10-15-1994

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Economic Staff Paper No. 94-13

October 1994

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*This paper is based on an earlier version that was presented at the March 1994 Midwest Economics Association Meetings in Chicago, IL. We especially want to thank Stephen Woodbury for his very helpful comments. All remaining errors are our own.

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ABSTRACT

Union opposition to free trade policies suggests that international trade damages the union movement. Previous research has found little relationship between union *wages* and international trade. However, greater trade may hinder unions by reducing the likelihood that workers enter the union sector. A bivariate partial observability probit model is used to predict union choice with respect to risk aversion, union strategic behavior, and product market effects of trade. The model estimates the probability of workers entering the union sector queue and the probability of being hired from the union queue. The results suggest that trade has had some adverse effects on union choice, but it is exports rather than imports that have the greatest negative impact on unions. Sectorial results show that high-technology sector workers have a high likelihood of union choice, *ceteris paribus*, which acts to offset the adverse impact of trade. Finally, the empirical evidence implies that most of the determination of individual union status is due to firm behavior, not due to characteristics of the individual worker.

I. Introduction.

Union opposition to the North American Free Trade Agreement (NAFTA) exemplifies the staunch resistance to free trade in general by U.S. union leaders. Previous research has indicated that trade has relatively little influence on average U.S. wages (e.g., Partridge, 1993; Freeman and Katz, 1991). However, union opposition may arise because trade influences the likelihood that individuals belong to unions. In this case, greater trade either reduces the likelihood individuals are willing to work in the organized sector, or it reduces the likelihood that unionized employers will expand their work force. By separating workers' demand for unionization from unionized firms' hiring decisions, the effects of trade on union strength can be better understood.

U.S. union densities have steadily declined since the 1950s (Freeman, 1988), a period during which the U.S. economy became much more exposed to international trade. Thus, some analysts have claimed that trade has weakened the U.S. labor movement. However, other industrial nations, which are exposed to significantly greater international trade shares than the United States (e.g., Canada, Germany), have not experienced major declines in unionization. Therefore, international trade may not be a major cause of the decline of the U.S. union movement. Alternatively, trade may have a different influence on U.S. workers' demand for unions and U.S. unionized firms' hiring decisions. Thus, it is an empirical issue regarding trade's overall impact on the likelihood workers belong to unions.

Martinello and Meng (1992) and Belman (1988) have considered whether import shares influence the likelihood a worker belongs to a union by employing univariate probit specifications.[1] However, simple probit does not distinguish between the choice that individual workers make regarding whether to enter the queue for union jobs from the union firm's selection process regarding which workers to hire from the union queue. Thus, this study advances our understanding of the precise mechanism that trade influences union strength by using a partial observability probit model. Moreover, unlike previous studies (with the exception of Partridge, 1994), this study considers whether exports affect union status and how the relative comparative advantage of a sector affects the union choice decision.[2] This study advances previous research by jointly considering these issues by using 1978-1980 National Longitudinal Survey of Young Men (NLSYM) data.

II. Union Behavior and International Trade.

International trade can influence union status in three ways. First, it directly affects domestic product market power. Second, because trade is a signal of the future viability of the industry and future employment possibilities, trade can influence *strategic behavior* by unions and management. Third, greater international trade can trigger risk averse behavior by unions and management. These three hypotheses are summarized in Table 1. Closely related to these points is that individual union status can be affected by the characteristics that determine the relative comparative advantage of the sector, which is addressed in the next section.

The basis for most union choice studies is that workers decide to join a union when the benefits of unionism outweigh the costs. Net benefits of unionism are influenced by many factors including the worker's demand for unionization, the supply of unionization, and employer hiring decisions. Union choice is positively related to the union-nonunion wage gap, $(W^U-W^N)/W^N$, and other factors including industry, trade, labor market, and individual characteristics.[3] Equation (1) represents the union choice decision:

(1) $U = G((W^U-W^N)/W^N, Z, L, I), G_{(W^U-W^N)/W^N}>0,$

where U is a union choice indicator variable, Z, L, and I represent industry characteristics, labor market characteristics, and individual attributes, respectively.

The model shown in (1) does not fully illustrate the sequential decision that is undertaken by workers and their employers. First, workers decide whether to join the union queue. Second, union employers decide which workers to hire from the queue or whether to hire workers in the first place. This sequential model has been previously considered by Abowd and Farber (1982) and DeFreitas (1993) (Maddala, 1983 also discusses this model). Nevertheless, neither study considered industry characteristics (e.g., trade shares, etc.), which are the subject of this study. The individual worker's decision whether to join the union queue is represented by:

(2) $Q=X_1\beta_1 + e_1,$

where Q is a union queue indicator variable, X_1 is a vector of individual and industry characteristics, and e_1 is an error term. The firm's decision to hire from the queue is shown in (3):

(3) $HFQ=X_2\beta_2 + e_2,$

where HFQ is an indicator variable, X_2 is a vector of relevant individual and industry characteristics, and e_2 is an error term. A worker is only hired for a union job if both Q and HFQ equal 1 (i.e., both conditions are true).

An individual's union status using reduced form *univariate probit models* has been examined in several studies (e.g., Hirsch and Berger, 1984; Belman, 1988; Martinello and Meng, 1992; Lee, 1978). Most of these studies emphasize the role of the domestic industry's *product market* power on individual union status.[4] For example, both the four-firm concentration ratio (CR4) and exports are positively related while imports are negatively related to a domestic firm's product market power. Greater product market power implies a smaller labor demand elasticity and greater profits. Therefore, following from a rent sharing/extraction model (Abowd, 1989) or a monopoly union model (McDonald and Solow, 1981), greater product market power implies a larger union wage gap and a greater demand for union coverage. Thus, the *product market* analysis suggests that imports are negatively related to the demand for unionization with the opposite association holding for exports. Likewise, unions may be more willing to organize an industry if there are greater profits to appropriate (e.g., Hirsch and Berger, 1984; Belman, 1988). Consequently, imports are negatively related to the supply of unionization, while exports are positively related. Therefore, a worker's likelihood of belonging to a union in a reduced form probit model or a worker's probability of joining the union queue in the partial observability probit model is negatively (positively) related to the industry's import (export) share.

Greater wages as a result of product market power should increase the quality of the applicant pool (e.g., an adverse selection argument from efficiency wage theory). Thus, CR4 and exports are positively related to union firms hiring from the union queue with the opposite applying for imports.

The product market model ignores potential long-run *strategic* responses by unions after changes in trade. For example, Kahn (1993) examines the likelihood that labor and management cooperate in repeated games. Kahn found that union-management cooperation is negatively related to an industry's or firm's bankruptcy or failure rate, where a greater failure rate reduces the expected gains for the union from long-run cooperation. In our case, greater imports can signal that there is a greater likelihood that the firm will fail, while increased exports can signal the opposite.

Clearly, one dimension of long-run union-management cooperation is the tradeoff between short-term wages and the likelihood of long-term employment. For example, Farber and Saks (1980) show that employment security plays an important role in individual decisions to vote for union certification; thus, employment security likely plays a role in union bargaining strategy. Similarly, Lawrence and Lawrence (1985) examine the influence of international competition on union behavior through an end game, which is essentially a tradeoff between current wages and the probability of long-term employment.[5]

Lawrence and Lawrence suggest that slow demand growth reduces the opportunity for an industry to invest in new plant and equipment. Unions can extract *higher* wages because a slowly growing firm has more difficulty substituting capital for labor (i.e., smaller elasticities of factor substitution σ_{KL} and/or labor demand). Yet, the tradeoff for higher current wages is ultimately a reduction in long-term employment. Consequently, because greater imports are negatively related to the firm's (or industry's) demand growth and positively related to its failure rate, greater imports can induce a less cooperative union-management atmosphere. The implication is that greater imports could actually increase the union-nonunion wage gap. Conversely, robust product demand growth encourages the industry to expand its capacity. The union fears that if its wages are too "high," the firm will adopt a capital-intensive technology which could result in lower long-run union employment. Hence, greater exports, by inducing increased demand growth and union-management cooperation, can reduce the union wage gap.

The strategic behavior hypothesis suggests a positive (negative) relationship between the union wage gap and imports (exports). Thus, this hypothesis implies that greater imports are associated with a greater demand for unionization with the opposite holding for exports. Consequently, strategic behavior suggests that the likelihood of belonging to a union or joining the union queue is positively related to imports and negatively related to exports. Moreover, because greater import competition increases union wages and induces an uncooperative union-management atmosphere, greater import shares reduce the likelihood that unionized firms will hire from the union queue. Likewise, increased export shares increase the chance that unionized firms will hire from the union queue.

In addition to product market power and strategic behavior, union membership may be influenced by the increased *uncertainty* associated with international trade. Industries with a high export or import share are exposed to changes in tariffs, exchange rate risk, and other risks due to changes in the terms of international competitiveness (e.g., Dornbusch, 1987). Moreover, foreign product markets and cost structures may not be completely understood by domestic firms. Since domestic production in high trade share industries is at a higher risk of displacement by foreign producers, these industries may suffer from greater variability in output and profitability.

Collective bargaining agreements have characteristics that may add to the uncertainty of international trade. Union contracts are typically set for three years and may inhibit the necessary labor market flexibility to react to changing international competitiveness. Also, if unions extract higher wages via monopoly power, unionized firms will have a labor cost disadvantage and will be less competitive. Consequently, as risk aversion increases, firms exposed to greater international competition will be less likely to hire from the union queue.

Workers may also be willing to tradeoff greater job security for lower wages and forego the benefits of unionization. Greater international competition in the union sector increases the risk of union busting tactics, lay-offs, or negotiated wage reductions. Thus, as workers' risk aversion increases, they will be less likely to enter the union queue. Overall, the uncertainty effect may have a stronger influence on firm behavior than on employee behavior because it affects their actions the most directly.

The three competing hypotheses regarding trade's influence on union status: (1) product market, (2) strategic behavior, and (3) risk aversion/uncertainty each imply that trade shares have a different influence on union status. Again, these are summarized in Table 1. Product market effects from greater imports and exports on the demand for unionization offset the effects of strategic behavior.[6] Product market analysis suggests that greater *imports* (*exports*) *reduce* (*increase*) the likelihood of a worker joining the union queue, while strategic behavior implies the converse. Nevertheless, the uncertainty hypothesis implies that uncertainty arising from greater international trade has a negative impact on the probability of both joining the union queue and being hired from the union queue. Therefore, it is an empirical question as to which effect dominates. In fact, it is possible that trade has very little influence

on the demand for unionism because the three effects offset each other.

III. Industry Comparative Advantage and Union Status.

The discussion above focussed directly on how import and export shares alter union behavior. Aside from a sector's import and export shares, there are other technological characteristics inherent within a sector which determine its level of international competitiveness (e.g., technology). For example, standard Heckscher-Ohlin trade theory emphasizes the role of factor intensities such as physical capital or human capital in determining international trade flows. In fact, traditional trade models do not point to trade shares, *per se*, as a measure of how trade influences a sector. Instead, the emphasis is on factor intensities in the sector.

Since the 1960s, U.S. manufacturing has undergone tremendous changes in its trade balance where all industries have not fared equally. For example, the high-tech sector is very competitive while other sectors (e.g., autos and steel) have fared poorly. Johnson and Stafford (1993) suggest that foreign technological convergence has reduced the technological quasi-rents available in the medium-tech industries the United States dominated after World War II. By contrast, high-tech industries account for an increasing share of U.S. exports. Thus, technological differences across sectors should also influence union behavior.

To further investigate these matters, manufacturing will be divided into four sectors.[7] The division stresses both technological and factor endowment differences. The four sectors are natural resources (NR), labor-intensive common technology (CTL), capital-intensive common technology (CTK), and high-technology (HT) (e.g., computers, aerospace, chemicals, scientific instruments, and most machinery). NR goods intensively use natural resources in the manufacturing process (e.g., lumber, processed food). CTL (e.g., apparel, footwear) and CTK goods (e.g., steel, autos) utilize a readily available technology used throughout the world.[8] Arndt and Bouton (1987) show that there are significantly different product market and technological characteristics between these four sectors, and Partridge (1993) finds that union and nonunion wage patterns vary across these three sectors. For instance, the HT sector appears to possess greater product market power (e.g., greater CR4, trade surpluses, and value added per worker). In an international context, especially since the 1970s, the CTL

and CTK sectors have less product market power (e.g., large trade deficits), and for the most part, fall in the medium-tech industries that were referred to by Johnson and Stafford.

It is very likely that each sector has its own *separate* impact on union status that depends on the technological characteristics of the sector. Standard international trade theory suggests that the more skilled HT unionized labor-force should fare relatively better than the CTL and CTK sectors in response to international trade. Moreover, the product market analysis from above reinforces traditional international trade theory. In this case, the positive relationship between the product and labor demand elasticities suggests that HT unions have a superior wage-employment relationship to exploit, while CTL and CTK unions have an inferior wage-employment relationship. The implication is that the demand for unionization should be *greater* (*smaller*) in the HT (CTL, CTK) sector(s) *on average*.[9] However, because unions can influence the capital-intensity of the industry, the CTL and CTK results should be cautiously interpreted.

The superior union wage and long-run employment opportunities in the HT sector also suggest that the quality of the applicant pool will be superior in the HT sector. Thus, unionized HT firms will be more willing to hire workers than unionized firms in the CTL and CTK sectors.

IV. Empirical Methodology.

Following DeFreitas (1993), the sequential union model suggests that a worker will be unionized only if equations (2) and (3) are true (i.e., $Q=1$ and $HFQ=1$). In this case, a worker first decides whether to join the queue and second, the worker is hired from the queue. The probability of a worker being employed in a union job equals:

(4) $P(U=1) = P(Q=1) \bullet P(HFQ=1 \mid Q=1)$.

The probability of a worker not belonging to a union equals:

(5) $P(U=0) = P(Q=0) + P(Q=1) \bullet P(HFQ=0 \mid Q=1)$.

Unfortunately, we do not observe whether a worker has joined the queue or whether a firm has refused to hire a worker if they were in the queue. Instead, we observe the product of Q and HFQ. To account for this problem, a partial observability probit model is used. Thus, the errors in equations (2) and (3) are assumed to be normally distributed. The estimates of $ß_1$ and $ß_2$ are derived from maximizing the

following likelihood function:

(6) $L=\prod_{U=1}\{F(X_1\beta_1)F(X_2\beta_2)\}\bullet\prod_{U=0}\{1-F(X_1\beta_1)F(X_2\beta_2)\}$.

To identify β_1 and β_2, the variables in X_1 cannot be identical to the variables in X_2. Like Abowd and Farber (1982) and DeFreitas (1993), to identify the equation, union and nonunion tenure (UNTEN, NUNTEN) and their squares (UNTEN2, NUNTEN2) will be omitted from the firm's hiring equation.[10] Because wages and tenure are positively related, union tenure reflects a union worker's costs of leaving the union sector, while nonunion tenure reflects a nonunion worker's costs of leaving the nonunion sector. Consequently, it is expected that union (nonunion) tenure is positively (negatively) related to being in the union queue.

The worker's decision to join the union queue is based on 1978 data and the firm's decision to hire from the queue is based on 1980 data. This construction takes advantage of the longitudinal nature of our data set, and captures the sequential nature of the union choice decision. Thus, the time frame is workers with a given set of *ex ante* characteristics in 1978 decide whether to join the union queue. Then in 1980, firms decide to hire from the union queue based on relevant *ex post* characteristics in 1980. This formulation also improves the identification of equation (6).

A quasi reduced form probit is also estimated to measure the likelihood an individual belongs to a union. Like DeFreitas (1993), the reduced form estimates will be compared to partial observability probit estimates. The specification for individual i is:

(7) $P(U=1) = P(\mathbf{Y}\Gamma + \epsilon_i) > 0$, $\epsilon_i \sim$ i.i.d. N(0,1).

The dependent variable is the worker's union status (i.e., *union: U=1*). Vector $\mathbf{Y}$ contains the independent variables and ϵ_i is the error term. Vector $\mathbf{Y}$ contains variables that control for the net benefits of union membership including variables that influence the union wage gap.

Equation (7) is a reduced form of equation (1), which allows us to estimate the *total impact* of trade on union choice. Martinello and Meng (1992) also estimate a similar reduced form probit model for Canadian workers. Analogously, we estimate a reduced form representation of equation (6). Thus, the empirical specifications will measure the direct impact of the trade variables (e.g., on employment and labor demand elasticity) *plus* their indirect influence through the union wage gap.

V. Data.

NLSYM data from 1978-1980 is combined with three-digit industry data for the empirical analysis, resulting in a sample of 734 observations. The advantage of this time period is that the trade balance was approximately zero and the wild currency fluctuations of the 1980s had not affected manufacturing, which implies that we are considering a period that was approximately in equilibrium. Moreover, this period did not experience the dramatic declines in unionization and the tremendous changes in management attitudes towards unions that are attributed to the 1980s and 1990s. Hence, we do not confound these other effects with trade's influence. Previous studies use similar individual and industry control variables (e.g., Martinello and Meng, 1992; DeFreitas, 1993); and thus, we will only emphasize the predicted effects for the variables unique to our study.

To assess how comparative advantage influences union choice, HT, CTL, and CTK dummies are included where NR is the omitted category. The trade variables consist of the import share (M=imports/(imports+output)) and the export share (X=exports/output). The trade variables are from U.S. Department of Commerce data. Several industry variables are included to measure industry effects on the net benefits of union membership (e.g., the supply of unionism and the probability that a worker is hired from the queue). First, an international trade adjusted CR4 accounts for domestic product market power adjusted for imports and exports (CR4INT).[11] Industry dummy variables are included for durable goods (DUR) and nondurable goods (NONDUR) where the equipment, intermediate goods, and automobile producing industries are the omitted category (Lawrence, 1984). A steel dummy variable (STEEL) is also included. The three-year percent change in real industry output (RCHS) helps control for "temporary" shifts in the labor demand curve. (Freeman and Katz (1991) report that three-year changes seem to be the best choice.) For example, if domestic demand is growing rapidly, imports may increase even though the domestic industry is healthy, where RCHS accounts for this effect. Regional differences in labor markets and attitudes towards unions are captured by a dummy for the South (SOUTH). Similarly, dummies for residence in a metropolitan area (SMSA) and the unemployment rate multiplied by 10 (UNEMP) are also included.

Many individual characteristics are in **Y** to control for the demand for unionism and the

probability of being hired by a union employer. It is expected that less-skilled individuals will particularly desire union employment while firms will desire more skilled employees (DeFreitas, 1993). Years of completed education (ED) and dummies for part-time employment, marriage, health problems in the last year that affected the individual's work, and minorities (PART, MAR, HEALTH, MINOR) are included. Potential work experience along with its square are also added (EXP, EXPSQ). Occupational dummy variables represent professional and technical, managers, clerical, sales, craftsmen, operatives, and household and service workers (PROF, MANAG, CLER, SALES, CRAFT, OPER, SERV); laborers are the omitted category. Finally, the simple probit model controls for the worker's tenure and its square (TEN, TENSQ).

VI. Empirical Results.

Table 2, column (1) shows the descriptive statistics for the specific variables of each model. Column (2) reports the relevant parameter results for the non-queue or traditional univariate probit model. In general, the parameter estimates are consistent with results reported by previous studies. The sequential bivariate queuing model results follow in the next two columns. Column (3) reports the results for entering the queue and column (4) shows the results for being hired from the queue. Although these individual parameter estimates are not as precisely estimated as those of the simple probit, they are suggestive of separate worker and firm considerations. This point is shown by the union queue model being a statistically significant improvement over the simple reduced form probit model.[12]

The lack of any highly significant coefficient estimates in the entry into the queue model suggests that few specific individual characteristics determine the worker's entry decision. It may also reflect a diverse pool of workers queuing for manufacturing industries. This result is consistent with Farber and Saks (1980) who find that individual characteristics have little effect on worker's union voting preferences. Consequently, selection into the union sector is primarily dependent on the employer hiring decision, where the significant probit estimates in the hired from queue model imply that employers take advantage of the characteristics of the applicant pool.

The individual import and export parameter estimates are generally insignificant in all three cases. Nonetheless, since the data have been "stretched" by combining the NLS micro-data set with

aggregate industry data, the parameter coefficients and the t-statistics should be interpreted cautiously.[13,14] Specifically, in all three models, the export and import share variables are *jointly significant*, but are generally *individually insignificant*. Similarly, the HT, CTL, and CTK dummies are typically insignificant individually, but are jointly significant. Therefore, given the imprecision of the traditional hypothesis test, we utilize a likelihood ratio test to evaluate the *joint* restriction that the trade share and technological-based sectoral variables have no effect on union choice. The likelihood ratio test results for all three models are reported at the bottom of Table 2. Generally, these *joint* significance tests indicate that the trade share variables and the sectoral dummies influence union status as a group.

Table 3 illustrates the change in the probability of union choice after a one standard deviation change from the mean export share (mean = 9.3%, std. dev. = 7.3%) and the mean import share (mean = 8.3%, std. dev. = 7.7%), as well as the difference in union choice for the HT, CTL, and CTK sectors relative to the NR sector. Table 3 also describes how these probabilities were derived. Below, we will detail these trade and sectoral results.

Imports and Exports. For the non-queue model, Panel 1 of Table 3 shows that the probability of union coverage declines by 10.2% with a one standard deviation increase in the export share and increases by .6% with a one standard deviation increase in the import share. The results reflect the probit estimates in column (2) of Table 2. From Panel A of Table 1, the negative export effect implies that either uncertainty or strategic behavior effects dominate any product market effects. For imports, the positive relationship is consistent with the strategic behavior effect dominating, though the small import estimate suggests that, for the most part, the three effects offset.[15]

The non-queue model suggests that greater exports, not greater imports, have a negative influence on the likelihood an individual belongs to a union. Consequently, the real problem for the labor movement appears to be export expansion which was supposed to help offset union membership loss from imports. Moreover, the results seem to be weakly inconsistent with the experience in other industrial nations where greater trade has apparently not significantly weakened their labor movements.

To sort out how individual workers or firms alter their behavior in response to changes in the international environment, we turn to the union queue model's results. Panel 1 of Table 3 shows that

entering the union queue is negatively related to exports. For industries with high export shares, either increased trade exposure causes workers to view union employment as more uncertain or strategic behavior effects dominate entry into the union queue (Panel B of Table 1). Another possible explanation is that industries with a high export share tend to attract workers that have low taste parameters for unionization.

Imports also have a negative effect on entering the queue. This is consistent with the risk aversion argument, which suggests that workers perceive union employment as more risky in industries exposed to import competition (e.g., anti-union activities, lay-off, etc.). Alternatively, as import shares increase, product market effects dominate causing the union wage differential and, hence, union choice to decline as the import share increases. Overall, the negative influence of imports and exports are *both* consistent with greater trade increasing the risk of union employment, which suggests that greater trade may reduce the desire of workers join the union queue.

Panel 1 of Table 3 shows that the probability of being hired from the union queue is negatively related to the export share. The results are consistent with the uncertainty argument that unions cause export competition to become more risky, as hypothesized in Panel C of Table 1; and they are inconsistent with both the strategic behavior and product market effects. This suggests that firms resist unionization as their export share increases because management apparently views collective bargaining contracts as too costly (i.e., greater wage rates) or too confining for rapid response to maintain export competitiveness. This may be especially the case when the terms of international trade are rapidly changing.

The probability of being hired from the union queue is positively related to the import share. The import results are inconsistent with the arguments in Panel C of Table 1, since all three hypothesize a negative impact on the probability of being hired from the union queue. This result implies that import competition shifts employers' preferences from low wage nonunion workers to higher cost union workers--a counter-intuitive finding at first glance. Nonetheless, this still could be consistent with greater imports causing risk averse behavior. For example, Hirsch and Morgan (1994) found evidence that union firms may have been more risk averse than nonunion firms in the late 1970s where union

firms were able to shift their risk onto their unionized labor-force. In our case, this implies that if greater import competition increases uncertainty, the hiring rate of risk-averse union employers could be relatively greater than nonunion employers.

The union queue model is consistent with union claims that trade has been a factor--albeit a small factor--in the decline in union membership. The results, however, suggest that exports rather than imports have had the primary impact on union employment. The union queue results also show that trade's influence on union employment affects firm choice differently than worker choice (this issue cannot be identified using the ordinary probit model). The different pattern can be seen in the case of imports where the positive import response of employers is offset by workers' aversion to union coverage. Moreover, the negative impact of exports occurs because, not only are potential workers in the high export share industries less likely to enter the union queue, but also firms are less likely to hire union workers as their international market expands. Rather than export expansion offsetting the negative effects of import competition, such as the loss of jobs, exports have even further hindered the union movement. Consequently, it is understandable that union leaders feel threatened and oppose free trade measures such as NAFTA or GATT. They see no benefit for unions even if the free trade legislation provides the expected increase in exports.

The HT, CTL, and CTK Impact. Because the sectoral dummy coefficients are jointly significant, worker union choice appears to vary by sector of employment. After controlling for industry and individual characteristics, Panel 2 of Table 3 shows the difference in the non-queue union choice probability for each sector *relative* to the NR sector. These results are consistent with our *a priori* expectations. HT employees have a positive probability of joining a union, ceteris paribus. The CTL and CTK coefficients suggests that common-technology sector employees have the lowest likelihood of joining a union, especially workers in CTK industries. This result is not surprising since one would expect capital-intensive firms to substitute capital for higher cost union labor. Overall, the sectoral differences in international comparative advantage appear to be at least as important as the impact of trade shares in the determination of union status.

The results for the union queuing model parallel the standard probit estimates. Table 3 suggests

that HT workers are relatively more likely to join the union queue than CTL and CTK workers. The finding that CTL and CTK industry workers are less likely to enter the union queue probably reflects the perceived susceptibility of these sectors to greater domestic and foreign competition. Panel 2 also indicates that HT workers have the highest probability of being hired from the union queue (likely due to greater human capital) while CTL and CTK workers have the lowest probability of being hired from the union queue, which is likely due to greater foreign and domestic competition.

Panel 2 also shows that sectoral differences in union choice are influenced by the difference in the firm's willingness to hire from the queue as well as a worker's willingness to join the union queue (again, this cannot be identified in the ordinary probit model). The non-queue probit model suggests that a positive relationship appears to exist between a sector's product market power and the probability of its employees belonging to a union. As we can see from the queuing model, this is mostly due to a HT firm's relative desire to hire union workers and relative employee and employer aversion to unions in the CTL and CTK sectors.

These results imply that a cause of union decline in sectors threatened by international competition (e.g., in the case of textiles but not in the case of aerospace) is related to factors associated with the comparative advantage of the sector (e.g., technology or human capital). Thus, the technological factors that determine both sectoral comparative advantage and the relative degree of foreign technological convergence have an impact on union membership that is separate from the influence of the sector's trade share. Moreover, consistent pressure from international competition will likely force further industrial restructuring that should favor the HT sector at the expense of the CTL and CTK sectors. If there is any opportunity for unions to stabilize (or increase) their membership in the face of increasing international competition, it is in the HT sector. If unions were to focus their organizational efforts on these industries, they could likely offset the adverse impact they suffer from the trade share effects.

The sectoral results are consistent with Johnson and Stafford's (1993) claim that U.S. medium technology industries are under competitive pressures from foreign economic convergence. The resulting loss of quasi-rents in these industries hurt CTL and CTK union workers and reduced their

union membership. Foreign economic convergence in the common-technology industries can help explain why other industrial nations' union movements have not fared as poorly as in the United States. Presumably, the other industrial nations' economic convergence after World War II was concentrated in their common-technology industries. Because international convergence favorably influenced their common-technology sector, it did not pull down their union movement as in the United States. However, now that this convergence has run its course, other industrial nations' labor movements may increasingly feel the pressures that have been felt in the United States.

These results are also consistent with standard international trade theory where union workers in the higher skilled HT sector are predicted to fare better than union workers in the less skilled CTL and CTK sectors. Thus, if we were to only examine the effects of trade shares, we may incorrectly conclude that standard Heckscher-Ohlin trade theory has little impact.[16]

Lastly, the probit results suggest that workers in durable good industries are less likely to be unionized relative to the base group, while STEEL industry workers are more likely to be in a union. Moreover, the occupational dummy variables indicate that professional, managerial, clerical, and sales workers are less likely to be in a union than less skilled workers (as suggested by DeFreitas, 1993). The occupational estimates in the hired from the queue model also indicate that employer resistance prevents unions from organizing these occupations. Education is negatively related to union status in the simple probit, but surprisingly, this was mostly due to employer resistance to hire more educated union workers from the queue. The negative three-year change in the real shipments (RCHS) coefficient may indicate that union firms react to a perceived temporary increase in output by increasing overtime rather than hiring new workers from the union queue. Finally, the simple probit suggests that minorities, residents of metropolitan areas, and residents outside of the South are more likely to belong to a union.

VII. Conclusion.

This paper examines how international factors influence individual union choice. We presented a model that distinguishes between the effects of trade shares and the factors which influence international competitiveness in the determination of union choice. Overall, we found that firm hiring

from the union queue is a more significant determinant of union status than a worker's decision to join the union queue. The probit results, in general, find that exports have a greater negative influence on union choice than imports. One explanation is that greater export shares result in more uncertainty about union employment which reduces the probability of union choice by workers and employers. Similarly, greater imports reduce the likelihood that employees join the union queue, which is also consistent with worker risk aversion. Although there were exceptions, the product market and strategic behavior hypotheses were less satisfactory in explaining union status.

The study also divided manufacturing based on comparative advantage into HT, CTL, CTK, and NR sectors. The typical HT worker appears more likely to belong to a union than the typical CTL and CTK worker. The differing sectoral effects in union status were found to be consistent with Heckscher-Ohlin trade theory and they are at least as important as the effect of trade shares. Thus, if we were to only consider trade shares, the influence of international trade on worker union status would have been understated. Overall, the results suggest that international trade may have damaged unionism, but increasing trade is not a death knell for the union movement. If unions can adjust to industrial restructuring by increasing their organizational efforts in the expanding HT sector, unions may well offset the losses they have experienced due to declines of the CTL and CTK sectors.

Table 1
Summary of Union Status Models

Panel A
Reduced Form Univariate Probit

Model	Imports' impact on union status	Exports' impact on union status
Product Market/Rent Sharing: Predicts that imports (exports) are positively (negatively) related to labor demand elasticity and negatively (positively) related to profits. Thus, imports (exports) are negatively (positively) related to the union wage gap.	(-)	(+)
Strategic Behavior (End Game): Predicts that unions tradeoff current wages with the probability of future employment. Greater imports (exports) increase (reduce) the union wage gap.	(+)	(-)
Risk Aversion/Uncertainty: Predicts that greater trade increases the uncertainty of union members (and management's uncertainty).	(-)	(-)

Panel B
Bivariate-Partial-Observability Probit
Probability of Joining the Union Queue

Model	Imports	Exports
Product Market/Rent Sharing: See above.	(-)	(+)
Strategic Behavior (End Game): See above.	(+)	(-)
Risk Aversion/Uncertainty: See above.	(-)	(-)

Panel C
Bivariate-Partial-Observability Probit
Probability of Being Hired From the Union Queue

Model	Imports	Exports
Product Market/Rent Sharing: Predicts that greater imports (exports) reduce (increase) profits and (likely) union wages. This reduces (increases) the quality of the applicant pool, *ceteris paribus*, which increases (reduces) firm resistance to hiring union workers.	(-)	(+)
Strategic Behavior (End Game): Predicts that greater imports in a declining industry result in greater wages. This increases firm resistance to hiring more union workers. Greater exports in an expanding industry result in lower wages. This reduces firm resistance to hiring union workers.	(-)	(+)
Risk Aversion/Uncertainty: Predicts that greater trade increases uncertainty about the future prospects of the industry. Risk averse behavior by management increases firm resistance to hiring union workers.	(-)	(-)

TABLE 2
SELECTED MEAN VALUES AND PROBIT ESTIMATES[a]

	(1) MEANS (STANDARD DEV)	(2) NON-QUEUE PROBIT MODEL	(3) ENTER UNION QUEUE PROBIT MODEL	(4) HIRED FROM UNION QUEUE PROBIT MODEL
EXPLANATORY VARIABLES:				
UNTEN78	33.6		1.18	
	(53.0)		(0.80)	
UNTENSQ78	3935.7		5E-02	
	(8079)		(0.01)	
NUNTEN78	39.2		7E-02	
	(52.1)		(0.72)	
NUNTENSQ78	4249.2		-5E-04	
	(104.8)		(0.77)	
EXP78	11.5		-0.22	
	(4.12)		(1.10)	
EXPSQ78	150.3		-6E-02	
	(8102)		(0.75)	
ED78	12.8		-0.02	
	(2.50)		(1.02)	
MAR78	0.78		5E-02	
	(0.60)		(0.02)	
MINOR78	0.26		0.05	
	(0.44)		(0.15)	
HEATH78	0.08		0.56	
	(0.27)		(1.35)	
UNEMP78	57.0		-5E-02	
	(32.6)		(1.17)	
SOUTH78	0.39		-5E-03	
	(0.49)		(0.02)	
SMSA78	0.68		0.35	
	(0.47)		(1.03)	
PART78	8E-02		-0.33	
	(0.09)		(0.25)	
PROF78	0.13		-0.05	
	(0.47)		(0.06)	
MANAG78	0.09		2E-02	
	(0.29)		(0.01)	
CLER78	0.06		-0.40	
	(0.24)		(0.54)	
SALES78	0.04		0.29	
	(0.21)		(0.26)	
CRAFT78	0.26		0.30	
	(0.44)		(0.51)	
OPER78	0.35		-0.02	
	(0.40)		(0.04)	
SERV78	8E-02		0.18	
	(0.09)		(0.13)	
DUR78	0.04		-0.31	
	(0.19)		(1.05)	
NOND78	0.14		-0.27	
	(0.34)		(0.55)	
STEEL78	0.07		0.39	
	(0.25)		(0.53)	
HT78	0.30		-0.03	
	(0.43)		(0.04)	
CTL78	0.19		-0.39	
	(0.37)		(0.75)	
CTK78	0.27		-0.29	
	(0.44)		(0.69)	
NR78	0.24			
	(0.40)			
CR4INT78	36.8		-0.02	
	(11.9)		(1.30)	
RCHS78	20.6		-0.02	
	(12.7)		(1.24)	
M78	0.08		-3.23	
	(0.06)		(1.11)	
X78	0.08		-4.89	
	(0.06)		(0.86)	
TEN80	88.3	9E-02		
	(59.6)	(2.97)		
TENSQ80	11338	-3E-04		
	(12370)	(2.05)		
EXP80	13.5	0.09		-0.08
	(4.14)	(0.95)		(0.23)

TABLE 2 CONTINUED
SELECTED MEAN VALUES AND PROBIT ESTIMATES

	(1) MEANS (STANDARD DEV)	(2) NON-QUEUE PROBIT MODEL	(3) ENTER UNION QUEUE PROBIT MODEL	(4) HIRED FROM UNION QUEUE PROBIT MODEL
EXPLANATORY VARIABLES:				
EXPSQ80	199.3	-4E-02		-3E-02
	(121.0)	(1.26)		(0.28)
ED80	12.8	-0.09		-0.30
	(2.51)	(2.56)		(2.60)
MAR80	0.77	0.03		0.02
	(0.42)	(0.24)		(0.06)
MINOR80	0.26	0.32		-0.20
	(0.44)	(2.24)		(0.61)
HEATH80	0.06	0.13		0.58
	(0.23)	(0.54)		(0.31)
UNEMP80	63.0	2E-02		6E-02
	(35.4)	(1.16)		(1.40)
SOUTH80	0.39	-0.59		-0.48
	(0.49)	(4.44)		(1.33)
SMSA80	0.68	0.35		-0.31
	(0.47)	(2.73)		(0.09)
PART80	2E-02	-4.23		-4.01
	(0.05)	(0.08)		(0.01)
PROF80	0.13	-1.85		-2.30
	(0.33)	(4.91)		(2.63)
MANAG80	0.11	-1.50		-1.81
	(0.31)	(4.18)		(1.87)
CLER80	0.07	-1.13		-1.12
	(0.25)	(3.22)		(1.37)
SALES80	0.03	-1.87		-2.99
	(0.16)	(2.89)		(0.67)
CRAFT80	0.25	-0.17		-0.53
	(0.43)	(0.61)		(0.71)
OPER80	0.37	0.05		-0.05
	(0.48)	(0.18)		(0.07)
SERV80	4E-02	-0.56		-0.39
	(0.06)	(0.63)		(0.05)
DUR80	0.04	-1.10		-0.72
	(0.19)	(3.19)		(0.80)
NOND80	0.14	-0.07		0.32
	(0.34)	(0.36)		(0.50)
STEEL80	0.07	0.47		0.19
	(0.25)	(1.81)		(0.39)
HT80	0.30	0.17		0.98
	(0.43)	(0.69)		(1.11)
CTL80	0.19	-0.04		-0.12
	(0.37)	(0.21)		(0.21)
CTK80	0.27	-0.62		-1.03
	(0.44)	(3.17)		(2.10)
NR80	0.24			
	(0.40)			
CR4INT80	36.4	-5E-02		-8E-02
	(12.4)	(0.59)		(0.48)
RCHS80	2.0	-0.01		-0.23
	(14.3)	(1.87)		(1.34)
M80	0.08	0.20		4.04
	(0.08)	(0.17)		(1.05)
X80	0.09	-2.84		-5.29
	(0.07)	(1.98)		(1.12)
DEPENDENT VARIABLE:				
U80	0.41			
	(0.49)			
N	734			
Log-Likelihood		-346.7	-204.1	-204.1
Likelihood ratio tests:[b]				
1. X=M = 0		α=.1281 ($\chi^2_{(2)}$=4.11)	α=.0001 ($\chi^2_{(2)}$=199.9)	α=.0001 ($\chi^2_{(2)}$=204.8)
2. HT=CTK=CTL = 0		α=.0046 ($\chi^2_{(3)}$=13.04)	α=.0001 ($\chi^2_{(3)}$=203.2)	α=.0001 ($\chi^2_{(3)}$=197.8)

[a] Standard deviations and the absolute values of the t-statistics are in parentheses. The other variables in the specification are described in the text.

[b] The joint null hypothesis for the X=M = 0 or HT=CTK=CTL = 0 restriction can be rejected at the α observed significance level.

TABLE 3
THE IMPACT OF TRADE AND TECHNOLOGY ON THE PROBABILITY OF UNION COVERAGE

Panel 1
THE IMPACT OF A ONE STANDARD DEVIATION CHANGE IN THE EXPORT AND IMPORT SHARE ON THE PROBABILITY OF BEING IN A UNION

	EXPORTS Mean = 9.3% 1 std. dev. = 7.3%	IMPORTS Mean = 8.3% 1 std. dev. = 7.7%
NON-QUEUE PROBIT MODEL:[a]	-10.2%	0.6%
ENTERING UNION QUEUE MODEL:[b]	-8.7%	-5.1%
HIRED FROM UNION QUEUE MODEL:[c]	-2.0%	1.4%

Panel 2
THE IMPACT OF THE HT, CTL, AND CTK SECTORS COMPARED TO THE NR SECTOR[d]

	HT	CTL	CTK
NON-QUEUE PROBIT MODEL:	6.7%	-1.7%	-23.8%
ENTERING UNION QUEUE MODEL:	-0.6%	-7.5%	-5.6%
HIRED FROM UNION QUEUE MODEL:	4.1%	-0.5%	-4.2%

[a]The estimates are based on the coefficients in Table 2. The estimated impact of a one standard deviation change in the export share is measured by using the derivative of X. The estimated impact of a one standard deviation change in the import share is measured by using the derivative of M. The normal probability density function is evaluated at the sample mean union probability of 0.394. The pattern would be the same if the normal probability density function was instead evaluated at the mean for all of the variables.

[b]The entering union queue estimates are calculated in a manner similar to Abowd and Farber (1982). The estimates reflect measurements at zero tenure. This is done to offset the dominance of the tenure variables on the union choice decision. This adjustment only affects the magnitude of the estimates.

[c]The hired from union queue estimates are calculated in a manner similar to Abowd and Farber (1982).

[d]The estimates show how much each sector's probability of being union varies from the NR sector's probability (the omitted category).

NOTES.

1. Belman emphasized the influence of product market concentration on the union wage gap where he only controlled for the import share. Martinello and Meng, on the other hand, only considered Canadian data making it unclear how their results generalize to the United States. For example, one striking difference between Canada and the United States is Canadian labor law is decidedly more pro-union.

2. The exact opposite issue is whether unionization, in turn, influences export and import shares. However, Karier (1991) finds no evidence that union wages or coverage effect trade share levels.

3. Lee (1978) and Hirsch and Berger (1984) find a positive relationship between union choice and the union wage gap. Assuming workers have freedom over job choice, a union choice model is useful because unionization is one job characteristic which workers consider when deciding whether to accept a job (Hirsch and Berger, 1984). Union status can also change due to quits and certification and decertification drives. Hundley (1989) also discusses the effect of job attributes and occupation.

4. These studies generally find that four-firm concentration is positively related to individual union choice. Industry level data yield mixed results (e.g., Hirsch, 1982; Kahn, 1979).

5. Lawrence and Lawrence suggest that the steel and auto industries of the late 1970s and early 1980s are good examples of end game behavior by unions.

6. In the case of *union wages*, Partridge (1993) and Macpherson and Stewart (1990) find evidence consistent with product market effects offsetting strategic behavior effects. Lawrence and Slaughter (1993) summarize the literature regarding trade's impact on wages.

7. The classification directly follows from Partridge (1993), Arndt and Bouton (1987), and Lawrence (1984).

8. One reason for the CTL/CTK division is the Heckscher-Ohlin emphasis on the capital-labor ratio.

9. The HT/CTL-CTK union choice relationship should hold *after* controlling for the individual characteristics of the labor force. For example, HT (CTL, CTK) workers are more (less) educated on average and education is negatively related to union status.

10. Abowd and Farber provide more details of the interpretation of the coefficients and the interpretation of the model given that many union employees have job rights to their positions.

11. Let S, X, and M equal domestic output, exports, and imports. Then CR4INT equals: $CR4INT = CR4 \cdot ((S-X)/(S+M-X))$. Industry output is derived from U.S. Bureau of the Census (a and b) and industry CR4 is from U.S. Bureau of the Census (b) and Weiss and Pascoe (1986).

12. The standard probit model places 28 restrictions on the union queue model. As shown in Table 2, the negative of the log likelihood ratio for the standard probit is 346.7, and for the union queue model it is 204.1. This gives a likelihood ratio statistic of 285.2 with 28 degrees of freedom, which suggests that the restrictions are significant at the 0.001% level.

13. There are two offsetting considerations when using aggregate industry level data in a micro data set. First, Greenberg *et al* (1989) argue that data stretching of this type leads to an errors-in-variables problem which leads to parameter estimates that are biased towards zero. Since the estimates are smaller than the true parameter values, the results should be interpreted as a lower bound estimate. Second, Moulton (1990) shows that if the random disturbances within variable groups are correlated, then the standard

errors are downward biased and the t-statistics are inflated.

14. The t-statistics for the individual trade variable coefficients may also give a misleading indication of their statistical significance due to a high correlation between imports and exports that result from a high degree of *intra*-industry trade.

15. Previous reduced form probit results have found imports to be negatively related to union status (Belman, 1988; Martinello and Meng, 1992). However, these studies did not consider exports.

16. Traditional Heckscher-Ohlin trade theory suggests that trade's effect depends on the factor intensity of the sector (e.g., high skilled versus less skilled labor), not the import or export share of the sector.

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