PROTECTION AND UNEMPLOYMENT

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1 INTRODUCTION

Unemployment and the scarring it causes strongly influence the politics of trade protection. Yet, no political economy of trade model known to the author explicitly models unemployment. (Wallerstein 1987 incorporates union-induced unemployment into an analysis of the demand for protection but ignores the government supply of protection and thus does not model the equilibrium choice of protection.) This paper seeks to extend the literature by incorporating an unemployment model with search and recruiting frictions into a political economy of trade model. The unemployment model is based on Mortensen and Pissarides 1999 and resembles the model in Davidson, Martin, and Matusz 1999.

The analysis implies that an industry's labor turnover rate, a variable neglected by the political economy of trade literature, may significantly influence how much protection that industry gets. (While no other paper known to the author explores the connection between labor turnover and protection levels, Magee, Davidson, and Matusz 2001 does provide an interesting analysis of labor turnover and campaign contributions.) The modeling also implies that an industry's unionization rate plays a key role in protection, since unions can influence how quasi-rents arising from search are divided between capitalists and workers. Other papers have examined empirically the relation between unionization and protection but not within the context of a rigorous model.

This paper uses US data to test the implications of the theory for the structure of protection across industries. The empirical results imply that protection for an industry declines with its turnover rate and increases with its unionization rate.

2 THE MODEL

2.1 The Economy

Consider a small economy whose consumers all have identical preferences given by $\bar{u} = \sum_{i=1}^{n} \bar{u}_i(x_i)$. Each $\bar{u}_i$ is differentiable and strictly concave. Let the population be normalized to 1, so that total consumer surplus for each good is $s(p_i) = \bar{u}_i[d_i(p_i)] - p_i d_i(p_i)$, where p_i is the price and $d_i(p_i)$ is demand.

For production, we adapt the continuous time search model of Mortensen and Pissarides (MP) 1999. Our model also resembles that of Davidson, Martin, and Matusz 1999. Each sector has two types of agents: identical workers, each of whom owns one unit of labor, and identical entrepreneurs, each of whom owns one unit of capital. In each sector, define units of capital so that production requires one unit of each factor. Unemployed workers search for entrepreneurs with idle capital. When such searching agents meet, a match is created. They negotiate a wage and produce an amount x_i, whose price is p_i, where the subscript *i* refers to the sector. Production continues until a shock destroys the match, whereupon each agent begins searching again. We follow MP and others and assume that such shocks arrive according to a Poisson process, with a rate of b_i for sector *i*. Thus, the average duration until a match dissolves is $\frac{1}{b_i}$. Let u_i be the fraction of workers who are searching (unemployed) and v_i be the fraction of entrepreneurs who are idle. Define "market tightness", $t_i = \frac{v_i}{u_i}$. The lower the unemployment rate, relative to the idle capital rate, the tighter is the market. Let $\lambda(u_i, v_i)$ be the arrival rate of matches for searching labor and $\kappa(u_i, v_i)$, the arrival rate of matches for idle capital. We follow the literature and assume that each of these is homogeneous of degree zero: scaling the unemployment rates for each factor by the same amount does not affect either factor's match arrival rate. Thus, we can write each of these as functions of market tightness: $\lambda(t_i)$ and $\kappa(t_i)$, where $\lambda' > 0$ and $\kappa_i' < 0$.

The path of the unemployment rate is given by $\dot{u}_i = (b_i(1-u_i) - \lambda(t_i)u_i)L_i^S$, where $\dot{u}$ is the change in the number of unemployed workers and L_i^S is the total fixed supply of labor in the sector. In this expression, $b_i(1-u_i)L_i^S$ is the number of workers who lose their jobs per time period, while $\lambda(t_i)u_iL_i^S$ is the number of unemployed workers who get hired per time period. In steady state equilibrium, the change in the number of unemployed is zero, which implies that

[1] $$u_i = \frac{b_i}{b_i + \lambda(t_i)}.$$

So, for a given break-up rate, market tightness in a given sector determines its unemployment rate. It turns out that market tightness is jointly determined along with the wage. Thus, we now discuss the wage bargain between workers and employers.

We follow MP and assume that the wage results from a generalized Nash bargain between labor and capital. The two sides bargain over how to split the quasi-rents, which arise from search frictions, associated with a match. The value of output associated with a match is $p_i x_i$. Denote the wage with w_i. An asset pricing equation determines the value of a match for each factor. Letting J_i and V_i be the expected lifetime utility of employed and idle capital, respectively, we have

[2] $$rJ_i = p_i x_i - w_i - b_i(J_i - V_i),$$

where r is the fixed interest rate. $p_i x_i - w_i$ is the instantaneous utility of a match to entrepreneurs, while $b_i(J_i - V_i)$ captures the expected capital loss associated with job destruction. Similarly,

[3] $$rV_i = -h_i + \kappa(t_i)(J_i - V_i),$$

where h_i is the cost of recruiting and hiring. For workers, let W_i be the value of having a job and U_i be the value of searching. The analogous expected lifetime utilities are

[4] $$rW_i = w_i - b_i(W_i - U_i)$$

and

[5] $$rU_i = \lambda(t_i)(W_i - U_i).$$

We normalize the value of leisure for workers to 0.

Surpluses for workers and entrepreneurs, therefore, are $W_i - U_i$ and $J_i - V_i$, respectively, with total surplus given by $W_i - U_i + J_i - V_i$. A generalized Nash bargain implies that the wage is $w_i = \arg\max (W_i - U_i)^{g_i}(J_i - V_i)^{1-g_i}$, where g_i reflects the relative bargaining strength of workers. This means that worker surplus will be

[6] $$W_i - U_i = g_i(W_i + J_i - U_i - V_i).$$

Substituting for W and J and solving for the wage, we get

[7] $$w_i = rU_i + g_i(p_i x_i - r(U_i + V_i) - b_i V_i).$$

Following MP, we assume perfect competition in the output market so that all rents associated with vacancies are exhausted, implying $V_i = 0$. Using this condition in [2], we get

[8] $$J_i = \frac{p_i x_i - w_i}{r + b_i}.$$

Using this and $V_i = 0$ in [3] and solving for the wage, we get what MP call the "job creation condition":

$$[9] \qquad w_i = p_i x_i - \frac{h_i(r + b_i)}{\kappa(t_i)}.$$

The ratio on the right side captures the impact of search frictions, which drive down the wage relative to what it would be with a perfectly competitive labor market. If search costs were zero, or if the match arrival rate for entrepreneurs were infinite, then the wage would simply equal the revenue product, as with perfectly competitive labor markets.

Using [5], [6], and [8] to solve for U and then substituting into [7], we get a second equation relating w_i and t_i, the "wage equation":

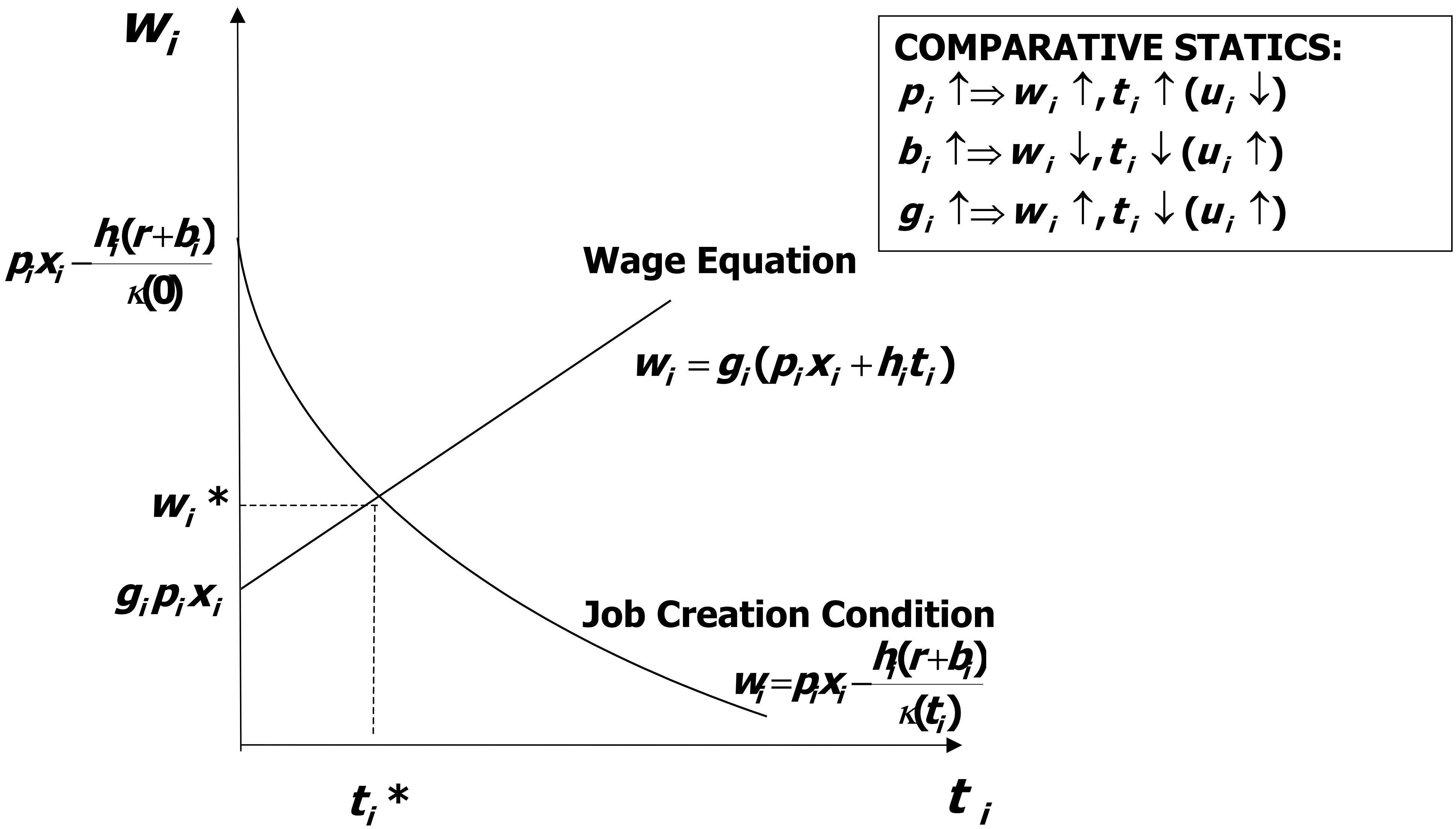
$$[10] \qquad w_i = g_i(p_i x_i + h_i t_i).$$

As worker bargaining power, hiring costs, and market tightness all increase, so does the wage.

w_i is a positive function of t_i in [10], and, since $\kappa'(t_i) < 0$, is a negative function of t_i in [9]. Thus, these two conditions jointly determine unique values of w_i and t_i, as long as the wage from the job creation condition exceeds the wage from the wage equation for some range of t_i. Figure 1 illustrates. Plugging the value of t_i determined by these two conditions into [1] gives the unemployment rate in sector *i.* Note that [1] implies that market tightness and unemployment move in opposite directions.

It will be useful to examine some comparative statics arising from this search model of unemployment. First, an exogenous increase in the price of the good will decrease the unemployment rate. In Figure 1, such a price increase will cause both the job creation and wage equations to shift up, but the former will shift up by more, as long as $g_i < 1$, which we assume. To see this, note that $\frac{\partial w_i}{\partial p_i} = x_i$ in the job creation condition and $\frac{\partial w_i}{\partial p_i} = g_i x_i$ in the wage equation. Thus, an increase in the price, as would occur if protection were increased, will cause market tightness to increase and unemployment to decrease. An increase in the job break-up rate, b_i, shifts the job creation condition down, reducing the wage and market tightness, which increases unemployment. An increase in worker bargaining power, g_i, shifts the wage curve up, increasing the wage and reducing tightness, which means unemployment increases in this case as well.

FIGURE 1



w_i
COMPARATIVE STATICS:
$p_i \uparrow \Rightarrow w_i \uparrow, t_i \uparrow (u_i \downarrow)$
$b_i \uparrow \Rightarrow w_i \downarrow, t_i \downarrow (u_i \uparrow)$
$g_i \uparrow \Rightarrow w_i \uparrow, t_i \downarrow (u_i \uparrow)$
$p_i x_i - \frac{h_i(r+b_i)}{\kappa(0)}$
Wage Equation
$w_i = g_i(p_i x_i + h_i t_i)$
$w_i *$
$g_i p_i x_i$
Job Creation Condition
$w_i = p_i x_i - \frac{h_i(r+b_i)}{\kappa(t_i)}$
$t_i *$
t_i

2.2 The Polity

For each industry, the government chooses a protection package.[1] We do not model which trade policies are chosen, so choosing a protection package for each import-competing sector is equivalent to choosing a domestic price, p_i, greater than the fixed world price, denoted by p_i^{FT}. We assume that revenues from trade taxes and the rents from other barriers are rebated lump-sum to consumers.[2]

Factor owners in import-competing sectors combine to form a single lobby to represent the entire industry. We assume that lobbying has a negligibly small impact on any lobby's consumer surplus. Thus, welfare for each producer lobby is given by total revenues arising from production in that sector. Let total sector output be given by $y_i = \mu_i x_i$, where μ_i is the number of matches in sector *i.* Total revenues, therefore, are given by a standard industry profit function: $\pi(p_i) = p_i y_i$. Lobbying consists of making contributions. Each lobby engages in a bilateral Nash cooperative game with the government, so that total surplus is maximized, with the division of the surplus indeterminate.[3] Most models assume that contributions are frictionless transfers, but we allow for transactions costs. Contributions received by the government from the producer lobbies are $C_i(p_i) = f \cdot (\pi_i(p_i) - A_i)$, where the constant $f \leq 1$ is a lobbying

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[1] We do not analyze why protection is chosen over more efficient tools, taking as given that protection is ubiquitous. Rodrik 1986 and Mitra 2000 model the choice of protection over subsidies.
[2] Bradford (forthcoming) tests a lump-sum rebating model against one that allows for political competition for import rents or revenues and does not reject the former, simpler model.
[3] Each lobby takes prices in other sectors as given. See Helpman 1995 for a discussion of why a series of bilateral bargains might be a more reasonable approach than a multilateral menu auction game.

friction coefficient[4] and A_i is the amount of revenues that lobbies retain in the bargain. In this Nash set-up, the price chosen does not affect the A_i term.[5]

The government chooses a price in each sector so as to maximize votes.[6] The government's objective function is:

$$[11] \quad V(\mathbf{p}) = \textstyle\sum_{i=1}^{n}([u_i^{FT} - u(p_i)]L_i^S + cC_i(p_i) + a[(p_i - p_i^{FT})m_i + (s_i(p_i) - s_i^{FT})]),$$

where $V(\mathbf{p})$ is total votes; u_i^{FT} is the free trade unemployment rate; s_i^{FT} is the free trade level of consumer surplus; c is the fraction of a vote that each contribution dollar buys; and a is the votes lost per dollar of lost consumer surplus. This is a political support function[7]: the government grants benefits to special interests, but the loss of support from those who must pay constrains the size of the benefits.

The first term, $[u_i^{FT} - u(p_i)]L_i^S$, gives the number of votes that protection generates from workers in that industry. $u_i L_i^S$ is the number of unemployed workers in industry *i*. As discussed above, the unemployment rate falls with the price. So, raising the price through protection reduces the number of unemployed workers. We assume

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[4] The lobbying frictions are exogenous and thus compatible with efficient bargaining: the parties still end up on the Pareto frontier, even though frictions may affect the position of the frontier. In this paper, we assume that *f* is constant across industries, though Bradford (forthcoming) allows *f* to vary according to industry characteristics, such as number of firms and geographical concentration.

[5] We could also allow for fixed costs in lobbying, but that would not affect the equilibrium prediction.

[6] This follows Peltzman 1976 and Baldwin 1987. We could reformulate the model to have the government maximize "power" or "wealth". See Becker's comments on Peltzman. Also, although democratic governments only need a simple majority of votes to stay in office, super-majorities have value because they make it easier for governments to implement their overall agenda.

[7] See Peltzman 1976, Hillman 1982, and Baldwin 1987.

that all workers who are hired as a result of protection switch from opposing the government, because they were unemployed, to supporting the government. (All the results below go through if we assume that just a fraction switch votes.) We also assume that changes in employment status override price changes in determining how workers vote.[8] The second term captures contributions induced by protection; the government uses these funds to "buy" votes at a rate of *c* votes per dollar.[9] The last terms in square brackets capture lost support from consumers who face higher prices, with the number of votes lost directly proportional to the loss of consumer surplus.[10]

Taking the derivative of *V* with respect to a representative price, p_i, we find:

$$[12] \quad \tilde{P}_i = \frac{p_i * - p_i^{FT}}{p_i *} = \frac{e_{(u,p),i} u_i L_i^S + (cf - a)\bar{y}_i}{e_{(u,p),i} u_i L_i^S + a e_{(m,p),i} \bar{m}_i},$$

where $e_{(u,p),i}$ is the absolute value (and thus the negative) of the elasticity of unemployment with respect to the price, $\bar{y}_i = y_i p^{FT}$ is the value of output at free trade prices, and $\bar{m}_i = m_i p^{FT}$ is the value of imports at free trade prices.[11] Appendix 2

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[8] Price changes in other industries could affect one's employment status. Such influences are likely to be either negligibly small or unnoticed by workers. To preserve tractability, we ignore such connections.
[9] See Potters, Sloof, and van Winden 1997 for a model of how campaign spending buys votes.
[10] One could extend the model by allowing the constant of proportionality, *a*, to vary across industries to account for social concerns as discussed in Baldwin 1989.
[11] Unemployment, output, imports, and the elasticities all depend on the price, but we have not shown this for notational simplicity. Also, our measure, $\tilde{P}_i$, takes on values in the [0,1) interval. This formulation follows Grossman and Helpman 1994 and Goldberg and Maggi 1999. We assume no import subsidies, so that $\tilde{P}_i$ is bounded below by 0, because they go against our assumptions that producers do not lobby against each other and consumers do not lobby at all. Ruling out negative protection appears justified since all the industries in our sample get positive protection.

shows the derivation.

3 DISCUSSION AND IMPLICATIONS OF THE MODEL

Two main features distinguish our model from most of the literature: treating workers as a separate source of support, instead of lumping them in with consumers as a whole, and allowing for lobbying frictions. In order to capture these forces while preserving tractability, we have assumed that all potential lobbies organize and that the impact of lobbying on that lobby's consumer surplus is negligible.

To help in interpreting equation [12], consider how each of the two main features affects it. The $u_i L_i^S$ terms capture the independent influence of unemployment and workers on protection. Without unemployment, these terms would disappear, and the equilibrium would be $\tilde{P}_i = \frac{(cf - a)\bar{y}_i}{ae_{(m,p),i}\bar{m}_i}$. This resembles more closely Grossman-Helpman (GH) type models, in which protection depends on the output—import ratio, the weight that contributions get relative to consumer surplus (c vs. a), and the elasticity of import demand.

Nevertheless, this expression is still a bit more complicated because of the lobbying frictions. If contributions are assumed to be frictionless transfers, then f would equal 1. Applying this change gives $\tilde{P}_i = \frac{(c - a)y_i}{ae_{(m,p),i}m_i}$. Adopting the GH convention of letting $c = 1 + a$ further reduces this to $\tilde{P}_i = \frac{y_i}{ae_{(m,p),i}m_i}$. This is the expression for protection that comes out of their framework with separate bilateral bargains when all industries lobby and each lobby's consumer surplus is ignored.[12] The model implies several *ceteris paribus* results for import-competing industries.

Result 1: Protection increases with the number of workers. More workers in an industry means more potential votes for the government when it imposes protection. The empirical literature finds a robust connection between workforce size and trade barriers. By incorporating unemployment, this model provides theoretical backing for the widely accepted claim that jobs play an important role in the protection game.

Result 2: Protection increases with the absolute value of the elasticity of unemployment. The more that unemployment in an industry shrinks with a given price increase, the more votes it will deliver. Thus, all else equal, the more protection that industry will get.

Result 3: Protection decreases with lobbying transactions costs. Lower transactions costs (higher *f*) imply that producer lobbies will have more clout with the government, since it will receive more of the resources that lobbies dedicate to lobbying. This result springs from the Becker 1983 idea that the pressure applied by interest groups may not equal the amount of resources that they devote to lobbying. We have chosen exogenous friction coefficients as a reduced form operationalization of this idea, but more explicit modeling would be interesting future work.

Result 4: Protection increases with output if $cf > a$. Large industries have more resources to contribute to politicians in order to acquire more rents. If, however, c or f is quite low (or both are), meaning either that contributions are not valued much or that lobbying costs are high (or both), then larger industries may get less protection. In this case, large industries cannot muster enough contributions to counteract the large amount of consumer surplus that protection in those industries would wipe out. This result goes against the conventional theoretical wisdom that protection increases with output. Much empirical work, however, finds the opposite. Maggi and Rodriquez-Claire 2000 is another formal model which allows for the possibility that protection decreases with output. Their result arises from distortionary taxation, not lobbying frictions.

Result 5: Protection is decreasing in imports and in the elasticity of import demand. Holding everything else equal, industries with more imports should get less protection, because more imports means that protection for such an industry will result in a larger loss of consumer surplus. Also, since more elastic demand leads to greater deadweight loss when prices are propped up, more elastic import demand leads to less protection. These results accord with all GH-type models and is implicit in other frameworks, as Helpman 1995 shows.

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[12] Referring to Helpman 1995, all industries being organized means that the equation on page 22 of his article applies to all industries, and abstracting from changes in lobbies' consumer surplus means that

4 EMPIRICS

We now turn to empirically testing the model's predictions. First, we develop an empirical specification based on the theoretical model. Then, we briefly describe the data. Finally, we present and analyze the regression results.

Referring to equation 12, output, imports, and unemployment are all endogenous with respect to the level of protection.[13] We follow Goldberg and Maggi 1999 and Trefler 1993 and instrument using industry-level factor shares. The presumption is that factor shares are correlated with imports, output, and unemployment but not with the price.[14]

4.1 Econometric Model

Since $\frac{\partial u}{\partial p}$ is a complicated function of the search model parameters-- p, b, g, h, r -- so is the unemployment elasticity, $e_{u,p}$. Rather than making an already somewhat complex estimation unwieldy, we do not include an explicit functional form for $e_{u,p}$. (Specifying a function for $\lambda(t_i)$ enables one to derive one.) Instead, we assume that $e_{u,p}$ is a simple linear function of two variables for which we have industry-level data: the job destruction rate (b_i) and worker bargaining power (g_i). Thus, we assume that

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$\alpha_j = 0$.

[13] Both elasticities can be thought of as endogenous, but we assume that they are constant around equilibrium.

[14] The factor instruments are physical capital, inventories, cropland, pasture land, forest land, coal, petroleum, engineers/scientists, skilled workers, and unskilled workers. The results are robust to various

$e_{(u,p),i} = e_0 + e_1 b_i + e_2 g_i$. Measuring worker bargaining power is not straightforward, but we will assume that an industry's unionization rate is a good proxy.

Since c and f both multiply the same variable, we will estimate a coefficient which gives the product of c and f without identifying separate values for each.

Thus, the econometric model can be written as:

$$[13] \quad \tilde{P}_i = \frac{(\varepsilon_0 + \varepsilon_1 DES_i + \varepsilon_2 UNIO)UNEM_i + (\chi - \alpha)OUT_i}{(\varepsilon_0 + \varepsilon_1 DES_i + \varepsilon_2 UNIO)UNEM_i + \alpha(ELAS_i)(IMP_i)} + u_i,$$

DES_i :	the job destruction rate in industry i (b_i),
$UNIO_i$:	the unionization rate (g_i),
$UNEM_i$:	the number of unemployed workers ($u_i L_i^S$),
OUT_i :	the value of output ($\bar{y}_i$),
$ELAS_i$:	the elasticity of import demand ($e_{(m,p),i}$),
IMP_i :	the value of imports ($\bar{m}_i$),
$\alpha, \chi, \varepsilon_0, \varepsilon_1$, and ε_2 :	parameters to be estimated or fixed, corresponding to a, cf, e_0, e_1, and e_2, respectively.

4.2 The Data

We use mid-1980's US data for 191 SIC 4-digit industries. This choice of country and time period stems from the fact that we only have the endowments data used as instruments for the US in 1983 (Trefler 1993). We use new, industry-level measures of protection from 1985.[15] Detailed price data from the OECD were used to construct

subsets of these instruments. Two other potential instruments—minerals and white collar workers—undermined the estimation and thus were not used. The data are from Trefler 1993.

[15] These protection measures are nominal, even though specific capital owners care about effective protection. Unfortunately, it is difficult to calculate effective protection. The standard measures assume

tariff equivalent price gaps that capture all kinds of barriers to international arbitrage for a sample of six OECD countries. Bradford 2003 provides details on the construction of these data and discusses why they are probably more trustworthy than other commonly used measures, such as NTB indices and unit value comparisons.

The employment data also come from Trefler and are 1983 US data. These data were adjusted to account for intra-industry trade. Since some output from almost all industries gets exported, we multiplied the number of workers by the ratio of non-exported production to total production, to arrive at an estimate of the number of import-competing workers for that sector.

The imports and exports data are from the Feenstra data set, and the output data are from the Bartelsman, Becker, and Gray data set, both of which are on the NBER web site. All of these data are from 1983. As with employment, we adjusted output downward so that it only reflects import-competing production. We did so by simply subtracting exports from output. These data sets give the value of imports and output at current (protected) prices. We converted these to values at world prices by dividing the current value by the ad valorem protection rate.

The job destruction rates are from Davis, Haltiwanger, and Schuh 1996. Industry level unionization rates are also from Trefler. Both of these come from 1983, as well.

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no substitutability among inputs and thus overstate true effective protection. Some researchers have tried to overcome this problem (see Bureau and Lakaitzandonakes 1995), but to do so is expensive, and few such estimates exist. There are, as a result, no reliable estimates of effective protection for the 191 sectors. In the end, it appears to make little difference. Using data from Deardorff and Stern 1984, the correlation between nominal and effective protection for 18 2-digit sectors in the US was .99.

Like Goldberg and Maggi 1999 and Gawande and Bandyopadhyay 2000, we take the import demand elasticity data from Shiells, Stern, and Deardorff 1986. These estimates are considered to be the best available at the level of disaggregation used in this empirical analysis. For a few industries, the elasticity estimates were positive, and we dropped these from the sample. Since the elasticity data are estimated, we used the errors-in-variables correction presented in Gawande 1997 to "purge" the elasticities data. Summary statistics for all variables are shown in Table 1.

4.3 Results

Since the estimating equation is homogeneous of degree 0 in all of the parameters, we need to peg one of them. We follow Bradford (forthcoming) and peg α. That article shows that a reasonable value for α is .001, which implies that every $1000 reduction in consumer surplus results in the loss of one vote.[16]

Table 2 shows the results of estimating the model using non-linear two-stage least squares (NL2S). (See Amemiya 1983.) The coefficient on ε_i is negative at the 5% level, indicating that industries with higher break-up rates receive less protection from the political process. To the author's knowledge, this result connecting protection to worker turnover is novel. This seems reasonable: If the break-up rate is high, then preserving jobs through protection is less rewarding to the government than if the break-up rate were lower. The results also imply that protection for an industry

[16] None of our main conclusions depends on the value at which we peg α.

increases with that industry's unionization rate, since this coefficient is also significant at the 5% level. This fits with the idea that more unionized industries have more political power.

The model, however, implies that the mechanisms through which these two variables influence protection are more subtle. Recall that the search model variables, including the break-up rate and the unionization rate, affect protection through their influence on the price elasticity of unemployment. A higher elasticity leads to more protection because increasing the price through protection reduces unemployment by a larger amount. So the fact that the break-up rate has a negative effect on protection implies in this framework that a higher break-up rate leads to a lower price elasticity of unemployment. Similarly, the positive sign on unionization means that higher unionization increases the price elasticity of unemployment. Without more analysis one can only speculate concerning the causes of these relations. Recall, though, from the comparative statics discussion above that increasing both the break-up rate and the unionization rate increases the **level** of unemployment, while the break-up rate is negatively related to the wage, and the unionization rate is positively related to the wage. Higher break-up rates increase unemployment by reducing the demand for labor; higher unionization rates increase unemployment by increasing the share of quasi-rents that workers collect, which drives up the wage. It appears, therefore, that lower wages and reduced demand for labor lead to a lower price elasticity of unemployment, while higher wages increase the elasticity. More analysis of this relation is probably warranted.

Are these connections economically significant? Although it is not obvious from the non-linear estimating model, it turns out that the results imply that, if one evaluates the other variables at their means, increasing unionization by 10 percentage points would increase protection by about two percentage points. Thus, the actual impact of unionization, while not trivial, does not appear to be large. The results also imply that a 10 percentage point increase in the break-up rate would decrease protection by about four percentage points.

5 CONCLUSION

We have developed a protection model that explicitly accounts for search friction unemployment. This has enabled us to formally analyze the key role that concerns over unemployment play in the political economy of protection. The modeling and empirics imply that the job break-up rate in an industry has a significant negative effect on protection. We know of no other results in the literature that connect break-up rates and protection. The analysis also tests, for the first time, to our knowledge, the impact of unionization rates on protection within the context of a rigorous model. We find that higher unionization rates lead to more protection.

APPENDIX: DERIVATION OF EQUATION 12

The objective function is

$V(\mathbf{p}) = \sum_{i=1}^{n}([u_i^{FT} - u(p_i)]L_i^S + cC_i(p_i) + a[(p_i - p_i^{FT})m_i + (s_i(p_i) - s_i^{FT})]) =$

$\sum_{i=1}^{n}([u_i^{FT} - u(p_i)]L_i^S + cf(\pi_i(p_i) - A_i) + a[(p_i - p_i^{FT})m_i + (s_i(p_i) - s_i^{FT})])$,

where we have substituted for $C_i(p_i)$.

Taking the derivative with respect to a representative price, p_i, and setting it equal to 0, we get:

$$\frac{\partial V}{\partial p_i} = -u'(p_i)L_i^S + cf_i y_i(p_i) + a\{(p_i - p_i^{FT})m_i'(p_i) + m_i(p_i) - [y_i(p_i) + m_i(p_i)]\} = 0 .$$

Note that $\pi_i' = y_i$, by Hotelling's Lemma, and $s_i' = -d_i = -(y_i + m_i)$.

Dropping the i subscripts and not writing out the explicit dependence of y, m, and u' on p_i, we have the following:

$$am'(p^* - p^{FT}) = -(cf - a)y - u'L^S$$

$$\Rightarrow am'\frac{p^*}{m}\frac{m}{p^*}(p^* - p^{FT}) = -(cf - a)y - u'\frac{p^*}{u}\frac{u}{p^*}L^S$$

$$\Rightarrow ae_{m,p}\frac{m}{p^*}(p^* - p^{FT}) = -e_{u,p}\frac{u}{p^*}L^S + (cf - a)y \text{ , where } e_{u,p} = -\frac{\partial u}{\partial p^*}\frac{p^*}{u} \text{ and}$$

$$e_{m,p} = -m'(p^*)\frac{p^*}{m} .$$

$$\Rightarrow ae_{m,p}m(p^* - p^{FT}) = e_{u,p}uL^S + (cf - a)yp^*$$

$$\Rightarrow (ae_{m,p}m - (cf - a)y)p^* = e_{u,p}uL^S + ae_{m,p}mp^{FT}$$

$$\Rightarrow p^* = \frac{e_{u,p}uL^S + ae_{m,p}mp^{FT}}{ae_{m,p}m - (cf - a)y} \Rightarrow \frac{p^*}{p^{FT}} = \frac{e_{L,p}uL^S + ae_{m,p}mp^{FT}}{(ae_{m,p}m - (cf - a)y)p^{FT}} = \frac{e_{u,p}uL^S + ae_{m,p}\overline{m}}{ae_{m,p}\overline{m} - (cf - a)\overline{y}}$$

$$\Rightarrow \frac{p^{FT}}{p^*} = \frac{ae_{m,p}\overline{m} - (cf - a)\overline{y}}{e_{u,p}uL^S + ae_{m,p}\overline{m}}$$

$$\Rightarrow 1 - \frac{p^{FT}}{p^*} = \frac{p^* - p^{FT}}{p^*} = \frac{e_{u,p}uL^S + ae_{m,p}\overline{m} - ae_{m,p}\overline{m} + (cf - a)\overline{y}}{e_{u,p}uL^S + ae_{m,p}\overline{m}} = \frac{e_{u,p}uL^S + (cf - a)\overline{y}}{e_{u,p}uL^S + ae_{m,p}\overline{m}} .$$

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TABLE 1
SUMMARY STATISTICS (191 US INDUSTRIES, 1983)

	MEAN	MEDIAN	MIN	MAX	SD
Regression Variables					
Protection: $\tilde{P}$	.188	.138	.000999	.627	.150
Job Destruction Rates (% loss): *DES*	15.4	13.6	1.29	50.3	8.06
Unionization Rate: *UNIO*	.333	.308	.0630	.754	.126
Unemployed Workers (thousands): *UNEM*	6.33		0.00	145	12.9
Production ($ million, valued at world prices): *OUT*	4360	1920	42.1	165,000	12,800
Imports ($ million, valued at world prices): *IMP*	443	144	.0129	16,224	1410
Elasticity of Import Demand (corrected): $e_{m,p}$ or *ELAS*	1.62	1.33	.221	3.78	.876
Underlying Data					
Tariff Equivalent: $\frac{p}{p^*}$	1.28	1.16	1.001	2.68	.295
Raw Employment (thousands)	57.4	26.0	2.20	999	106
Raw Production ($ million, valued at domestic prices)	5640	2690	73.1	183,000	14,600
Raw Imports ($ million, valued at domestic prices)	509	187	.0167	17,500	1510
Exports ($ million)	424	124	0	10,400	1150
Uncorrected Elasticities	2.00	1.07	.0420	23.9	2.65

TABLE 2
NON-LINEAR TWO-STAGE LEAST SQUARES ESTIMATION OF THE MODEL

Dependent Variable: $\tilde{P} = \frac{p^* - p^w}{p^*}$ **.**

Number of Observations: 191.

Para-meter	**Estimate (t-score)**
ε_0	5.75** (2.50)
ε_1**: *Break-up Rate***	-0.480** (-2.47)
ε_2 ***: Unionization***	22.5** (2.41)
χ ***: Industry Output***	.000999 $(-1.14)^{\#}$
Pseudo-SSR	1.69
Variance of the Residuals	0.0732

** Significant at the 5% level.
\# t-score refers to whether $\chi < \alpha = 0.001$. If so, then protection is decreasing in output.