Direct Employment Effects of Increased Imports: A Case Study of the Textile Industry

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I. Introduction

The United States, Western Europe, and Japan have all been subjected to a great deal of protectionist sentiment during the five year period following the meeting of ministers at Tokyo in September 1973. In the U.S. this protectionist pressure has focused on expected job losses caused by reductions in domestic output as consumers switch to import substitutes. It is, therefore, extremely important for trade negotiators to possess sound estimates of the expected impact of trade liberalization on the domestic output and employment in the import substituting sector.

Past research designed to provide these estimates of the influence of trade liberalization on domestic production and employment have utilized either a partial equilibrium or a highly aggregated general equilibrium approach. The most notable of the partial equilibrium approaches developed by Baldwin [3], has as one of its basic premises that increased expenditure on imports reduces the expenditure on the domestic substitute by the full amount. Taking these output changes and multiplying by the corresponding set of labor requirements per unit of output, this approach will provide a set of direct and indirect employment changes.

The purpose of this paper is to develop and test an alternative partial equilibrium model where the direct impact of increased imports on domestic production and employment of the competing domestic industry can be measured without restricting the changes in expenditure on the domestic good to equal that of the foreign good. Moreover the direct impact on employment is estimated through the use of a derived labor demand function rather than an input-output approach. The distinguishing feature of our partial equilibrium approach is

1. See Balassa and Kreinin [1]; Baldwin and Mutti, [2]; Baldwin [3; 4]; Baldwin and Lewis [5]; Baldwin, Mutti, and Richardson [6]; Cline, Kawanabe, Kronsjo and Williams [8; 9]; Salant [31; 32]; Salant and Vaccara [33]; and Vaccara [34].
2. Clements [7]; Deardorff, Stern, and Baum [11]; Deardorff and Stern [12]; and Walker [35].
that it allows domestic supply curves to be less than perfectly elastic and it does not restrict expenditure changes.

The textile industry\(^3\) was chosen as a case study for a number of reasons. First, it represents a mature industry which is protected by both high tariffs and quotas. Second, it is generally assumed that textile imports have been devastating to the U.S. textile producers. Finally, despite the fact that international trade in textiles is governed by the multilayer agreement (MFA)\(^4\) the recent Multilateral Trade Negotiations (MTN) indicate that the U.S. has included textiles in its trade liberalization program.\(^5\)

A brief discussion of the accepted partial equilibrium methodology is presented in Section II. Section III of the paper develops the methodology employed in estimating our three elasticities—the price elasticity of import demand, the import elasticity of domestic output, and the output elasticity of employment. The empirical results of our partial equilibrium model when applied to the textile industry are presented in Section IV. The implications of the results are discussed in Section V. Data definitions and sources are given in the Appendix.

II. The State of the Art

Past partial equilibrium attempts to estimate the impact of tariff reductions on domestic production and employment have been compelled to assume that increased expenditure on an imported good would reduce the expenditure on the domestic substitute by the full amount.\(^6\) To justify such a conclusion these models are forced to assume that domestic competing and foreign goods are imperfect substitutes that domestic and foreign supply curves are perfectly elastic, that the marginal propensity to save is zero and that the cross price elasticity between the domestic and foreign good and some third good is zero. By concentrating the full impact of trade liberalization on the side of production, this approach may overstate the impact of increased imports. As was noted in Cline et al. \(^8, 33\) "an increase in imports will be accompanied by some increase in consumption and some decrease in production domestically, and the sum of these two changes will equal the rise in imports."

The estimate of the direct impact on employment has been treated in a similar manner. Past attempts have simply multiplied the estimated output changes by a set of labor requirements per unit of output to produce the set of employment changes. The bulk of research on labor as a quasi fixed factor demonstrates, however, that adjustment does not occur instantaneously.\(^7\)

In order to identify direct changes in output and employment resulting from tariff liberalization one must be able to measure the effects of trade liberalization on domestic production, given the growth of domestic demand for the composite good. The model must resolve

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3. Standard Industrial Classification (SIC) product group 22.
4. The full text of the MFA is reproduced in Pelzman [29].
5. The administration's proposal with respect to the Textile industry is outlined in the Administration Textile Program, [50] released on February 15, 1979 pursuant to the President's statement on November 11, 1978. In this so-called 'White Paper', the administration sets out its determination to control imports under the existing 'multifiber agreement' in return for industry support of the MTN.
6. The most notable of these are Baldwin [3; 4], Baldwin and Lewis [5], Baldwin, Mutti and Richardson [6], and Cline et. al., [8; 9]. The assumptions of the model are detailed in Baldwin [3] and in the Appendix to Baldwin and Lewis [5].
7. An excellent source on labor as a quasi fixed factor is Fair [14].
the following questions: First, by how much would imports of a given commodity rise as a result of a proposed tariff reduction? Second, what would be the impact of this change in imports on the domestic production of its substitute? Finally, how will this change in production be reflected in that sector’s employment?

A resolution of these questions would involve the computation of three relationships.

\[
\begin{align*}
\% \Delta M_j &= \eta \Delta t_j / (1 + t_j) \\
\% \Delta Q_i &= \beta, \% \Delta M_j \\
\% \Delta E_i &= \delta, \% \Delta Q_i
\end{align*}
\]

Where \( M_j \) = quantity of imports of commodity \( j \)
\( \eta \) = price elasticity of import demand for commodity \( j \)
\( t_j \) = ad-valorem tariff rate
\( Q_i \) = domestic output of commodity \( i \)
\( \beta_i \) = import elasticity of output
\( E_i \) = units of labor employed in the production of commodity \( i \) in the domestic market.
\( \delta_i \) = output elasticity of employment for commodity \( i \).
\( \% \Delta \) = percentage change

The methodology outlined in the next section presents a three stage procedure by which a consistent estimate of the direct output and employment effects resulting from tariff liberalization may be derived. In the first stage the relative price elasticity of import demand is estimated using a disequilibrium model of import demand outlined by Yadav [36]. In the second stage, using a disequilibrium model of domestic output with both price and non-price rationing mechanisms, the import elasticity of output is estimated. Finally in the third stage the output elasticity of employment is derived using a model presented by Nadiri and Rosen [27].

III. An Alternative Methodology

The Relative Price Elasticity of Import Demand

An equilibrium model of import demand is generally specified as a log linear function of the relative price of imports (i.e., the ratio of the import price to the domestic price of commodity \( j \)) and the domestic real income or output variable of commodity \( i \) in a given period \( t \):

\[
\log M_{j,t}^{d} = \log \alpha_0 + \alpha_1 \log (PM_{j,t}/PD_{j,t}) + \alpha_2 \log Q_{j,t} + \mu_{j,t}
\]

where \( M_{j,t}^{d} \) = quantity of imports of commodity \( j \) demanded
\( PM_{j,t} \) = weighted import unit value index of the \( j \)th commodity

8. As Leamer and Stern [24, 13–14] have pointed out, the income or “activity” variable chosen depends on the nature of the import category under study. Given the fact that import demand functions are excess demand relationships and the fact that textile products are intermediary goods, the use of industrial production as an activity variable is far superior to the use of income as a proxy for demand. For further discussion of this problem see Houthakker and Magee [19].
\( PD_d \) = wholesale price index of the domestic substitute  
\( Q_d \) = index of production of the domestic competing good.  
\( u_{t,t} \) = an error term  
\( t \) = subscript denoting time period.

Equation (4) embodies the hypothesis that as the price of imports fall relative to the domestic price, the quantity of imports rise. The expected sign pattern of the coefficients is:

\[ \alpha_1 < 0; \alpha_2 > 0. \]

The sign of \( \alpha_2 \) could be negative since imports are usually considered to be the difference between consumption and production. Moreover, this model assumes that the adjustment process, in terms of both quantities imported and prices, converge to their respective equilibrium levels instantaneously. However, since quarterly data is used this assumption would imply full adjustment within one-quarter. Such an assumption would be highly unrealistic.

In order to take this possibility into account a disequilibrium model utilizing a partial adjustment mechanism9 is adopted. This model assumes that adjustment between equilibrium and actual values may occur with some lag:10

\[ \Delta \log M_{j,t} = \gamma [\log M_{j,t-1} - \log M_{j,t}] \]

where \( \gamma \) is the coefficient of adjustment, \( 0 \leq \gamma \leq 1 \) and

\[ \Delta \log M_{j,t} = \log M_{j,t} - \log M_{j,t-1}. \]

Substituting equation (4) into (5) yields our estimating equation for imports:

\[ \log M_{j,t} = \log C_j + C_{j1} \log (PM_j/ PD_j) + C_{j2} \log Q_j + C_{j3} \log M_{j,t-1} + u_{j,t} \]

where \( C_{j0} = \gamma \alpha_1, C_{j1} = \gamma \alpha_2, C_{j2} = \gamma \alpha_3, C_{j3} = 1 - \gamma, u_{j,t} = \gamma u_{j,t-1}. \)

We would expect that

\[ C_{j1} < 0; C_{j2} > 0; C_{j3} > 0. \]

However, if one assumes that import demand is an excess demand relationship filling the gap between domestic production and consumption then \( C_{j2} \) could be either negative or positive. Its sign would be determined by the difference in variation in the excess of domestic consumption over domestic production [26, 187–194].

This partial adjustment process assumes that while import prices are exogenous to the importing country, the existence of adjustment costs implies that quantities are only partially adjusted domestically within a given period. As a result, the short run relative price elasticity may not capture the entire adjustment. The long-run relative price elasticity of import demand \( \eta \), calculated as \( C_{j2}/1 - C_{j3} \), however, does capture the entire adjustment and therefore can be used to solve the first relationship (equation 1).

The Import Elasticity of Output

General equilibrium models of a competitive market argue that equilibrium will be maintained by instantaneous price changes. Eckstein and Fromm [13] however, argue that this in-

9. See Yadav [36] and Houthakker and Taylor [20].
10. Implicit in this assumption is that imports may not be on their demand functions, that is \( M_{j,t} \neq M_{j,t-1} \).
stantaneous adjustment is a limited case. The evidence presented strongly supports the argument that in the short-run, demand and supply curves are not equilibrium relationships. Moreover, adjustment to excess demand and excess supply are achieved via both price and nonprice rationing mechanisms. Zarnowitz [37] in his study of the role of orders and stocks as buffers to changes in demand, points out that prices do not change greatly in response to short-run demand fluctuations even in the case where sellers set prices. His findings suggest that delivery period adjustments and inventory accumulation serve as "shock absorbers" to excess demand and supply. In the context of an open economy Gregory [17] has observed that excess demand (supply) is adjusted via trade, prices and inventory changes. In what follows, we propose a more efficient estimate of the relationship between domestic output and imports of the competing product, within this disequilibrium framework.

In order to determine the effect of exogenous supplies of foreign goods on the competing domestic good one must, at the optimum, calculate the cross price elasticity between the domestic and foreign good. However, given the enormous data limitations, especially with foreign trade prices, a second best alternative is to approach the problem by estimating \( dQ_J/dM_i \). In particular we wish to estimate the effect of a change in imports on domestic production, given the growth of overall demand for the good.

Consider the case where the domestic output is disturbed by an increase in imports resulting from a reduction in the ad-valorem tariff rate. The conventional assumption of instantaneous price changes would imply that:

\[
dQ_J/dM_i = -1.
\]

However, this would ignore the possibility of a lag in recognizing the existence of excess demand or supply on the part of the domestic producers. Furthermore, it would assume that the total consumer expenditure on the composite of commodity \( i \) and \( j \) is held constant and that consumers totally shift their expenditure from domestic to foreign goods.

However, if domestic producers do not observe imports as such without a lag and react to shifts in overall demand as expressed through changes in inventories then the assumption of instantaneous adjustment would result in over estimating the impact of imports on domestic production. Based on Zarnowitz's [37] work it is fair to say that in an industry such as textiles inventories act as shock absorbers to shifts in overall demand and supply. An exogenous shock such as increased imports would in the short-run result in changes in inventories. The industry would respond to these inventory changes rather than to imports. Only in the long-run will the industry make adjustment to increased foreign competition.

In order to assess the impact of an increase in imports on domestic production one must separate these two effects. Therefore we suggest the following possible responses to an increase in imports in this disequilibrium framework.

If the increase in imports occurs when domestic demand is growing then we may expect that as a first response inventories will be depleted.

\[
I_{i,t}/I_{i,t-1} < 1
\]

On the other hand if imports increase when there is no positive growth in domestic demand then the first response would involve inventory expansion,

\[
I_{i,t}/I_{i,t-1} > 1.
\]

Furthermore, given the quasi-competitive market structure of the textile industry, producers
may respond to an increase in inventories by changing the product price. Such that when

\[ I_{t,i}/I_{t-1,i} < 1 \text{ then } PD_{t,i}/PD_{t-1,i} > 1 \]

and when

\[ I_{t,i}/I_{t-1,i} > 1 \text{ then } PD_{t,i}/PD_{t-1,i} < 1. \]

Only after these adjustments are taken, do we expect an increase in imports to affect domestic production to any large extent.

These probable responses to an increase in imports resulting from trade liberalization, are quite plausible given the empirical evidence presented in Zarnowitz.\(^{11}\) Furthermore as Richardson [30] points out, the existence of inventory and order backlogs in U.S. manufactures suggests that continuous market clearing via price is a poor descriptive assumption.

Formalizing our assumptions about the possible responses of domestic producers to increased imports we estimate the following disequilibrium domestic supply equation, in log linear form:

\[
\log Q_{t,i} = \log \beta_0 + \beta_1 \log w_i + \beta_2 \log r_i + \beta_3 \log (PM_i/PD_i) + \beta_4 \log Y_i + \beta_5 \log (PD_{t-1,i}/PD_{t,i}) + \beta_6 \log (I_{t,i}/I_{t-1,i}) + \beta_7 \log M_{j,t-\delta} + v_{t,i}
\]

(7)

where the new variables are defined as:

- \(w_i\) = average hourly earnings of production workers.
- \(r_i\) = rental price of capital.
- \(Y_i\) = real disposable income.
- \(I_i\) = quantity of commodity \(i\) in inventory.
- \(t\) = subscript denoting time period.
- \(v_{t,i}\) = an error term.
- \(n\) = length of the time lag

and the expected sign pattern of the coefficients is:

\[ \beta_1, \beta_2, \beta_6, < 0; \beta_3, \beta_4, \beta_5, > 0; \beta_7, 0. \]

If imports serve to displace domestic production then \(\beta_7 < 0\), ceteris paribus. However, if both imports and domestic production are growing in response to a general increase in demand for the given commodity then \(\beta_7 > 0\). The resulting estimate of the import elasticity of output, \(\beta_7\), would provide an estimate of the direct impact on the domestic production of good \(i\) of increased imports of good \(j\) resulting from trade liberalization.

**Output Elasticity of Employment**

The final stage of the procedure involves the estimation of the short-run effects of output changes on total employment in the given industry. The analysis begins with the added as-

\(^{11}\) We calculated a ratio of inventories to unfilled orders in order to determine whether or not more of the industries' output is geared toward order or towards stock. For the textile industry the ratio was greater than one suggesting a larger proportion of output to stock. In this industry, therefore, changes in finished goods inventories could be an indicator of excess demand or supply. Similar results were found by Zarnowitz [37] for the textile industry.
sumption of long run cost minimization. The procedure for estimating the output elasticity of employment follows that presented by Nadiri and Rosen [27] where output is assumed to be exogenous, and input adjustment take into account "the stock and flow dimensions" of labor and capital.

The Nadiri and Rosen model begins with the familiar Cobb-Douglas production function:

\[ Q_i^t = A \prod_{k=1}^{6} (Y_{kh})^{ah} \]  

where \( Q_i^t \) = output in the industry corresponding to commodity \( i \).

\( Y_1 = \) the stock of production workers.

\( Y_2 = \) the average weekly hours per worker.

\( Y_3 = \) the capital stock.

\( Y_4 = \) capital utilization.

\( Y_5 = \) inventory.

\( Y_6 = \) the stock of non-production labor.

\( ah = \) output elasticities of each input.

\( A = \) an exogenous technological shift parameter.

\( t = \) subscript denoting the time period.

Long run optimal factor demand functions \( (Y_i^*) \), are determined by minimizing total costs subject to the production function (8). These factor demand equations are expressed as functions of relative factor prices \((w/r)\) and the long run equilibrium level of output \( Q_i^* \).

\[ Y^* = f((w/r), Q^*_i). \]  

The adjustment of the factor inputs towards their long run equilibrium levels is estimated by the following set of partial adjustment equations:

\[ Y_{kh} = Y_{kh-1} + \sum_{k=1}^{6} \Theta_{kh}[Y_{k,^*} - Y_{k,t-1}] + \epsilon_{kh} \]  

where the \( \Theta_{kh} \)'s are adjustment coefficients.

Substituting (9) into (10) and replacing \( Q_i^* \) with current output \( Q_i^t \) yields, in matrix form the basic equations to be estimated:

\[ Y_i = AQ_i + B(w/r)_i + C Y_{t-1} + \epsilon_i \]  

where \( A \) is a 6 x 1 vector of output coefficients \( B \) is a 6 x 1 vector of relative factor price coefficients and \( C \) is a 6 x 6 matrix of own and cross adjustment coefficients equal to \((1 - \Theta)\), where \( \Theta \) is the matrix of partial adjustment coefficients in equation (10).

Specifying equation (11) in log-linear form yields:

\[ \log Y_{h,i} = \log d_{h0} + d_{h1} \log Q_i^t + d_{h2} \log (w/r)_i \]

\[ + d_{h3} \log Y_{1,i-1} + \cdots + d_{h8} \log Y_{6,i-1} + \epsilon_{h,i} \]

\[ h = 1 \cdots 6. \]  

This formulation permits the estimation of a consistent set of response patterns of all inputs.
The own adjustment coefficients $\Theta_{hh}$ are calculated as $(1 - d_{hh})$ and the cross-adjustment coefficients, $\Theta_{hs}$, are calculated as $-d_{hs}$. These partial adjustment coefficients can then be used to derive the long run output elasticity of employment $\delta_n$ necessary for the third relationship.

IV. Empirical Results

Estimated Elasticities

Equations (6), (7), and (12) have been estimated using seasonally adjusted quarterly data for Textile products (SIC22) for the period 1964I to 1977IV. The estimating procedure used in equation (6) was Ordinary Least Squares (OLS). Conclusive evidence of the existence of serially dependent residuals for this import equation was not found. Therefore, it was decided that the OLS procedure would not lead to biased results. However, in the case of the supply equation (7), in order to eliminate (as far as possible) the simultaneous equation bias, the instrumental variables estimator used was the two-stage least squares estimator where the instrument chosen is $M_{t-n}$.13 In the six equations represented by equation (12), the existence of first-order serially correlated residuals necessitated using the search procedure outlined by Cochrane and Orcutt [10].

First, the total demand for imported textile products has been estimated as:

$$\log M = 3.73 - .22 \log (PM/PD) + .96 \log Q$$

$$+ .34 \log M_{t-1}$$

$$R^2 = .71, F(3, 54) = 41.83, h = 1.00$$

(the set of figures in parentheses are the standard errors)

where $h$ is the Durbin statistic [22] used to test for the presence of autocorrelation when lagged values of the dependent variable are contained in the equation.14 The $h$ statistic, for our result fails to reject the hypothesis of no autocorrelation at the 95 percent confidence level. Therefore we have no evidence that serial correlation is causing a biased estimate.

The dependent variable ($M$) in the import demand equation is the quantity of imported textile products, ($PM$) is the trade weighted average import unit-value index, $PD$ is the textile wholesale price index, and $Q$ is the Federal Reserve Board index of textile production (all in 1967 = 100).

The calculated long-run relative price elasticity of import demand $\eta$ is $- .33$.15 Such a

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12. The implied long-run output elasticities of the particular factors of production are determined from $[I - (I - d)]^{-1} = A$ where $A$ is a $6 \times 1$ vector of output coefficients and $I - d$ and $dA$ are taken from the solutions of the six equations represented by equation (12).

13. The two-stage least squares estimator is considered to be a more general and often the best instrumental variables estimator because it takes into account the influence on the dependent variable of all the predetermined variables of the system, and that it results in the minimum asymptotic covariance matrix Maddala [25, 475-79].

14. The statistic, which is tested as a standard normal deviate, is: $h = r \sqrt{n/1 - n} \bar{V}(C_3)$ where $r = 1 - d/2, d$ is the Durbin-Watson statistic, $\bar{V}(C_3)$ is the estimate of the sampling variance of $C_3$, the coefficient of $M_{t-1}$ in the least squares regression and $n$ is the number of observations.

15. The long-run price elasticity is calculated as $C_3/1 - C_{3B} = - .22/1 - .34 = - .33$. 
low price elasticity is not unreasonable for textile products given the distorting effects of the quantitative restrictions imposed on textile imports.\(^\text{16}\)

The estimated coefficients for the textile supply equation are:\(^\text{17}\)

\[
\log Q = 2.45 - .57 \log w^* - .04 \log r - .08 \log (PM/PD) \\
(\text{.22}) \quad (\text{.12}) \quad (\text{.05}) \\
+ 2.55 \log Y^* + 1.55 \log (PD/PD_{t-1})^* - .10 \log (I/I_{t-1}) \\
(\text{.39}) \quad (\text{.35}) \quad (\text{.15}) \\
- .26 \log M_{t-4}^*. \\
(\text{.09})
\]

(The set of figures in parenthesis are the standard errors. An asterisk denotes that the estimated coefficient is significantly different from zero at \(\alpha = .05\).

The dependent variable \((Q)\) in the supply equation is the Federal Reserve Board index of textile production, \(w\) is the average hourly earnings of production workers, \(r\) is the rental price of capital, and \(I\) is the quantity of textile products held in inventory. The import elasticity of output is \(-.26\) and is statistically significant. Its magnitude is not surprising given the fact that domestic production and imported textiles are both expanding. Over the 1964-1977 period textile imports grew at approximately 3.5 to 4 percent per year while domestic production with the exception of 1974 and 1975 grew at approximately 4 to 6 percent per year. Furthermore, these results are consistent with those of Frank [16, 29] and Isard [21] who found that the impact of imports on domestic textile production was quite small.

The responses of the other variables to an exogenous flow of imports are partially correct. While the change in price is positive and statistically significant, the inventory change is not significant. Likewise, although the wage variable is of the correct sign and is statistically very significant, the rental price of capital is insignificant although of the correct sign. The demand variables in this supply relationship are statistically significant and of the correct sign.

The estimated coefficients of the factor demand equations represented by equation (12) are presented in Table I. The coefficients on output are highly significant in all equations except that of capital stock \((Y_3)\). The impact of output is strongest on the capacity utilization rate \((Y_4)\) followed by production worker employment \((Y_5)\). As is generally expected inventories are inversely related to output. However, the coefficients on the relative cost variables are extremely small and with the exception of non-production employment are all insignificant. Estimated trend coefficients are statistically significant in all but capital stock \((Y_3)\) inventory \((Y_5)\), and non-production employment \((Y_6)\). The magnitude of the trend coeff-

\(^{16}\) In an earlier study Richardson [30] estimated the relative price elasticity of textile imports (SIC 22) to be \(-.10\). This estimated elasticity was based on annual data for the period 1957-1969 and relies on Richardson's structural model. The major reason for this low elasticity was the distorting effects of the non-tariff barriers. Unfortunately both in Richardson's case and in our own it is impossible to determine whether or not the quotas were binding. Given that these quotas are imposed on commodities at the textile category level which are based on fiber content and cannot be concorded to the output based SIC and which differ across bilateral partners, and until the recent "White Paper" could be underfilled one year and overfilled the next, it is impossible to determine whether or not the quotas were binding. The only implication of the low relative price elasticity is that during the observation period (1964I-1977IV) textile imports were not responsive to relative price changes.

\(^{17}\) An \(R^2\) is not reported because its relevance as a measure of goodness of fit as in the case of two-stage least squares is open to interpretation. As Fisher pointed out [15, 34] in the case of two-stage least squares "the orthogonality properties ... which make \(R^2\) easy to interpret in terms of fractions of variance explained are not preserved." The only proper measures of goodness of fit are provided by the asymptotic standard errors.
Table 1. Estimated Structure of Factor Demand Equations and Implied Long Run Output Elasticities*

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Production Employment</th>
<th>Weekly Hours per Production Worker</th>
<th>Capital Stock</th>
<th>Capacity Utilization</th>
<th>Inventory</th>
<th>Non production Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent Variables</td>
<td>Y1,t</td>
<td>Y2,t</td>
<td>Y3,t</td>
<td>Y4,t</td>
<td>Y5,t</td>
<td>Y6,t</td>
</tr>
<tr>
<td>Constant</td>
<td>3.858* (.74)</td>
<td>4.987* (.72)</td>
<td>.0646 (.38)</td>
<td>.0582 (.31)</td>
<td>2.193 (.40)</td>
<td>.7079 (.39)</td>
</tr>
<tr>
<td>Output (Q)</td>
<td>.3916* (.04)</td>
<td>.2857* (.04)</td>
<td>.0265 (.02)</td>
<td>.9766* (.01)</td>
<td>-.2897* (.09)</td>
<td>.1769* (.02)</td>
</tr>
<tr>
<td>Relative Cost(w/r)</td>
<td>.0161 (.03)</td>
<td>.0178 (.04)</td>
<td>-.0023 (.02)</td>
<td>-.0094 (.01)</td>
<td>-.0979 (.07)</td>
<td>-.0988* (.02)</td>
</tr>
<tr>
<td>Y1,t-1</td>
<td>.1096 (.16)</td>
<td>-.3910* (.17)</td>
<td>.0462 (.09)</td>
<td>-.1498* (.05)</td>
<td>-.7534* (.30)</td>
<td>.3606* (.09)</td>
</tr>
<tr>
<td>Y2,t-1</td>
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<td>-.1594 (.14)</td>
<td>-.0176 (.07)</td>
<td>.0777 (.04)</td>
<td>-.0974 (.37)</td>
<td>-.2328* (.10)</td>
</tr>
<tr>
<td>Y3,t-1</td>
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<td>.0211 (.07)</td>
<td>.7720* (.03)</td>
<td>.0499 (.01)</td>
<td>.1328* (.04)</td>
<td>.0221 (.01)</td>
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<td>Y4,t-1</td>
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<td>.2304* (.10)</td>
<td>-.0068 (.03)</td>
<td>.0415* (.02)</td>
<td>.7203* (.03)</td>
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<td>-.0188 (.04)</td>
<td>.0123 (.02)</td>
<td>.0093 (.01)</td>
<td>.9490* (.07)</td>
<td>.0442* (.02)</td>
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<td>Y6,t-1</td>
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<td>-.0896 (.14)</td>
<td>.0522 (.04)</td>
<td>.0277 (.02)</td>
<td>.3002 (.27)</td>
<td>.4210* (.07)</td>
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<tr>
<td>Trend</td>
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<td>-.0020* (.0009)</td>
<td>-.0009 (.0004)</td>
<td>-.0046* (.0012)</td>
<td>.0017 (.0010)</td>
<td>-.0003 (.0003)</td>
</tr>
<tr>
<td>R²</td>
<td>.95</td>
<td>.86</td>
<td>.99</td>
<td>.99</td>
<td>.87</td>
<td>.99</td>
</tr>
<tr>
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<td>.7744</td>
<td>.9599</td>
<td>-.9278</td>
<td>-.3734</td>
</tr>
<tr>
<td>SEE</td>
<td>.0105</td>
<td>.0108</td>
<td>.0057</td>
<td>.0036</td>
<td>.0385</td>
<td>.0085</td>
</tr>
<tr>
<td>SSR</td>
<td>.0048</td>
<td>.0052</td>
<td>.0014</td>
<td>.0005</td>
<td>.0654</td>
<td>.0031</td>
</tr>
</tbody>
</table>

Implied Long-Run Elasticities

|                      | Q | .7961 | -.0078 | .8993 | 1.042 | 6.966 | 1.245 |

---

aThe sample period is 1964:1 to 1977:4. All variables except trend are in natural logarithms. Figures in parentheses are standard errors. R² is the coefficient of determination corrected for degrees of freedom; ÇEE is the standard error of the estimate; SSR is the sum of squares of the residual for this particular equation. An asterisk denotes that the estimated coefficient is significantly different from zero at α = .05. Ç represents the first-order correlation coefficient which minimizes the sum of squares of the residuals for each equation.

The own adjustment coefficients with the exception of weekly hours worked (Y2) are all positive. The cross-adjustment coefficients, however, need not be positive nor be non zero. Out of the possible 30 cross-adjustment coefficients 11 are significantly different from zero.
(at 0.05). However, in all cases there is at least one significant cross-adjustment, suggesting that input adjustments are interrelated. In general these short-run elasticities are consistent with the Nadiri and Rosen [27] model of partial adjustments toward long-run optimum levels of factor inputs.

The long-run output elasticity of production employment, in which we are primarily interested, is estimated to be \(0.7961\). This suggests returns to scale of about 1.2 implying slightly increasing returns to production employment. While the long-run output elasticity of hours per man, is as expected, almost zero, there is a significant long-run scale effect on capacity utilization. This may be accounted for by our inability to accurately measure the capital utilization rate.

Overall, the results presented in Table I, suggest that while production employment and capital stock, in the long-run, maintain a roughly stable relationship to output, adjustment to a change in output of textile products is taken up mostly by inventory.

*Direct Employment Effects*

Given the estimates of the relative price elasticity of import demand, the import elasticity of output, and the output elasticity of production worker employment, the direct impact on production worker employment resulting from tariff liberalization in textile products can be calculated. Three alternative tariff cutting options have been chosen to represent the full range of possible tariff cuts as it would apply to SIC 22.18

The results in terms of increased imports, decreased output and employment, based on the three alternative tariff reductions are presented in Table II. In each of these cases we have assumed that the tariff reduction would be instituted immediately. However, if the tariff cuts are spaced over a ten year period, as is generally believed, then the resulting immediate impact on domestic textile output and employment would be far smaller. Furthermore, we have assumed that the decline in price reflects the full tariff reduction. If the tariff reductions are not passed through to the retailers the decline in prices may not equal the full tariff cut suggesting that the stated percentage changes of output and employment may be overestimates.

The results presented in Table II should be more realistic then those presented by Cline et al. [8], where it was estimated that a 60 percent reduction in the textile tariff would result in a 2 percent reduction in textile employment. From our results, it is clear, that even if one assumes the largest tariff cut (35 percent) the resulting change in output and employment would only be .45 and .36 percent respectively. Given the present state of protectionist sentiment in the United States, it is far more likely that a tariff cut would be at the lower end of the spectrum. A 25 percent reduction in the tariff would result in a decline of domestic textile production and employment of .32 percent and .25 percent respectively. Likewise, a 30 percent reduction in the tariff would result in a decline of domestic textile production of .38 percent and in employment of .3 percent. Overall, these results demonstrate that the percentage changes in domestic output and employment are quite small. This should not be surprising given a small percentage change in price and a relatively inelastic price elasticity of demand for textile imports.

18. See footnote 12.
19. Present trade negotiations have placed the true tariff cutting option between the 25 to 35 percent interval for textile products (SIC 22).
Table II. Percentage Change in Imports, Output and Employment from Various Tariff Reductions

<table>
<thead>
<tr>
<th>Description</th>
<th>Tariff Cutting Options</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.25</td>
</tr>
<tr>
<td>Trade weighted ad-valorem tariff rate&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.175</td>
</tr>
<tr>
<td>Long-run relative price elasticity of imports</td>
<td>-.33</td>
</tr>
<tr>
<td>Long-run import elasticity of output</td>
<td>-.26</td>
</tr>
<tr>
<td>Long-run output elasticity of employment</td>
<td>.7961</td>
</tr>
<tr>
<td>Percentage change in imports&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.0123</td>
</tr>
<tr>
<td>Percentage change in output&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-.0032</td>
</tr>
<tr>
<td>Percentage change in employment&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-.0025</td>
</tr>
</tbody>
</table>

<sup>a</sup> Tariff figures provided by the Office of the United States Trade Representative.

<sup>b</sup> Computation based on equations 1, 2, and 3 respectively.

V. Concluding Remarks

The primary objective of this paper was to set up and test an alternative model designed to estimate the direct effect of increased imports on domestic output and employment. The empirical evidence with respect to the textile industry presented in Section IV demonstrates that such a procedure is in fact valid. Moreover, the results are encouraging in so far as they suggest that this approach may easily be applied to analyze these kinds of questions for other industries.

With respect to the textile industry itself, the results demonstrate that given the proposed tariff reductions, the impact on employment and domestic output would be very small. Moreover, if these tariff reductions are staged over a number of years, the resulting ripple effects on the industry would indeed be minimal. Furthermore, these estimates are considered to be more accurate than those of earlier studies where it is simply assumed that expenditure on imports displaced an equal amount of expenditure on the domestic good.

One should note, however, that our results, depend significantly on the elasticities employed, the tariff rate in existence and the tariff cuts assumed. Moreover, our approach is
hampered by the existence of non-tariff barriers. A further limitation of this analysis is that it presents only first round trade and employment responses. Consequently, it ignores changes in trade and employment from second round effects which may affect the estimated results. Despite these limitations, however, we believe that our approach extends the existing body of literature by removing one of the more cumbersome assumptions, that of the dollar for dollar displacement between domestic and foreign goods.

Appendix

Quarterly seasonally adjusted time series data used to estimate equations (6), (7) and (12) are taken from published sources. Some variables have been constructed by the procedure outlined below. All of the data was converted to the SIC—output based classification.

\( Q \) The Federal Reserve Board index of textile output, 1967 = 100, taken from Industrial Production [38] and Federal Reserve Bulletin [39].

\( PM \) the weighted average unit value index of textile imports was computed from the Bureau of the Census publication, U.S. General Imports, FT 135 [42]. These unit values were computed at the seven digit level of the Schedule A nomenclature. They were then aggregated up and concorded to the two digit SIC output based classification.

\( PD \) the wholesale price index for textile products was provided by the U.S. Department of Commerce, Office of Textiles. These wholesale prices were at the two digit SIC output based classification.

\( M \) the quantity of imported textiles was computed from the Bureau of the Census publication. U.S. General Imports, FT 135 [42]. These import data were aggregated up and concorded to the two digit SIC output classification.

\( Y \) the U.S. real disposable income taken from the Office of Business Economics and Bureau of Economic Analysis publications [44; 45; 46].

\( Y_s \) & \( I \) represent the inventory data compiled by the Bureau of the Census in their Manufacturers’ Shipment, Inventories, and Orders: 1958-1977 [43]. The value of inventory was deflated by the wholesale price index, 1967 =100. These data were available at the two digit SIC level. Further disaggregation was not available.

\( w \) the average hourly earnings of production workers, undeflated. Data for this variable was taken from the U.S. Department of Labor publication, Employment and Earnings [48; 49].

\( r \) the rental price of capital available at the two digit SIC level is constructed by the formula stated in Hall and Jorgenson [18].

\[
    r = (1 - w T)/1 - w (p_k (i + \delta))
\]

where

\[
    z = (1/dT) (1 - e^{-dT}) \text{ assuming straight line depreciation.}
\]

\( \delta \) = constant depreciation rate of .03276 calculated in Jorgenson and Stephenson [23].

\( w \) = corporate income tax assumed to be constant over the period at 52 percent.

\( T \) = lifetime of capital for tax purposes taken to be 72 quarters.

\( d \) = discount rate assumed to equal .035.

\( i \) = cost of capital is the government bond rate.

\( P_k \) = stock price of capital is the implicit fixed investment deflator.

\( Y_t \) the number of production workers taken from the Bureau of Labor Statistics publications [48; 49].

\( Y_s \) the average weekly hours per production worker taken from the Bureau of Labor Statistics publications [48; 49].

\( Y_3 \) the capital stock constructed by the recursive formula stated in Jorgenson and Stephenson [23].

\[
    K_{t+1} = I + (1 - \delta) K_t
\]

where \( K_{t+1} \) is the capital stock at the beginning of period \( t + 1 \), \( I \) is gross investment in constant 1967 prices in period \( t \) and \( \delta \) is the constant depreciation rate.

\( Y_4 \) the capital utilization rate taken from the Board of Governors publication Federal Reserve Measures of Capacity and Capacity Utilization [40].
Yₜ, the number of non-production workers was derived from the Bureau of Labor Statistics publications [48; 49].

References


