IMF Working Paper

WP/96/143

INTERNATIONAL MONETARY FUND

Research Department

Union Behavior, Industry Rents, and Optimal Policies

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December 1996

Abstract

This paper examines the supposed welfare gains from strategic trade and industrial policies in the U.S. steel industry. Strategic policies to capture labor rents lead to an endogenous response which greatly diminishes their importance. On the other hand, reducing domestic labor market distortions results in welfare gains nearly as large as those from optimal trade and industrial policies. The paper concludes that the focus on labor rents as the subject of U.S. trade and industrial policy is overstated, at least in manufacturing industries such as integrated steel.

JEL Classification Numbers: F13, F14

[1] I thank Alberto Alesina, Ernst Berndt, Don Davis, Joe Gagnon, Graham Hacche, Ann Harrison, Bill Helkie, Judith Hellerstein, Dale Jorgenson, Larry Katz, Kala Krishna, Cathy Mann, Ana Revenga, and Ling Hui Tan for helpful discussions and suggestions, and Catherine Morrison for generously providing data.

Contents

Summary

This paper evaluates the consequences for welfare of activist trade and industrial policies that target the integrated carbon steel industry in the United States. Recent studies have suggested that potentially large welfare gains are to be had from targeting industries with labor rents -- that is, from protecting "good jobs at good wages." The wage premium paid to steel workers is often cited as a reason to give protection to that industry.

The paper first develops a model of competition in the U.S. steel market among firms from the United States., Europe, and Japan, and then uses the model to simulate the effects of various policies over 1973-1986. For much of the period under consideration, U.S. steel firms were faced with substantially underutilized capacity.

Taking into account underutilized capacity turns out to be crucial for evaluating the effects of protection. When the cost function for steel includes energy, raw materials, and services, then labor and capital are complementary inputs in the production of steel. Faced with too much capital relative to demand, steel firms rationally use too much labor relative to the amount that would be optimal if there were no underutilized capacity. Protecting the steel industry, either through tariffs or through direct subsidies to production, increases utilization. As a result, steel firms shift their mix of inputs away from labor. In seeking to capture labor rents, activist policy actually diminishes their importance -- the policy destroys what it seeks to capture.

The analysis finds only modest gains from trade policy relative to the size of the industry; moreover, a decrease in union bargaining power provides for a welfare gain nearly as large as that from trade policy. It thus conclude that a focus on labor rents as the object of trade policy is overstated, at least in large-scale manufacturing industries such as integrated steel. Instead, policy should focus on the domestic sources of any competitive disadvantage.

I. Introduction

Proponents of activist trade policies argue that the existence of industry-specific labor rents leads to socially inefficient underproduction and thus underemployment, and seek to remedy the inefficiency through trade protection or industrial subsidies. These calls for protection appear to be supported by recent empirical work, which indicates that there are large welfare gains to be had from strategic trade policies when labor rent is taken into account. As noted by Katz and Summers (1989a,b) and Dickens and Lang (1988), even though there is only a small amount of product market rent to be captured, factor market distortions can mean that the very act of producing more is desirable, since this brings with it labor rents. In Dixit's (1988) study of the U.S. automobile industry, for example, the gains from optimal policies are about eight times larger when labor rents are taken into account—$2 billion versus $250 million when they are ignored.

This paper evaluates the focus on labor rents by simulating the effects of optimal trade and industrial policies in the U.S. market for integrated carbon steel. While Topel (1989) questions the existence of labor rents across a wide variety of industries, the integrated carbon steel industry is among the most likely industries in which labor rents are to be found. All production workers belong to a single union, and wages are substantially above those for other manufacturing industries. This suggests that the steel industry is likely to represent a 'best case' for protection.

An innovation of this paper is a careful treatment of the supply side of the market. This is crucial for evaluating the effects of strategic trade and industrial policies, since most of the rents to be captured are in factor markets such as labor rents rather than in product market profits. Towards this end, I explicitly model the wage-setting process in order to take account of one source of labor rents, as suggested by Eaton (1988). I obtain measures for union bargaining power vis-a-vis the firm, and then examine the implications of the union's strategic behavior on wages and thus on the gains from optimal policies.

I also econometrically estimate a cost function which takes into account the existence of fixed capital and underutilized capacity in the steel industry. It turns out that as protection causes domestic utilization to increase, firms adjust their input mix to reduce the share of labor in income generated. As a result, activist policy to capture labor rents leads to an endogenous response which actually diminishes their importance—the policy eliminates the very rents it seeks to capture. On the other hand, I find that there are potentially substantial gains to be had not by capturing labor market rents, but instead by eliminating the underlying distortions. Reductions in union power lead to welfare gains nearly as large as the most active (and perfectly informed) industrial policy.

These results are obtained using a model with assumptions which favor the possibility of finding gains from capturing labor rents: the entire premium of steel wages over average manufacturing wages is taken as rent, the U.S. government has full information and the ability to set policies before firms set prices, and foreign governments do not retaliate. Perhaps most important, I assume that there are no spillover costs to other sectors of the economy as protection causes resources to be drawn into the steel industry. Despite these 'best case' assumptions for protection, I still find only modest gains from trade policy relative to the size of the industry, and these gains are substantially smaller than would be indicated by previous studies which do not take into account supply side changes in response to protection. I conclude that a focus on labor rents as the object of trade policy is overstated, at least in large-scale manufacturing industries such as integrated steel. Instead, policy should focus on the domestic sources of any competitive disadvantage.

The paper proceeds as follows. Section II sets forth the model, after which I describe the data in Section III. Implementation of the model is discussed in Section IV. In Section V, I then use the model to simulate the effects of optimal trade and industrial policies. Section VI presents sensitivity analysis, after which Section VII concludes.

II. A Model of the Steel Industry

I model competition in the U.S. steel market between U.S., Japan, and EU integrated steel producers, using data for the years 1973 to 1986. I do not include steel produced by mini-mills, which have become increasingly important since the mid-1980's. These mini-mills tend to produce more sophisticated alloys, and are thus differentiated from the carbon steel industry.[1] Though other nations have become important in U.S. steel imports, as late as 1986, Japan and the EU accounted for 51% of U.S. steel imports, down from 80% in 1973. Although the data do not include the past several years, they encompass the period of most severe decline in the industry, which is the time during which protection would be expected to have the largest benefits.

The timing structure of the model is as follows. The U.S. government moves first, and commits to specific production subsidies and tariffs before wages and prices are set. The equilibrium is subgame perfect, so that the government takes union and firm responses into account in setting optimal policy. Since labor contracts in the steel industry typically last three years, I assume that wages in each year are set before firms set prices. The union and firms bargain over wages, using the Nash Bargaining Equilibrium as the solution concept. Firms then set prices to maximize profits (taking wages and other factor prices as given), after which demand is satisfied as the steel market clears.

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1 Harris (1994) examines the transition of the steel industry from integrated producers to minimills.

As discussed in Old (1985), it is generally acknowledged that U.S. firms in the 1970's and 1980's faced substantially underutilized capacity in the form of fixed capital such as plants and equipment. To model this, I estimate a cost function in which fixed capital results in short-run diminishing average costs. The estimated cost function is then used to measure the effect of changes in wages and output on U.S. firms' marginal costs and thus on pricing decisions and demand. I do not model production in Japan or the EU, but rather assume that wages and costs in those countries do not respond to U.S. policies. While not strictly correct, this is probably not too bad an assumption, since exports to the U.S. account for less than 7% of Japanese production and less than 6% of EU production over 1973 to 1986.

A. Demand

Demand is parameterized with nested constant elasticity of substitution (CES) functional forms; this is similar to Krishna, Hogan, and Swagel (1994). This considerably simplifies the demand equations, at the expense of imposing particular restrictions on cross-elasticities between goods from the three countries. A level of steel "services" S is demanded by an aggregate consumer who receives all profits and revenues, and maximizes a utility function of the form:

$$\mathcal{U} = m + \beta S^{1-\frac{1}{\epsilon}}$$

where m is a numeraire good, S is the level of steel services consumed in the U.S. market, and ϵ is the price elasticity of demand for steel.

Steel services are derived from the U.S. and foreign aggregate goods U and F using the CES production function:

$$S = (U^{\rho} + F^{\rho})^{1/\rho}$$

where ρ parameterizes the elasticity of substitution σ between domestic and foreign steel. The longer lead times and warehousing costs associated with ordering foreign steel are often cited as giving rise to this differentiation.

Having decided to purchase foreign steel, consumers then choose between Japanese steel, J, and EU steel, E, where ρ_F parameterizes the elasticity of substitution, σ_F, between the two. The foreign aggregate good F is composed of the aggregate Japan good J and the aggregate EU good E, with the elasticity of substitution, σ_F, between foreign steels:

$$F = (J^{\rho_F} + E^{\rho_F})^{1/\rho_F}$$

Aggregate production in each country (U, J, and E) is in turn composed of the outputs of the individual firms in each country. For the U.S., the aggregate good U is:

$$U = \left(\sum_{i=1}^{n_U} (q_U^i)^{\rho_U} \right)^{1/\rho_U}$$

where q_U^i is the output of steel by U.S. firm i, n_U is the number of U.S. firms, and ρ_U parameterizes the elasticity of substitution, σ_U, between the goods produced by firms in the U.S. The aggregate Japan and EU goods, J and E, are defined analogously, with n_J and n_E firms in the two countries, and elasticities of substitution σ_J and σ_E.

The demand for the steel produced by an individual firm is a derived demand, and can be obtained by calculating the demands for the corresponding aggregate goods. The CES production function for S implies the cost function, C:

$$C = \left(C_U^{1-\sigma} + C_F^{1-\sigma} \right)^{\frac{1}{1-\sigma}}$$

where C_U and C_F are the costs of the aggregate U.S. and foreign goods U and F. The elasticity of substitution between U.S. and foreign steel is $\sigma = 1/(\rho - 1)$; elasticities of substitution between Japan and EU steel (σ_F) and within each country (σ_U, σ_J, and σ_E) are analogous.

From the cost function, $\frac{\partial C}{\partial C_U}$ is the number of units of the aggregate U.S. good U needed to produce a service S. Similarly, if p_U is the price of a ton of steel produced by a U.S. firm, then $\frac{\partial C_U}{\partial p_U}$ is the unit input requirement for each U.S. firm in the aggregate U.S. good U. The demand for a particular U.S. firm's product q_U^i is thus:

$$q_U^i = S \frac{\partial C}{\partial C_U} \frac{\partial C_U}{\partial p_U}$$

The partial derivatives are easily obtained from the CES cost functions, while the total demand for steel services, S, is found by setting the marginal utility of steel equal to its marginal cost.

Demands for Japan and EU firms are slightly more complicated, since the unit-input requirements of aggregate goods J and E in the aggregate foreign good F must also be considered. Let C_J and C_E denote the costs of the aggregate Japan and EU goods, and p_J and p_E denote the price of the steel produced by individual Japan and EU firms. The demand for the steel produced by a firm in Japan is then:

$$q_J^i = S \frac{\partial C}{\partial C_F} \frac{\partial C_F}{\partial C_J} \frac{\partial C_J}{\partial p_J}$$

Demands for EU firms are analogous.

I next assume symmetry between the firms within a country, and use the numbers-equivalent of the Herfindahl index to calculate the number of firms. Note that this is an approximation, since the steel produced by each firm is different. What is most important is to allow for product differentiation, since with homogenous goods, any markup of price over marginal costs would imply conduct more collusive than Bertrand and there is no reason to arbitrarily restrict firms' behavior.

Summing the demands for U.S. steel q_U^i over the n_U domestic firms gives the total demand for domestic steel, Q_U. Similarly, summing the demands for Japan and EU steel over the n_J and n_E firms gives total demands Q_J and Q_E:

$$Q_U = Q_U(p_U, p_J, p_E, n_U, n_J, n_E; \Theta) \quad (1)$$
$$Q_J = Q_J(p_U, p_J, p_E, n_U, n_J, n_E; \Theta) \quad (2)$$
$$Q_E = Q_E(p_U, p_J, p_E, n_U, n_J, n_E; \Theta) \quad (3)$$

As shown above, quantities depend on prices of all firms, the number of firms in each country, and the demand parameters, which I denote as Θ. These include the elasticity of demand, ϵ, the scale parameter β, and the substitution parameters σ, σ_U, σ_F, σ_J, and σ_E. The three markets are assumed to clear, so that Q_U, Q_J, and Q_E are observable as actual sales. Although use of CES demands means that equations (1) to (3) are quite messy (and hence not written out above), they are straightforward to solve numerically.[2]

B. Price-Setting

The next step is to examine firms' pricing decisions. U.S. firm i sets price p_U^i to maximize profits:

$$\max_{p_U^i} \; (p_U^i + s)q_u^i - \mathrm{TC}(q_U^i)$$

where $\mathrm{TC}(q_U^i)$ is the total cost for firm i and s is the specific subsidy to domestic production. The existence of underutilized capacity means that marginal cost c_U is not constant, but is instead a function of output, $c_U(q_U^i)$. Of course, output depends on prices, so that profit-maximization must be solved simultaneously with cost-minimization.

Profit maximization by a U.S. firm gives the first order condition:

$$\epsilon_{UU}^{ii} - \gamma^U = p_U^i/(p_U^i - c_U(q_U^i) + s) \quad (4)$$

where ϵ_{UU}^{ii} is the U.S. firm's own-price elasticity of demand. The second term on the left hand side of the U.S. first-order condition, γ^U, is an aggregate conjectural variations (CV) parameter which summarizes U.S. firms' competitive behavior. The problems of CV's are well-known in that they imply ad hoc dynamics; they are used here only as a convenient

2 A complete derivation of the demand equations is available on request.

means by which to parameterize firm behavior.

The aggregate CV γ^U is made up by the firm's reactions to its competitors:

$$\gamma^U = (n_U - 1)\epsilon^{ij}_{UU}\gamma^{UU} + n_J\epsilon^{ij}_{UJ}\frac{p_U}{p_J}\gamma^{UJ} + n_E\epsilon^{ij}_{UE}\frac{p_U}{p_E}\gamma^{UE}$$

where γ^{AB} denotes the conjecture of a firm in country A about the price response of a firm in country B (for example, $\gamma^{UJ} = \partial p_J/\partial p_U$). Similarly, ϵ^{ij}_{AB} denotes the elasticity of demand for the steel produced by a firm in country A in response to a change in the price of a competing firm in country B. From this definition, $\gamma^U = 0$ corresponds to Bertrand behavior, since this indicates that a firm believes that its competitors will not change their prices, $\gamma^U < 0$ reflects behavior more competitive than Bertrand, and $\gamma^U > 0$ implies behavior more collusive than Bertrand.

First order conditions for Japan and EU firms are similar:

$$\epsilon^{ii}_{JJ} - \gamma^J = p^i_J/(p^i_J - c_J - t) \tag{5}$$

$$\epsilon^{ii}_{EE} - \gamma^E = p^i_E/(p^i_E - c_E - t) \tag{6}$$

where c_J and c_E are the constant marginal costs of production, and t is a specific tariff on steel imports. The Japan and EU conjectural variations, γ^J and γ^E, similarly represent the beliefs of firms in each nation about the price responses of their competitors.

C. The Cost Function for Steel

To measure the effect of policies on domestic costs, I estimate a restricted translog cost function for U.S. firms. The cost function is "restricted" in that the capital input is assumed to be fixed in each year, while firms optimize over the variable inputs of labor, energy, materials, and services. One can think of the "short-run" as the period over which the capital stock is fixed (not necessarily at the optimal level), while the "long-run" is the period over which firms adjust investment so that capital is at the cost-minimizing level. In the short-run, capital can be "underutilized" in the sense that the level of the capital stock is higher than it would be if capital was not fixed but was instead in long run equilibrium. Firms do not actually leave capital idle; the stock of capital is simply larger than optimal.[3] The existence of underutilized capital implies that marginal costs are not constant, since a higher level of output means that the stock of capital moves closer to the desired long-run level, allowing the firm to change its

3 The existence of fixed costs associated with shutting down (buying mothballs, for example) and then restarting a plant (taking out the mothballs) might explain why firms do not concentrate production sooner in a smaller number of plants. In the spirit of the literature on hysteresis and irreversible investment surveyed by Pindyck (1991), if plant restarts involve a fixed cost, then keeping an underutilized plant on-line has an option value which arises from the possibility that demand might pick up.

mix of the variable inputs.[4]

Denote total variable cost by VC, so that total cost TC equals variable cost plus the fixed cost of capital: $\text{TC} = \text{VC} + P_K K$, where P_K is the price per unit of capital, K. The restricted translog variable cost function is:

$$\begin{aligned} \log \text{VC} \quad = \quad & \beta_0 + \sum_i \beta_i \log(P_i/P_M) + \log(P_M) + \beta_K \log(K/Q_U) + \beta_t t + \log(Q_U) \\ & +0.5 \sum_{ij} \gamma_{ij} \log(P_i/P_M) \log(P_j/P_M) + 0.5\gamma_{tt} t^2 + 0.5\gamma_{KK} \log(K/Q_U)^2 \\ & + \sum_i \gamma_{iK} \log(P_i/P_M) \log(K/Q_U) + \sum_i \gamma_{it} t \log(P_i/P_M) + \gamma_{Kt} t \log(K/Q_U) + e_C \end{aligned} \tag{7}$$

where P_i is the price of factor i, with $i = L, E$, and S for labor, energy, or services, P_M is the price of materials (the normalizing input), K is the beginning of period quantity of capital input, t is a time counter to allow for exogenous technological change, and Q_U is the output level. I impose the restrictions of symmetry, $\gamma_{ij} = \gamma_{ji}$; homogeneity, $\sum_i \beta_i = 1$, $\sum_i \gamma_{ij} = \sum_i \gamma_{iQ_U} = \sum_i \gamma_{it} = \sum_i \gamma_{iK} = 0$; and constant returns to scale (CRS) at full capacity, $\beta_{Q_U} = 1 - \beta_K$.

I also estimate share equations for the variable factors, dropping the equation for materials. The share equation for factor i, where i, j are L, E, and S:

$$\text{Share}_i = \beta_i + \sum_j \gamma_{ij} \log(P_j/P_M) + \gamma_{iK} \log(K/Q_U) + \gamma_{it} t + e_i$$

To allow for imperfect competition, I add an equation which equates the marginal cost of steel (derived from the cost function (7)) with marginal revenue, where marginal revenue is derived from a CES demand function for U.S. steel:

$$\frac{p_U Q_u}{\text{VC}} = 1 - \beta_K - \sum_i \gamma_{iK} \log(P_j/P_M) - \gamma_{KK} \log(K/Q_U) - \gamma_{Kt} t + \beta_1 \beta_2 \frac{Q_u^{\beta_2+1}}{\text{VC}} + e_K$$

where β_1 and β_2 are demand parameters to be estimated.[5] As in Morrison (1988, 1991), this can be thought of as an equation for the "shadow" share of capital. As discussed by Berndt (1990), the multivariate normal error terms (e's) can be thought of as arising from mistakes made by firms in cost minimization. Preliminary estimation indicated the presence of first-order serial correlation (AR1), so I implement a Berndt-Savin AR1 correction, allowing

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4 Morrison (1988) estimates a similar cost function for the steel industry in the US and Canada, while Morrison (1991) and Berndt (1990) discuss models which incorporate investment dynamics.

5 The limited number of years for which data are available precludes estimation of the entire demand system (1) - (3).

for separate autocorrelation coefficients on the cost function, variable cost shares, and the capital share equation.

The data used to estimate the cost function are unpublished Bureau of Labor Statistics (BLS) data from 1949 to 1986 for SIC 3312, blast furnaces and steel mills. Since wages and other factor prices are set before firms set prices, these are properly taken as exogenous. Firms' market power, however, implies that output decisions are not exogenous with respect to costs. I thus employ Zellner's Iterated Three Stage Least Squares (I3SLS), using the log of aggregate U.S. real investment, the log of the money supply (M2), and the log of industrial production for final goods as instruments for the log of steel output, Q_U.

Table 1 contains estimation results for the restricted cost function. The R^2 for the five equations range upwards from 0.85, showing as in Morrison (1988) that the restricted cost function fits well for steel industry data. Further, 17 of the 26 parameters are significant at the 5% level, with 2 more significant at the 10% level.

Since the translog coefficients are difficult to interpret by themselves, the top half of Chart 1 shows the estimated cost function plotted for 1978 (with quantity shown as a proportion of actual output). I plot both average and marginal costs, where the marginal costs are easily obtained by taking the derivative of total variable costs from equation (7). Marginal cost is less than average cost at the actual level of output in 1978; the size of this gap reflects the extent to which capacity is underutilized.

The bottom half of Chart 1 plots the variable and total cost elasticities which result from estimation of the cost function (these are the percent changes in costs for a percent change in output). If capital were fully utilized, the total cost elasticity would equal one from the assumption of constant returns at full capacity; a value less than one indicates declining average costs and thus underutilized capacity. Until 1968, capacity was generally overutilized in the sense described above that average cost was less than marginal cost (that is, the total cost elasticity was greater than one).

The declines in capacity utilization from 1968 to 1970 and then again after 1981 were both accompanied by calls for protection from steel imports. I leave aside the question of why firms apparently overinvested in capital after 1968. That they did, however, has implications for trade and industrial policies, since protection not only captures product and factor market rents, but also changes firms' input mix and lowers costs through increasing utilization.

Obtaining marginal costs from an econometrically estimated cost function eliminates a major problem with the previous literature, which relies on ad hoc estimates of marginal costs. This is important because as discussed by Saloner (1994), the simulation results in Dixit

Table 1. Estimation of the Restricted Translog Cost Function

Three-Stage Least Squares with Berndt-Savin AR1 correction

Coefficient	Estimate	Coefficient	Estimate	Coefficient	Estimate
β_0	0.731 (5.03)	γ_{LL}	0.141 (4.81)	γ_{LK}	0.085 (6.64)
β_1	0.299 (1.74)	γ_{EE}	0.052 (16.66)	γ_{EK}	0.002 (0.50)
β_2	1.300 (2.70)	γ_{SS}	0.058 (8.21)	γ_{SK}	-0.003 (-0.72)
β_L	0.543 (17.39)	γ_{EL}	-0.019 (-1.89)	γ_{Kt}	-0.0002 (-0.05)
β_E	0.070 (6.72)	γ_{ES}	-0.003 (-0.066)	γ_{Lt}	-0.005 (-5.98)
β_S	0.019 (2.92)	γ_{SL}	-0.041 (-5.69)	γ_{Et}	0.0003 (0.93)
β_K	0.132 (1.37)	γ_{tt}	0.002 (2.48)	γ_{St}	0.001 (6.51)
β_t	-0.048 (0.012)	γ_{KK}	0.208 (2.39)		

Berndt-Savin autocorrelation coefficients

Cost function		Variable shares		Capital share	
ρ	0.792 (17.64)	ρ_s	0.402 (4.24)	ρ_K	0.951 (50.34)

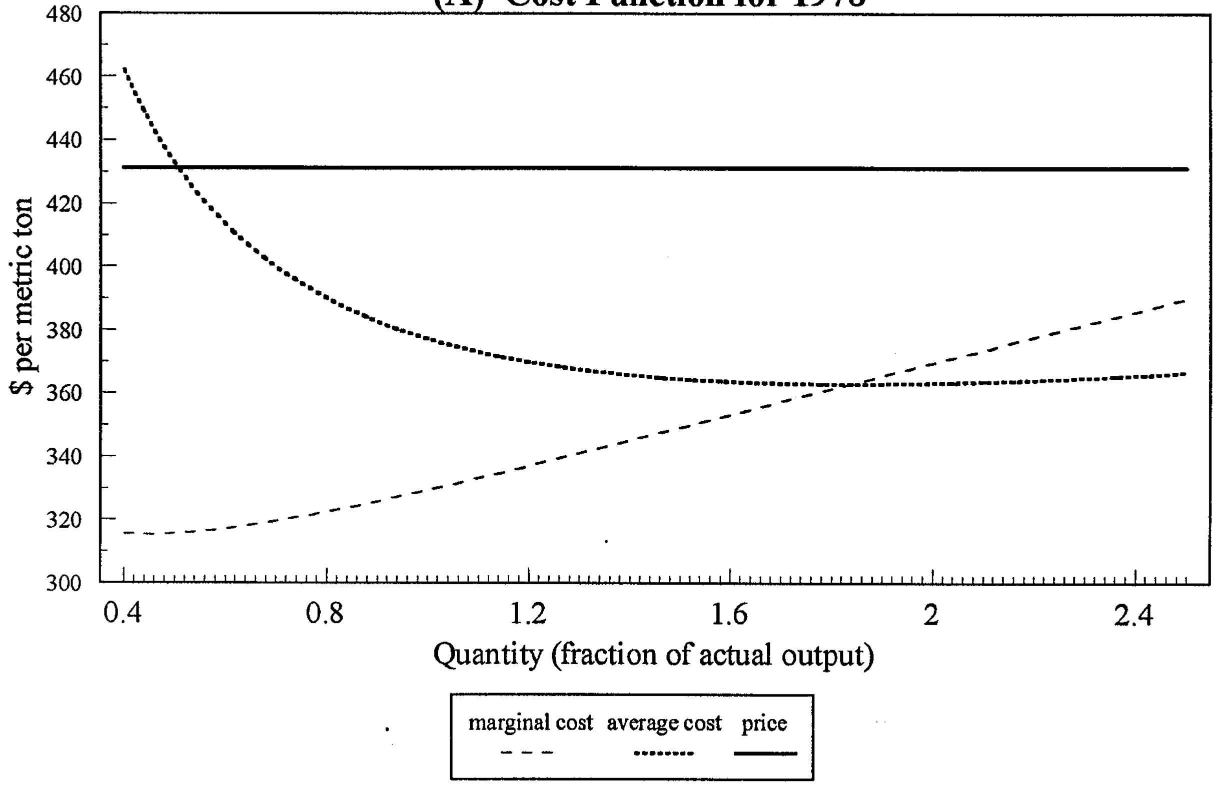
Note: t-statistics in parentheses.

R^2's for the 5 equations

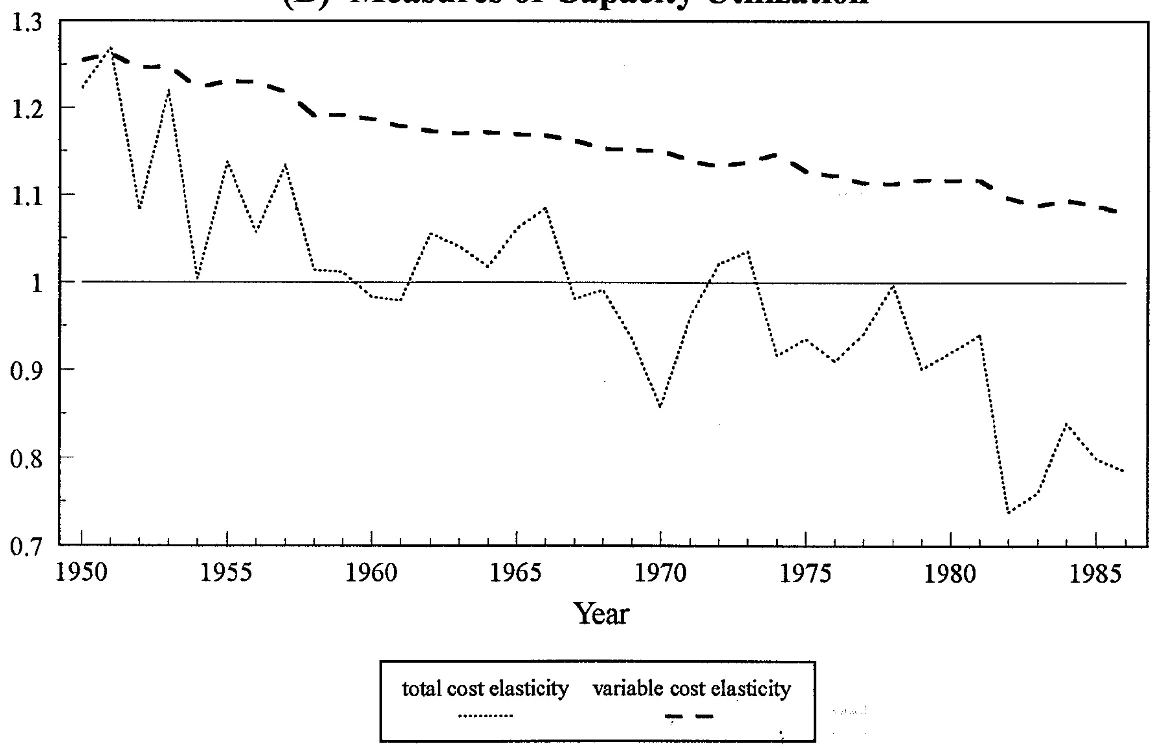
Cost Function	Factor Share Equations			
	labor	energy	services	capital
0.93	0.85	0.97	0.87	0.98

Chart 1

(A) Cost Function for 1978



(B) Measures of Capacity Utilization



(1988) and Krishna, Hogan, and Swagel (1994) are most sensitive to the assumed marginal costs, since the price-cost markup directly affects the measures of firm behavior.

D. Wage-Setting: Bargaining between Union and Firms

Wages are determined by bargaining between a union which maximizes labor rents and firms which maximize profits, where the distribution of bargaining power is a parameter determined from the data. An infinite supply of labor is assumed to be available, so that employment is determined by labor demand, which is in turn derived from the demand for steel. This is thus the "right to manage" model rather than "efficient bargaining" in the sense of Leontief (1946) or McDonald and Solow (1981), since workers and firms bargain only over wages, after which the firm is free to determine the level of employment. Fully efficient bargaining would eliminate the incentive to target labor rents, since in this case the marginal revenue product of workers already equals the opportunity cost of workers' time in other employment.[6]

I employ the Nash Bargaining Solution to find the equilibrium wage.[7] The union maximizes labor rents, while firms maximize profits:

$$\max_{w} \ [\text{Labor Rent}]^{\theta}[\text{Profits}]^{1-\theta} \ = \ [(w-\overline{w})L]^{\theta}\,[(p_U+s)Q_U - \text{TC}(Q_U)]^{1-\theta}$$

where $\overline{w}$ is the alternative wage for steel workers, L is hours of labor input, and θ indicates the bargaining "power" of the union. The wage w is the hourly compensation rate for steel workers, including benefits and pensions. I take $\overline{w}$ as the average wage for U.S. manufacturing workers. Of course, some of the wage premium of steel workers over other manufacturing workers might be a consequence of specific skills possessed by steel workers, in which case $\overline{w}$ is too low. This would imply that fewer labor rents exist, providing less scope for policy.

Maximizing with respect to wages gives the first order condition for the wage bargain. Given data on wages, costs, and quantities, it is then straightforward to use the demand equations (1) - (3), firms' first order conditions (4) - (6), and the estimated cost function (7) to solve for union power, θ. A value of $\theta = 1$ indicates a monopoly wage-setting union which maximizes its labor rent, while smaller values for θ indicate less than complete power on the part of the union, and thus correspond to wages lower than those set by a monopoly union.

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[6] MaCurdy and Pencavel (1986) and Brown and Ashenfelter (1986) test between efficient and inefficient bargaining in the typesetting industry. While both find support for efficient bargaining, neither is able to reject the labor demand model of wage determination. Oswald (1985) provides an excellent survey of the literature on unions, while Grossman (1984) examines wage-setting and employment determination by unionized firms facing import competition.

[7] A note of caution is in order here. The Nash Bargaining Solution is a cooperative solution, and the union-firm wage-setting process is not necessarily best described as cooperative. While the Nash Bargaining Solution can be obtained as the outcome of a non-cooperative game—Binmore, Rubinstein, and Wolinsky (1986) is the canonical example—it might be best to think of this wage-setting process as a descriptive device rather than as a strict behavioral assumption.

The results of solving for union behavior are discussed in Section IV.C, and then used to simulate the effects of government policies in Section V.[8]

III. Data

Data other than the BLS data used to estimate the cost function come from Paine-Webber *World Steel Dynamics* (WSD), the American Iron and Steel Institute (AISI), and the International Iron and Steel Institute (IISI). All figures are per metric ton, while all prices and costs are deflated by the producer price index to 1978 dollars. Most data are available from 1973 to 1988, though lack of the BLS factor input data precludes use of the post-1986 data. Unfortunately, data for Japan and Europe are not available for the years prior to 1973.

For U.S. firms, I use AISI total shipments for quantity Q_U, and the domestic list price from WSD for p_U. For Japan and EU firms, I use AISI figures for total imports Q_J and Q_E (converting all quantities to metric tons), and Japanese and EU export prices plus freight costs (both from WSD) for p_J and p_E. In all years, Q_E includes imports from all eventual EU members—imports from the UK and Spain are included before either joined the EU. The EU price is the production share-weighted average of prices in the UK, France, and Germany.

To obtain average U.S. costs, I divide the price given in WSD by the markup of price over average costs implicit in the BLS data. Marginal costs are then calculated from the estimated cost function. For Japan costs, I multiply the U.S. marginal cost by the percentage cost advantage (or disadvantage) of Japanese firms cited in WSD. Costs for EU firms are obtained in the same way, with the EU cost differential being a weighted average as with price.

For hourly wage, w, I use the per hour employment cost of U.S. firms at the actual operating rate from *WSD* for 1978, and multiply this by the BLS employment cost index for steel for the other years. The WSD employment cost includes the estimated value of all benefits and pension. Over 1973 to 1986, the simple correlation between the BLS and WSD measures of employment costs is 0.987. I use the average wage rate for manufacturing workers from the BLS for the reference wage $\overline{w}$.

U.S. Herfindahl number-equivalents come from AISI production data, while number-equivalents for foreign firms are calculated from production data in various IISI publications. Finally, I specify a tariff of \$20 (in 1978 dollars) on both Japan and EU goods for each year; this roughly corresponds to the actual ad valorem MFN tariff rate which varied from 5 to 6%.

[8] I also experimented with a wage-setting process in which a monopoly union sets a wage to maximize a Stone-Geary preference function; in this case the parameter which details the union's preferences between wages and employment is solved for from the data. Because the union holds a large degree of bargaining power in most years, this gives similar results for the optimal policy simulations.

IV. Calibration

Having specified a complete system of demand (equations 1 to 3) and supply (equations 4 to 6 plus the cost function 7), the next steps are to obtain values for the parameters of the model, and then use the model to evaluate the effects of policies. In principle, not just the cost function, but instead the entire model of the steel industry could be estimated econometrically. In practice, however, data constraints make this impossible—it is simply not possible to obtain consistent industry-level data for a long enough span of time to provide the degrees of freedom necessary for estimation. Since I have only 14 observations, the model is instead calibrated to the data one year at a time, and then used for the policy simulations.

There are 10 unknowns to determine: firms' behavioral parameters γ^U, γ^J, and γ^E, the elasticity of demand ϵ, the scale parameter β, and the substitution parameters σ, σ_U, σ_F, σ_J, and σ_E. The calibration method is similar to that of Dixit. Values for ϵ, σ, σ_F and σ_E are taken from the literature, and then the model is solved a year at a time for the remaining six parameters. Since there are no standard errors to evaluate the "fit" of the model, Section VI provides sensitivity analysis over a range of values for the assumed parameters.

De Melo and Tarr (1992) cite estimates for the price elasticity of demand for steel, ϵ, which range from 0.42 to 1.64, with a central figure of 0.81. For the utility function to be concave, ϵ must be greater than one. I thus take ϵ to be 1.1. For the elasticity of substitution between U.S. and foreign goods, they cite a range from 1.1 to 5.0; I use their central estimate of 3.05.

This leaves σ_F and σ_E. I assume that $\sigma < \sigma_F < \sigma_E$; that is, from the point of view of a steel consumer in the U.S., there is a greater distinction between U.S. and foreign steel than between the two types of foreign steel. The second inequality, $\sigma_F < \sigma_E$, says that any EU firm is more similar to another EU firm than it is to a Japanese firm. I set $\sigma_F = 5.0$ and $\sigma_E = 7.0$. The sensitivity analysis of Section VI shows that the results do not depend on these numerical choices.

Given these values, numerical solutions for the other parameters are easily obtained. I solve for σ_J by dividing (3) into (2), and then for σ_U by dividing (2) into (1). Solving the first order conditions (4) to (6) numerically then provide γ^U, γ^J, and γ^E, after which any of the demand equations (1) - (3) can be used to obtain β.

A. Calibration Results

Table 2 contains the results for the calibrated parameters. The demand shift parameter β

Table 2. Calibration Results

Year	Demand Shift	Elasticity of Substitution		Firm Behavior		
	β	σ_U	σ_J	γ^U	γ^J	γ^E
1973	6.8	2.41	6.12	-2.77	2.59	3.35
1974	8.3	2.72	4.71	-2.25	-0.67	1.89
1975	6.3	2.24	4.14	-2.32	0.07	2.06
1976	6.5	2.14	3.88	-2.54	0.91	2.24
1977	7.0	2.19	5.24	-2.43	1.76	2.09
1978	7.5	2.30	6.16	-2.05	4.02	3.04
1979	7.8	2.27	5.54	-2.53	2.80	2.49
1980	6.7	2.24	4.42	-2.76	1.80	2.16
1981	6.7	2.25	4.81	-2.84	1.73	-0.40
1982	4.8	2.27	5.71	-2.41	1.83	1.79
1983	4.6	1.99	5.79	-2.91	1.21	1.69
1984	5.2	2.07	5.57	-2.97	1.78	0.54
1985	4.8	2.09	6.20	-2.25	2.87	1.71
1986	4.6	2.33	10.78	-1.59	7.75	2.93

Note: $\beta \times 10^{10}$

scales the utility function to match the actual size of the market, and gives an indication of the strength of demand in each year. The pattern of values for β matches the analysis in *World Steel Dynamics* that 1982 marked the beginning of a string of particularly difficult years for the steel industry.

The next two columns are the elasticity of substitution within U.S. goods, σ_U, and the elasticity of substitution within Japanese goods, σ_J. For all years, σ_U is smaller than σ, which is in turn smaller than σ_F, σ_J, and σ_E. As expected, U.S. goods are thus more differentiated from one another than they are from foreign goods. The sensitivity analysis of Section VI shows that varying the values for the elasticities does not greatly affect the simulation results. Better estimates for ϵ, σ, σ_F, and σ_E would, however, help to more accurately gauge firm behavior.

B. Firm Behavior

The right three columns of Table 2 show the conjectural variations parameters (γ's) which measure firm behavior. U.S. behavior is always more competitive than Bertrand ($\gamma^U < 0$), while foreign firms are always more collusive than those in the U.S., and nearly always more collusive than Bertrand. To more easily interpret these results, Table 3 shows actual prices and costs as well as the prices that would have resulted had firms acted Bertrand or Cournot. Behavior is far from identical across countries, even though the prices consistent with Bertrand and Cournot behavior are not that far apart. Actual U.S. prices are far lower than the Bertrand and Cournot-equivalent prices, implying that U.S. firms act quite competitively. Prices of firms in Japan and the EU, on the other hand, are typically substantially above those for both Bertrand and Cournot behavior, indicating relatively collusive behavior.

C. Union Behavior

Table 4 presents the results for union behavior. The first column, θ, denotes the union's bargaining strength in the Nash Bargaining equilibrium. Interestingly, the rise in union power starting in 1982 coincides with the beginning of several very bad years for the industry. The combination of rising wages but declining profits led observers to postulate that the U.S. steel industry was in an "end game" (Lawrence and Lawrence (1985)). In an end game, the union, realizing that the domestic steel industry and thus steel jobs are in inexorable decline, takes advantage of fixed capital to extract rents, even though this hastens the industry's decline. Lawrence and Lawrence point out that this can explain why real wages in steel far outpaced wages of other manufacturing workers, even while firm profits and employment in steel fell. In the end game scenario, demand eventually falls enough to cause firms to shut down plants, thereby reducing overcapacity and limiting union power. This may correspond to the dropoff in union power after 1984, as steel firms shut plants and reduced their underutilized capacity. Also consistent with the end game, Table 4 shows that the union captured an increased share

Table 3. Firm Behavior

	United States					Japan				Europe			
Year	c_U	ac	p_U	p_U^B	p_U^C	c_J	p_J	p_J^B	p_J^C	c_E	p_E	p_E^B	p_E^C
1973	296	321	369	496	505	271	389	344	345	287	417	357	358
1974	330	351	417	518	531	460	575	593	600	434	561	528	529
1975	324	365	418	580	593	329	438	438	449	319	424	395	395
1976	331	377	423	615	627	273	389	368	382	299	403	372	372
1977	335	389	431	614	624	249	357	325	328	280	374	349	349
1978	329	377	431	576	584	210	384	270	271	283	401	353	354
1979	350	393	444	617	628	271	419	347	350	329	445	406	407
1980	341	384	429	606	618	282	428	373	381	323	431	400	400
1981	333	367	416	586	595	248	369	327	333	282	349	352	352
1982	312	374	398	557	566	218	310	284	285	235	313	296	297
1983	318	392	402	650	661	208	285	272	273	217	290	276	276
1984	321	380	402	619	628	186	269	246	248	208	269	265	267
1985	299	366	391	578	586	169	261	223	224	193	260	247	248
1986	287	362	388	508	515	153	277	190	191	215	307	273	274

Notes: All prices and costs are dollars per metric ton, deflated to 1978 dollars

- c — marginal cost
- ac — average cost
- p — actual price
- p^B — price if firms acted Bertrand
- p^C — price if firms acted Cournot

Table 4. Union Behavior

Year	Union power θ	Wage ($/hr) w	$\bar{w}$	50%	ΔWelfare ($bn) 50%	Labor's share of rent s.q.	50%	Labor rent ($bn) s.q.	50%	US firm profits ($bn) s.q.	50%
1973	0.62	12.08	6.26	8.91	1.571	0.59	0.29	6.14	2.66	4.35	6.36
1974	0.56	12.33	5.87	8.76	1.786	0.53	0.27	6.87	3.09	6.14	8.41
1975	0.64	12.99	5.79	8.63	1.804	0.61	0.30	6.13	2.65	3.98	6.10
1976	0.68	13.98	5.99	8.92	1.957	0.64	0.32	6.54	2.78	3.61	5.93
1977	0.71	14.50	6.13	9.12	2.141	0.68	0.33	7.02	2.97	3.35	5.92
1978	0.64	14.73	6.17	9.25	2.182	0.60	0.30	7.05	3.07	4.67	7.21
1979	0.66	14.74	6.03	9.11	2.048	0.62	0.31	7.36	3.17	4.52	7.10
1980	0.68	15.12	5.77	8.85	1.758	0.64	0.32	6.44	2.75	3.57	5.85
1981	0.64	15.09	5.80	8.85	1.518	0.60	0.30	6.01	2.62	3.93	6.01
1982	0.80	17.22	5.93	8.76	1.303	0.77	0.38	4.79	1.97	1.41	3.20
1983	0.92	16.28	6.07	8.85	1.379	0.90	0.44	5.22	2.01	0.56	2.56
1984	0.80	15.05	6.19	9.21	1.366	0.77	0.38	4.98	2.03	1.45	3.36
1985	0.77	15.51	6.36	9.28	1.179	0.74	0.37	4.43	1.86	1.52	3.20
1986	0.76	16.16	6.58	9.51	1.151	0.73	0.36	4.15	1.76	1.50	3.08

Notes: s.q. status quo
50% 50% cut in union power, θ

of total industry rents in the face of declining demand and capacity utilization after 1981.

The columns labelled "s.q." show the actual, status quo, values, while the columns labelled 50% show results from the experiment of cutting the union power parameter θ in half. In these simulations, the union is arbitrarily given less power in the wage bargaining and then the modelled is solved for the new equilibrium in each year. The results of the 50% columns show that even without activist trade or industrial policies, a less powerful union would have resulted in a welfare gain of 1 to 2 billion dollars (in 1978 dollars). The weaker bargaining strength of the union leads to substantially lower wages, while the relatively robust competition between firms means that the lower costs translate into lower steel prices. Labor rents fall as a result of the weaker union, but this is more than offset by gains in firm profits and consumer surplus. And the parameters of the cost function are held fixed in these simulations, so that the calculations do not include benefits from increased productive efficiency which result from the weaker union, beyond simply the effects of lower wages. Even so, the sizeable increase in welfare suggests that policies which alleviate domestic factor market imperfections have potentially large welfare benefits without the need for policies which bear the risk of retaliation by trading partners.

V. Optimal Policies

I next use the calibrated model to simulate the effects of optimal tariffs and subsidies. These policies are chosen not only for consistency with previous studies, but also because Krishna (1989) shows that quantitative restrictions will affect firms' behavior. It would thus be incorrect to take behavior as the same in each year, since firms would be expected to become more collusive in years with a quantitative restraint. This is an advantage of calibrating the model to the data one year at a time, since the calibrated conjectural variations are allowed to vary in each year. For years in which a quota exists, the calibrated CV's represent the nature of firms' behavior in the face of quantitative restrictions, and are thus appropriate for use in evaluating the effects of a tariff or subsidy, neither of which would be expected to further affect behavior.

The government sets its policy to maximize welfare, which is the sum of consumer surplus, labor rents, domestic firms' profits, and tariff revenues minus subsidy costs. I compare the changes in welfare from various policies, both with the Nash-Bargaining wage-setting process as well as the assumption that there is no wage-bargaining or labor rent. I also examine the extent to which the welfare gains from optimal policies are affected by taking underutilized capacity into account, as compared to the assumption of constant marginal costs used in previous work.

In results not shown, I find that the welfare gains from an optimal tariff are very small—even if the entire difference between steel wages and average manufacturing wages is taken as labor rents, the gains reach $100 million in only one year. And of course gains are even smaller without labor rents. This lack of responsiveness of welfare to tariffs is familiar from Dixit (1988), and comes about because trade policies are not efficient instruments to target what are essentially domestic distortions of firm and union market power.

On the other hand, there are more substantial welfare gains from an optimal production subsidy to domestic firms. Table 5 shows the results when underutilized capacity is present, both with and without wage-bargaining and labor rents, while Table 6 shows the results when costs and factor shares are fixed—that is, when capacity utilization is ignored.

As expected, considering labor rents results in a stronger policy (larger subsidy) and larger welfare gains than when labor rents are ignored—the welfare gains are about $1 billion without labor rents, and range from $1 to 6 billion with labor rents. However, taking wage-bargaining and capacity utilization into account dramatically reduces the gains from the production subsidy compared to the case when these are ignored. In Table 6, where costs are taken as fixed and capacity utilization ignored, taking labor rents into account results in a more than a four-fold increase in the welfare gain from the production subsidy. When costs are properly modelled as in Table 5, however, the welfare gain with labor rents is only about twice that without labor rents.

The principal reason for the far smaller welfare gain than in previous studies is that firms adjust their input mix in response to the subsidy. When underutilized capacity exists, firms start from a position of using "too much" labor compared to the amount they would use were capital fully utilized. As the production subsidy causes domestic production to rise, firms' cost-minimizing input bundle changes, so that the share of labor in the value of production falls. This is because the estimated cost function implies that capital and labor are complements in production when the inputs of materials, energy, and services are taken into account—this matches the results across U.S. manufacturing industries discussed by Berndt (1990). Before the subsidy, the firm is stuck with too much capital, and thus employs relatively more of the complementary factor labor. The production subsidy increases utilization, reducing the amount of excess capital and thus the labor share with it. This can be seen numerically in Table 5, where the labor input and wage together increase by less proportionately than output. In Table 6, the labor share and wages are both fixed so that employment grows proportionately with output. In seeking to capture labor rents, policy actually diminishes their importance—the activist policy destroys what it seeks to capture.

The endogenous response of wages which results from the union-firm bargaining also contributes to the smaller welfare gains of Table 5, though to a lesser degree than the fall in the labor share which results from the increase in capacity utilization. As in Brander and Spencer

Table 5. Optimal Subsidy with Underutilized Capacity

year	Wage Bargaining, WITH Labor Rent						Wages Fixed, NO Labor Rent				
	s	ΔWelfare	Δlabor	Δwage	ΔQ_U	Δprice	s	ΔWelfare	Δlabor	ΔQ_U	Δprice
	$	$b	%	%	%	$	$	$b	%	%	$
1973	102	2.10	27	11	44	-92	59	0.79	18	26	-59
1974	117	2.66	29	10	46	-105	71	1.03	20	28	-70
1975	121	2.46	30	11	51	-116	74	1.00	20	31	-79
1976	120	2.40	27	12	49	-114	73	0.99	19	30	-78
1977	123	2.60	27	14	50	-117	75	1.09	20	31	-81
1978	123	3.04	30	11	52	-121	79	1.35	21	34	-86
1979	122	2.63	26	12	46	-115	76	1.10	19	29	-80
1980	116	2.09	24	13	44	-107	71	0.86	17	27	-74
1981	110	1.94	24	12	42	-100	67	0.80	17	26	-69
1982	110	1.62	23	17	48	-105	68	0.71	18	31	-75
1983	109	1.47	19	21	44	-102	66	0.65	17	29	-74
1984	102	1.40	19	17	41	-95	64	0.65	16	28	-69
1985	106	1.72	24	16	50	-107	70	0.85	19	34	-80
1986	109	1.99	27	15	58	-118	76	1.05	22	41	-92

s: production subsidy to domestic firms, $ per metric ton (1978 dollars)

Table 6. Optimal Subsidy with Costs Fixed

year	WITH Labor Rent				NO Labor Rent			
	subsidy	ΔWelfar	ΔQ_U	$\Delta price_U$	subsidy	ΔWelfare	ΔQ_U	$\Delta price_U$
	$	$billion	%	$	$	$billion	%	$
1973	112	4.28	81	-139	57	0.95	32	-71
1974	127	5.31	86	-160	68	1.28	36	-86
1975	135	5.08	95	-174	72	1.18	38	-93
1976	137	5.19	93	-175	71	1.15	36	-91
1977	142	5.80	99	-182	73	1.26	37	-94
1978	140	6.29	99	-183	77	1.57	41	-101
1979	140	5.63	88	-178	73	1.30	35	-93
1980	134	4.65	85	-168	68	1.01	33	-85
1981	125	4.22	80	-156	65	0.96	32	-81
1982	131	3.84	97	-167	66	0.80	36	-84
1983	135	3.86	95	-170	65	0.71	33	-82
1984	125	3.55	85	-156	63	0.74	33	-79
1985	126	3.86	97	-165	69	0.95	40	-90
1986	128	4.22	108	-173	74	1.15	46	-100

(1988), the union "skims" the rents from the production subsidy by negotiating increases in wages which range from 10 to 21 percent. This offsets the cost-reducing benefits of increased utilization, so much so that average costs (not shown in the table) rise in all but two years. As a result, domestic firms pass through less of the subsidy in the form of lower prices, so that consumption of domestic steel rises by less than when wages and costs are fixed. Even in 1985 and 1986, when there is enough underutilized capacity so that average costs fall, the drop in prices is proportionately far smaller than when costs are fixed. When wages and costs are fixed (Table 6), the optimal policy is both stronger and more than completely passed-through; that is, domestic prices fall by more than the amount of the subsidy. This shows the importance of not constraining firm behavior, since the degree of competition between firms determines the extent to which prices change in response to costs. This interaction between the wage-setting process and firms' price-setting provides an empirical counterpart to Rodrik (1987), who shows that all relevant distortions must be considered in determining the effects of policies.

In results not shown, I experimented with another mechanism for wage determination: that a wage differential exists, but that the gap is fixed and does not change with trade policy—this corresponds to the right side of Table 5 where wages are fixed and costs vary only with changes in capacity utilization, except that the difference between steel wages and average wages is assumed to be labor rent. This might occur if steel firms paid workers a premium over other manufacturing workers for "efficiency wage" reasons, as in Krueger and Summers (1988). An optimal subsidy is slightly more effective in raising welfare in this case because the union does not raise wages and skim off the rents captured by the policy. However, the welfare gains are still dramatically smaller than when costs and the labor share are taken to be fixed.[9]

To summarize the effects of the optimal production subsidy, note that the difference in the welfare gains is fairly small between the results with wage bargaining and those with fixed wages, but large in moving between the simulations which model costs and capacity utilization and those in which marginal costs are held fixed. That is, it doesn't matter much whether wages are fixed or not, but it matters a lot whether capacity utilization is taken into account. Finally, the welfare gains from the optimal production subsidy in Table 5 are not that different from those which result from reducing the union's bargaining power. And this assumes that other governments do not respond to the U.S. protection; any such retaliation would be expected to even further reduce the gains from trade and industrial policies.

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[9] I also examined a labor subsidy paid to the firm per hour of labor hired. Since this more directly targets the principal market imperfection, it gives slightly larger welfare increases than the production subsidy (less than an additional $1 billion in all years). However, the wage subsidies required are extremely large—over $300 per hour for all years. Although this is a partial equilibrium model, if one factors in a distortion created by raising the revenues needed to fund this subsidy, then the far less costly production subsidies are preferable.

VI. Sensitivity Analysis

Table 7 shows the effects of varying the assumed values for the elasticity of demand, ϵ, and elasticities of substitution, σ, σ_F, and σ_E. Because the available data are insufficient to estimate the model, this sensitivity analysis is important in determining whether the welfare results depend on particular numerical values. For the sake of brevity, results are shown only for 1978—other years yield similar results. Also, rather than varying each of the parameters individually, I present two cases which are representative of the extensive sensitivity analysis performed: a "low" elasticities case with demand and substitution elasticities smaller than the base case, and a "high" elasticities case with larger values.

The results in Table 7 show that varying the elasticities affects the size of the welfare gains, but does not change the main result that there are much smaller welfare gains once wage-bargaining and underutilized capacity are taken into account. As before, the relevant comparison is the difference between the simulations in which capacity utilization is taken into account, and those in which costs are fixed. For both high and low elasticities, when wages and costs are fixed, taking labor rents into account gives a welfare gain about four times larger than when labor rents are ignored. When wages and costs are endogenous, however, taking labor rents into account only slightly more than doubles the welfare gains from the optimal subsidy. And as before, a reduction in union power gives almost as large a welfare gain as the optimal production subsidy.

The results for the optimal policy simulations depend crucially on the government's ability to move first, which is the usual assumption in the strategic trade policy literature. Matsuyama (1990) examines the case where wages are determined before policy, and shows that the union and firm would collude in a way which would leave the government no choice but to "rescue" the affected industry. Optimal policies would give a smaller welfare gain if firms and unions could act as Stackelberg leaders with respect to the government, so that my results should again be seen as a best case for the gains from policy.

Other closely related work is that of De Melo and Tarr (1992, 1993). Using a ten sector CGE model they find that taking account of labor rents does not necessarily reduce the welfare cost of imposing VER's in the steel and auto industries; they also find that a wage subsidy in those industries gives only very small welfare gains. While their results are similar in spirit to mine, the models are very different. De Melo and Tarr obtain the crucial data on marginal costs from the literature rather than from an econometric cost function, and they consider scale effects and capacity utilization only by adding an ad hoc fixed cost while maintaining constant marginal costs. As a result, they do not capture the large changes in firms' factor demands in response to protection, and find only a small effect of underutilized capacity on the welfare gains of policy. They also assume values for union preferences over wages and employment

Table 7. Sensitivity Analysis for 1978

Assumptions for Wages and Costs	Elasticities	Subsidy $	ΔWelfare $bn	ΔLabor %	ΔQ_U %	Δp_U %
50% cut in union power	low	0	2.015	20.2	12.0	-9.6
	high	0	2.635	23.3	17.5	-8.3
Wage-bargaining and underutilized capacity, with labor rent	low	121	2.760	27.6	47.1	-29.3
	high	131	3.836	35.5	67.7	-25.5
Wages fixed and underutilized capacity, no labor rent	low	79	1.188	18.6	29.4	-20.5
	high	81	1.844	28.9	45.9	-19.0
Wages and costs fixed, with labor rent	low	139	5.363	83.3	83.3	-42.2
	high	140	9.453	152.4	152.4	-42.3
Wages and costs fixed, no labor rent	low	77	1.355	34.6	34.6	-23.4
	high	77	2.304	59.6	59.6	-23.2

rather than obtaining these from the calibration—and their sensitivity analysis shows that the welfare results depend greatly on the particular values.

A strength of the CGE approach is that it is possible to assess the distortionary costs that a policy in one sector imposes on the rest of the economy. I neglect these spillover effects, so that my results should again be viewed as the best case for protection. Even with the "best case" assumptions that labor rents exist and constitute the entire premium of steel wages over average manufacturing wages, that the government can move first, and that protection in the steel industry does not hurt other sectors or lead to foreign retaliation, I still find little support for strategic policies to capture labor rents.

VII. Conclusions

Previous models of the welfare effects of trade and industrial policies neglect crucial aspects of import-competing manufacturing industries such as steel. As a result, the gains from optimal trade and industrial policies are likely to be far smaller than previously indicated.

The most important reason for this is that the existence of underutilized capacity means that firms reduce the share of labor in response to protectionist policies, diminishing the very labor rents which the strategic policy seeks to capture. Considering the source of the rents further lessens the welfare gains, since strategic union actions decrease the effectiveness of optimal policies. Lastly, I show that there is a potentially significant benefit from simply reducing domestic distortions such as the union wage effect. While "busting unions" should not be taken as a literal prescription for policy, it is important to note that the gains from doing so may be nearly as large as the gains which result from optimal trade and industrial policies. And policies which explicitly target domestic distortions are less likely to elicit retaliatory responses from other nations.

These results suggest that actively targeting industries with labor rents should not be a primary aim of trade policy, and that a focus on preserving "good jobs at good wages" is overstated. If any policy is to be considered, it should focus instead on capacity utilization and on the adjustment of declining industries such as steel.

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