign producers, then $\varepsilon = 0$ and Eq. (1) simplifies to $\eta_{US} = \eta/s$.

An important aspect of Eq. (1) is whether cotton from Brazil, India, and Egypt was a perfect or an imperfect substitute for American cotton. Historical evidence suggests that there was a significant degree of substitutability between the different sources of cotton, but that they were not perfect substitutes for one another. According to Gray (1932, p. 693):

> Not all the foreign cotton competed directly with American cotton. Egyptian cotton was used for fine threads and fabrics, competing with the shorter types of American sea-island cotton, but to a less extent with upland cotton. Brazilian cotton ranked next to Egyptian in fineness and length of staple. Indian cotton was of such inferior character that is was employed mainly for mixing with American cottons in manufacture of the coarsest fabrics. There was a tendency to employ the Indian supply as 'a sort of imperfect check upon American prices,' but to prefer American cotton when conditions of supply and prices were favorable.[5]

[5]Writing about the 1860s, Surdam (1998, p. 122) notes: ''Indian cotton served largely as a backup for the years when the American crop was sparse .... Indian cotton was used only reluctantly and appeared likely to continue in a supporting role for the foreseeable future.''

The optimal export tax, therefore, depends upon the elasticity of export demand facing the US (η_{US}), which in turn depends upon the elasticity of foreign demand (η), the elasticity of substitution (σ), and the elasticity of foreign export supply (ε). Estimates of both η and σ will result from the econometric approach employed in Section 3, and existing estimates of ε are available as described below.

3. Estimating the elasticity of demand and optimal export tax

3.1. Estimation framework

The greatest concern in estimating the elasticity of foreign demand is to avoid an econometric specification that results in a substantial downward bias to the estimated elasticity and therefore overstates the degree of market power that the country possesses. The approach taken here is to estimate the linear approximation of Deaton and Muellbauer's (1980) almost ideal demand system (AIDS). The AIDS approach is useful because it is a flexible form derived explicitly from consumer cost minimization and is a general first-order approximation to any demand system. AIDS has been shown to be superior to either the log-linear demand estimation or the Armington approach, which put strong restrictions on demand (such as the invariance of market shares with respect to expenditures and the separability of different import sources). The separability restriction is frequently found to be inappropriate and, if so, would generate omitted-variable bias that leads to an understatement of the price elasticities. Alston et al. (1990), for example, show that AIDS dominates the Armington approach in modern commodity markets (including cotton) and that Armington understates demand elasticities by about 50% in comparison to AIDS estimation (and estimates of elasticities in single-equation log linear specifications are understated by an even greater margin).[6]

The AIDS budget share equations for estimation are given by

$$w_{it} = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_{jt} + \beta_i \ln(x_t/P_t) + u_t \tag{2}$$

where t is the index of time, w_{it} is the expenditure share of cotton from country i,

[6]The only existing estimates (to my knowledge) of the elasticity of demand for cotton during this period are Wright (1971, p. 119), who reports a British demand elasticity of about −0.31 to −0.65, and Surdam (1998, p. 11), who reports a world demand elasticity of about −0.6 and a US demand elasticity of about −0.88. These estimates are probably downward biased because they are based on a simple log linear regression of quantity on price, an approach that does not take into account the prices of alternative suppliers of cotton. For a critique of similar estimates of export demand, see Panagariya et al. (2001).

p_{jt} is the price of cotton from different source countries (index by j), x_t is total expenditures on the commodities in question, u_{it} is a random disturbance, and P_t is a price index defined by:

$$\ln P_t = \alpha_0 + \sum_{k=1}^{n} \alpha_k \ln p_{kt} + \frac{1}{2} \sum_{j=1}^{n} \sum_{k=1}^{n} \gamma_{jk} \ln p_{jt} \ln p_{kt}$$

In most empirical applications, this equation is replaced by the linear approximation:

$$\ln P_t^* = \sum_{k=1}^{n} w_{kt} \ln(p_{kt}).$$

The adding up constraint requires that $\Sigma_i \alpha_i = 1$, $\Sigma_i \beta_i = 0$, and $\Sigma_i \gamma_{ij} = 0$. Homogeneity of demand requires that $\Sigma_j \gamma_{ij} = 0$. Symmetry requires that $\gamma_{ij} = \gamma_{ji}$ and involves cross equation restrictions that require that the equations be estimated as a system. Homogeneity and symmetry can be easily imposed and tested.

The elasticity of demand can be calculated from the estimated parameters of Eq. (2). Alston et al. (1994) show that the (compensated) elasticity of demand for the ith good with respect to the jth price can be accurately calculated as:

$$\eta_{ij} = \frac{\gamma_{ij}}{w_i} - \frac{\beta_i}{w_i} w_j - \delta_{ij} \tag{3}$$

where δ_{ij} is the Kronecker delta ($\delta_{ij} = 1$ for $i = j$; $\delta_{ij} = 0$ for $i \neq j$). Thus the elasticity of foreign demand for American cotton exports is $\eta_{ii} = -1 + \gamma_{ii}/w_i - \beta_i$. The standard error of the elasticity is computed as the standard error of γ_{ij} divided by w_i. The elasticity of substitution is also implicit from the parameters of Eq. (2) and can be calculated as $\sigma_{ij} = 1 + \gamma_{ij}/(w_i w_j)$ where $i \neq j$. The associated standard error is calculated as the standard error of γ_{ij} divided by $w_i w_j$.

3.2. Estimation results and the optimal export tax

Mann (1860, p. 112) reports annual data on the quantity of cotton imported into the UK from various suppliers. As Table 2 indicates, over 95% of the cotton imported by the UK during this period came from the US, Brazil, and India, with smaller quantities imported from Egypt and the West Indies. Mann (1860, p. 96) also presents data on the prices of cotton from three regions—US, Brazil, and India. In estimating the AIDS system, one equation must be deleted to avoid singularity, and in this case it is Egypt. Mann does not report prices of Egyptian cotton, but Gray (quoted above) indicates that Egyptian and Brazilian cotton were very close substitutes and therefore the price of Egyptian cotton is assumed to be the same as that from Brazil in calculating total expenditures (x_t), also used as the denominator in calculating the expenditure shares (w_{it}). Due to the limitations of

Table 2
Percentage distribution of UK cotton imports (by weight)

Year	US	Brazil	India	Other countries
1820	59	19	15	6
1830	80	13	5	3
1840	82	2	13	2
1850	74	5	18	3
1859	78	2	16	4

Source: Mann (1860), p. 112.

the data, the estimates only apply to import demand in the UK, and not to continental Europe. Provided that the pattern of demand is the same in Europe as in the UK, so that the elasticities and the US market shares are comparable, the final results concerning the optimal tax should be unaffected.

The AIDS equations are estimated by iterative seemingly unrelated regressions (SUR) for the years 1820–1859. Table 3 reports the estimation results. Symmetry is imposed in the estimation, but not homogeneity. An F-test indicates that the hypothesis of homogeneity in demand cannot be rejected at the 5% level for each of the equations. The estimates of γ are statistically significant at the 5% level, with the exception of those pertaining to India.

The Durbin–Watson statistic suggests no evidence of serial correlation in the case of India and is inconclusive in the case of Brazil, but there appears to be serial correlation in the US equation. This would make the estimated US coefficients inefficient, but they would remain unbiased and consistent. Augmented Dickey–Fuller tests on the residuals of each equation (not reported) indicate that the hypothesis that the residuals are stationary cannot be rejected at the 5% confidence level.

Table 4 presents the own-price and cross-price elasticities of demand (and standard errors) implied by the parameter estimates in Table 3. The own-price elasticity of demand for US cotton is -1.5, for Brazilian cotton is -2.1, and for

Table 3
Estimation of demand system for cotton in UK, 1820–1859

Cotton from:	Estimated coefficients						
	α_i	β_i	γ_{US}	γ_{iB}	γ_{iI}	R^2	DW
US	−0.12	0.05*	−0.33*	0.18*	0.06	0.56	1.00
	(0.29)	(0.01)	(0.09)	(0.06)	(0.05)		
Brazil	1.98	−0.10*	0.18*	−0.13*	−0.03	0.82	1.36
	(0.21)	(0.01)	(0.06)	(0.06)	(0.03)		
India	−0.83*	0.04*	0.06	−0.03	0.03	0.28	1.99
	(0.22)	(0.01)	(0.05)	(0.03)	(0.05)		

Note: standard errors in parenthesis. *Significance at the 5% level.

Table 4
Implied price elasticities of UK demand for cotton

Source country	Average expenditure share	Price elasticity with respect to (standard errors in parenthesis)		
		US	Brazil	India
US	0.78	−1.49*	0.22*	0.07
		(0.12)	(0.08)	(0.06)
Brazil	0.11	2.29*	−2.11*	−0.18
		(0.54)	(0.54)	(0.27)
India	0.08	0.34	−0.39	−0.67
		(0.62)	(0.38)	(0.62)

Source: see text for details on calculation. *Significance at the 5% level.

Indian cotton is −0.7 (although this last estimate is not statistically significant). This ranking makes some sense: Brazilian cotton was the highest quality and most expensive, and hence plausibly the one for which demand would be most elastic, whereas demand for cotton grown in India would likely be least elastic due to preferences resulting from the colonial relationship with Britain.

The positive cross-price elasticities indicate that Brazilian and Indian cotton are substitutes for US cotton, with Brazilian cotton being the closer substitute. The calculated elasticity of substitution between American and Brazilian cotton is 3.88 (with a standard error of 0.70) and the elasticity of substitution between American and Indian cotton is 1.96 (with a standard error of 0.80). The cross-price term relating to Brazilian and Indian cotton is positive, indicating that they may have been complements rather than substitutes.

Although these elasticity estimates are likely to be much more elastic than those found using alternative approaches (cf. Alston et al., 1990), these estimates understate the true elasticities. The estimates assume that export supply from the US and other suppliers are perfectly elastic (i.e., the prices are exogenous) when in fact export supply from these countries is upward sloping. The lack of annual data on supply determinants such as acreage planted, labor employed, prices of alternative crops, and weather conditions for each of the supplying countries means that there are no readily available, satisfactory instruments for supply. The failure to control for supply imparts a downward bias to the estimated demand elasticities. Wahl and Hayes (1990) find that their estimates of γ at most double after controlling for the endogeneity of prices. In the present case of the US, this means that γ could be as high as 0.66 instead of 0.33. This has a modest effect of increasing the elasticity of export demand as will be discussed below.

As stressed earlier, the estimated elasticity of foreign (British) demand for US cotton should not be confused with the elasticity of export demand for US cotton. The elasticity of export demand is given in Eq. (1) and hinges on the US market share, the elasticity of substitution between US and foreign varieties of cotton, and the elasticity of foreign export supply. The sample average expenditure share on

US cotton is 0.78 and, based on the earlier results, the elasticity of substitution is taken to be approximately 3.

The elasticity of export supply from other cotton-producing regions is the final critical parameter. Antebellum commentators strongly disagreed about this factor. John C. Calhoun rejected the idea that the South possessed monopoly power in world cotton markets because of potential competition: ''We have no monopoly in the supply of our products; one-half of the globe may produce them. Should we reduce our production, others stand ready, by increasing theirs, to take our place; and instead of raising prices, we should only diminish our share of the supply'' (quoted in Pope, 1972, p. 379). Knowledgeable market participants, however, generally believed that foreign cotton could not displace that from the US. These experts believed that India lacked the climate and soil to produce quality cotton, and that sugar and other crops would always be much more profitable than cotton in Brazil (see the testimony in US House of Representatives, 1866).

Wright (1974, pp. 617–18) estimated the elasticity of cotton supply from India, Brazil, and Egypt during this period by regressing the quantity supplied on the lagged price. Depending on the time period, the elasticity of supply ranges from 0.3 to 0.8 for India, from 0.3 to 0.5 for Brazil, and from 0.3 to 0.6 for Egypt. The experience of the Civil War also suggests that export supply from India and Brazil was not very elastic. British imports of Indian cotton tripled between 1860 and 1864 at a time when the price of such cotton quadrupled, a supply response that implied an elasticity of less than 1, under the assumption that the Indian price is exogenous (Ellison, 1886, Appendix Table 1). While cotton exports from these countries did increase, they fell far short of making up for the war-time reduction in US supply due to the Northern naval blockade. The supply response may have been muted by the unwillingness of planters in other countries to make long-term investments in cotton cultivation because the Civil War was only expected to be a temporary disruption to US cotton exports. The elasticity of foreign supply appears to be inelastic and is therefore taken to be approximately 0.5, although the effect of higher values will also be examined.

Using Eq. (1), Table 5 presents the implied export demand elasticity for US cotton and, below that in parenthesis, the optimal export tax on cotton. A range of elasticities of substitution and foreign export supply is assumed. In all cases, η (the foreign demand elasticity) is taken to be the estimated value of -1.49 and σ (the expenditure share on US cotton) is 0.78. When $\sigma = 3$ and $\varepsilon = 0.5$, the implied elasticity of export demand facing the US is -1.7. In this case, the implied optimal export tax is 59%. Depending upon the assumed elasticity of substitution and foreign export supply, the optimal export tax ranges from about 50 to 59%. If cotton is assumed to be a homogeneous product (an infinite elasticity of substitution), then the optimal export tax is about 40–50%.

This should be considered the upper bound on the optimal tax because the demand elasticity is probably downward biased (for reasons discussed earlier) and the demand elasticity may rise when the tax itself is imposed. As noted above, if

Table 5
Implied elasticity of export demand for US cotton and optimal export tax

Elasticity of substitution (σ)	Elasticity of foreign export supply (ε)			
	0.0	0.5	1.0	2.0
3	1.69	1.71	1.72	1.75
	(59%)	(59%)	(58%)	(57%)
5	1.77	1.83	1.87	1.93
	(56%)	(55%)	(54%)	(52%)
∞	1.92	2.06	2.21	2.49
	(52%)	(48%)	(45%)	(40%)

The elasticity of export demand for US cotton exports is calculated using Eq. (1) under the assumption that the elasticity of foreign demand for US cotton is -1.5 and that the expenditure share on US cotton is 0.78.

the true value of γ is larger than originally estimated (0.66 rather than 0.33), then the implied elasticity of foreign demand for US cotton will be -1.9 rather than -1.5 and the elasticity of substitution will be closer to 4 than to 3. Taking $\eta = -1.9$, $\sigma = 4$ and $\varepsilon = 0.5$, then the implied elasticity of export demand is -2.2 and the implied optimal export tax is 46%. Thus, the central range of the optimal export tax appears to be about 45–55%.

In a general equilibrium evaluation of the antebellum tariff, Harley (1992) briefly considers the effects of a cotton export tax. After incorporating a foreign supply of cotton response into the model, Harley calculates that the optimal tax on cotton exports is about 60%. Therefore, quite remarkably, the econometric approach here yields a result that is almost identical to Harley's general equilibrium simulation. Harley even suggests that optimal export tax may have been in the range of 40–50% because the model does not incorporate lower foreign demand for raw cotton as a result of the greater US production of cotton textiles (due to the lower domestic price of raw cotton induced by the tax). This is also consistent, albeit for somewhat different reasons, with the discussion here that a higher elasticity would put the optimal tax in this range.

The economic gain from the optimal export tax depends not just upon the elasticity of export demand facing the US but also upon the elasticity of US export supply. Referring to Fig. 1, the net economic gain from such a tax can be approximated as the area $(P_2 - P_1)^*Q_2$, i.e., the consumer surplus extracted from foreign consumers, minus the area $\frac{1}{2}(Q_1 - Q_2)(P_1 - P_2(1-\tau))$, i.e., the domestic deadweight loss. The change in the world price, which measures the incidence of the export tax on foreign consumers, is calculated as:

$$\Delta p = \frac{\varepsilon_{\mathrm{US}}}{\varepsilon_{\mathrm{US}} - \eta_{\mathrm{US}}} \Delta\tau \tag{4}$$

where Δp is $P_2 - P_1$, $\varepsilon_{\mathrm{US}}$ is the elasticity of export supply from the US, and $\Delta\tau$ is the change in the export tax (the specific equivalent of an ad valorem rate).

Estimates of the elasticity of cotton supply put that elasticity at about one. Wright (1971) estimates the elasticity of antebellum land sales with respect to the price of cotton is between 0.6 and 1.5, while Duffy et al. (1994) use contemporary data to estimate that the response of cotton acreage with respect to price is 0.92. If three quarters of the crop is exported, and the elasticity of domestic demand for cotton is also about 1, then the elasticity of export supply is about 1.6.[7]

In 1859, the US exported 1386 million pounds of cotton (out of 2155 million pounds produced) and sold it for at an average price of $0.116 per pound (US Bureau of the Census, 1975, series K 554, U 275–276). Taking this as the benchmark from which the export tax would be imposed, Table 6 presents estimates of the net economic gain that would result from imposing an export tax of roughly 50%. Depending on the elasticity of US export supply, the world price would rise from between 13 and 20% and the volume of exports would fall about 24–40%. The incidence of the tax tends to fall on domestic cotton producers because the elasticity of export supply is probably less than the elasticity of export demand. These results should be viewed with some skepticism, however, because they are based on a linear approximation of a large shock.

Table 6
Welfare effects of a 50% cotton export tax in 1859

	Elasticity of US export supply (ε_{US})	
	1	2
Change in world price (percent)	+13	+19
Change in domestic price (percent)	−26	−19
Change in exports (percent)	−26	−39
Tax revenue (millions of dollars)	$46	$38
Change in welfare (millions of dollars)	$10	$13
Welfare as percent of US GNP (in 1859)	0.24	0.32
Welfare as percent of the South's GNP (in 1859)	0.9	1.2
Welfare as percent of value of cotton crop (in 1859)	4.0	5.2

Based on the imposition of a specific tax of $0.045 per pound exported. The elasticity of export demand is assumed to be −2. GNP for 1859 is assumed to be $4100 million.

[7]This comes from the standard formula that the elasticity of export supply is the elasticity of domestic supply times the ratio of supply to exports plus the elasticity of domestic demand times the ratio of domestic demand to exports.

The economic gain from the tax ranges from $10 million to $13 million. A welfare gain of this magnitude amounts to about 0.24–0.32% of US GNP in the 1859, using Robert Gallman's estimate of $4100 million in that year. Thus, despite America's considerable market power in cotton, the potential economic gain from such a tax appears to be modest. (In his general equilibrium model, Harley estimates that the welfare gain would be closer to 1% of GNP.) The gains from exploiting America's market position would have inflicted large losses on domestic producers (unless the revenue proceeds were rebated to them) without yielding a substantial net economic benefit. Because the optimal export tax has a sizeable effect on prices and exports, due to the underlying elasticities, the deadweight losses and the domestic redistributive effects are sizeable in comparison to the net gains.

The welfare gain appears small in relation to total GNP because cotton was not a large part of the overall antebellum economy; the value of cotton production amounted to 6% of GNP in 1859, and the ratio of exports to GNP was only about 9% in 1859. Alternatively, we could consider the South as an independent economic entity. Easterlin (1961, p. 535) estimates that the South accounted for 26% of America's income in 1860, which would imply that the welfare gain is between 0.9% and 1.2% of the South's GNP. The value of cotton production in 1859 amounted to 23% of the South's income, so this relatively small figure is not due to the unimportance of cotton to the South's economy.

Yet another calculation is the welfare gain in relation to the value of the entire cotton crop. The welfare gain was 4–5% of the value of the cotton crop, which in 1859 was about $250 million.[8] This gain would have accrued directly to cotton producers themselves under two scenarios: if they had received a full rebate of the revenue raised by the export tax, or if they had formed a cartel to reduce exports by the requisite amount. The gain would have been concentrated on relatively few plantation owners because the top 10% of all farms produced over two-thirds of all the cotton, given them a strong interest in adopting an export-tax rebate scheme or in forming an export cartel. Considered as a percentage of the profits of these plantations, the extra $10 million would have been enormous. And yet, as the next section indicates, cotton producers did not serious advance such proposals, perhaps recognizing that tariff-rebates were not politically feasible and that production cutbacks required by the cartel would have been extremely difficult to enforce.

A final consideration is that this partial equilibrium framework is static and ignores several important dynamic issues. Part of the long run response to the imposition of an export tax is that the export share of the taxing country declines and the absolute elasticities of foreign demand and competing supply rise (Corden, 1974, pp. 164–167). Therefore, the optimal export tax should declines over time

[8]That is, 5.387 million bales of cotton produced in that year at 400 pounds per bale times the average price of $0.116 per pound. US Bureau of the Census (1975), series K-554.

from its initial optimum or should be initially set lower than suggested here by a far-sighted government.

3.3. Implications

The empirical analysis presented here confirms the standard presumption that the US possessed considerable market power in cotton during the antebellum period. Did the US ever take advantage of this situation by restricting its cotton exports so as to reap a positive (albeit small) economic gain?

A simple export tax appears to have been impossible, at least in the antebellum period, because the constitutional prohibition of export taxes ruled out this course of action.[9] James (1981) suggested that existing import tariffs could have acted as an indirect tax on exports (via the Lerner symmetry theorem). However, Harley (1992) found that the actual tariffs apparently failed to improve America's terms of trade because these duties did not restrict cotton exports, but rather the sale of marginal exportable goods—particularly food—in which the US was a price taker on world markets. Only at imports tariffs above 30% would exports of food cease and America's market power in cotton come into play, according to Harley's results. In that case, however, there would be no economic benefit from the tariff because the gain from restricting cotton exports would fail to compensate for the added distortions resulting from lost food exports.

Were alternative methods of export restriction ever considered? No government tax would have been necessary if Southern cotton producers had organized a cartel or export marketing board to exploit their collective market power. Yet plantation owners were wedded to *laissez-faire* and vociferously asserted their right to plant and export as much cotton as they pleased without any interference whatsoever. Cotton producers operated in something close to a perfectly competitive auction market and it would have been extremely difficult to prevent any producer from making competitive sales outside any cartel or marketing board.

Plantation owners even resisted interference in their business by the Confederate government during the Civil War. The Confederate government actually imposed a 1.5% tax on exported cotton in an effort to raise revenue. But this tax was so widely ignored and easily evaded that it only collected the tax on 5% of cotton exports (Lebergott, 1983, p. 67). Planters also rejected any effort to cut the production and export of cotton as part of the war effort, insisting ''on their right to grow unlimited amounts of cotton; to retain it for sale whenever they chose; and to sell it whenever, and to whomever, they chose'' (Lebergott, 1983, p. 69). The

[9] Article I, Section 9 of the Constitution states: ''No tax or duty shall be laid on articles exported from any state''. There were a few Southern proposals to do away with this provision or the provision forbidding taxes on interstate trade, thus breaking up the US customs union. As Huertas (1979, p. 99) notes, ''during the 1850s Senator Rhett of South Carolina advocated the introduction of tariffs on interstate commerce, as did the southern commercial conventions''.

Confederate government considered buying all of the cotton produced in the South, but this option was ruled out as being too expensive because it would have had to compete with other buyers in the market. Confiscation was another option, but not a politically acceptable one. Thus, all efforts to restrict cotton exports (beyond the Northern blockade) would have been opposed or would likely have failed. In Lebergott's view, Southern owners like to trumpet the economic power of 'King Cotton,' but were frightened of actually exercising that power.[10] Plantation owners feared that any export restraint would promote the cultivation of cotton in other regions of the world, potentially undermining the sales of American cotton in the postwar period.

Immediately following the Civil War, the US Congress considered two bills that proposed amending the constitution to permit export taxes, precisely so that an export tax on cotton could be levied. New England radicals sought to repeal the constitutional prohibition of export taxes in order to punish the South for the war and to gain a cost advantage for their textiles industries by lowering the domestic price of cotton relative to that of foreign rivals.[11] Neither of these bills was reported from committee.

Congress did, however, levy an excise tax on cotton for several years after the war. In considering this tax, Congress repeatedly asked cotton merchants (mainly New England textile merchants but also Southern plantation owners) whether they would prefer an export tax or an excise tax with a drawback on exported textiles. Most of those who testified were indifferent to these two options and concluded that the incidence of the tax would be on consumers and not on cotton producers (see US House of Representatives, 1866). Yet the excise tax expired without much consideration given to implementing an export tax.

Thus, in view of the constitution prohibition of export taxes, the inefficiency of import tariffs as a way of reducing only cotton exports, and the hostility of Southern plantation owners to any restriction on their freedom to produce cotton, there does not seem to have been a politically feasible way of reducing cotton exports.

4. Conclusions

This paper estimated the elasticity of foreign export demand for US cotton during the antebellum period, a period in which the US was the dominant world

[10] "The Confederacy did not seek to implement its monopoly by becoming the sole source of Southern cotton, extorting as great a rent as possible. Instead it allowed its planters to make cotton freely available to several thousand blockade runners" Lebergott (1983, p. 73).

[11] Rep. Blaine proposed such an amendment in 1865, as did Rep. Stevens in 1866. See the Congressional Globe, 38th Congress, 1st Session, p. 1261, and Congressional Globe, 39th Congress, 1st Session, p. 10.

supplier. Particular care was taken to avoid an econometric method that fails to take into account the prices of competing cotton producers so that the underlying demand elasticity would be downward bias. Even though the US had close to a monopoly position in world cotton markets (the elasticity of supply from other regions was low), the export demand facing the US was somewhat elastic. While the US could have benefitted from restricting cotton exports, and the optimal export tax appears to have been in the range of 45–55%, the actual gains from such a tax would have been small, in relation to both the GNP of the US and of the southern states. The antebellum US may have been the quintessential example of a 'large' country in world trade, but that does not necessarily imply that the optimal tariff was high and the welfare gains from it would be large.

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