

NBER WORKING PAPER SERIES

THE EFFECTS OF INTERNATIONAL COMPETITION ON COLLECTIVE BARGAINING OUTCOMES:
A COMPARISON OF THE UNITED STATES AND CANADA

John M. Abowd

Thomas Lemieux

Working Paper No. 3352

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
May 1990

The author acknowledges financial support from the Ford Foundation and the NSF (Grant Number 88-13847 to Abowd), and the Industrial Relations Section at Princeton University. This research was begun while the authors were at the Industrial Relations Section, Princeton University. They thank David Card for providing a clean version of the Labor Canada wage tape. They thank Charles Beach, David Card, Henry Farber, Richard Freeman, Harry Gilman, Lawrence Katz, W. Craig Riddell, and Gregory Schoepfle for comments on previous drafts. This paper is part of NBER's research programs in International Studies and Labor Studies. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

NBER Working Paper #3352
May 1990

THE EFFECTS OF INTERNATIONAL COMPETITION ON COLLECTIVE BARGAINING OUTCOMES:
A COMPARISON OF THE UNITED STATES AND CANADA

ABSTRACT

We study the effects of import and export competition on collectively bargained wage settlements and bargaining unit employment from the sixties to the mid-eighties for the United States and Canada. Both value-based and price-based measures of international competition are considered. We distinguish between the expected effects of increased international trade on new collective bargaining agreements and the realized effects over the life of existing agreements. Using value-based trade measures, the estimated effect of an increase in import domestic market share, holding constant the rate of growth of the domestic market, is negative for employment in both countries and exceeds the effect of a comparable change in the size of the domestic market. The import effect on wage rates is also negative for the United States but not for Canada. The import wage effect in the U.S. is also larger than the effect of a comparable change in the domestic market size. The estimated effect of increased export growth is positive for employment in both countries. The export effect on employment is comparable in magnitude to the effect of a change in the size of the domestic market. The export effect on wage rates is mixed-weakly positive for the U.S. and ambiguous for Canada. For Canada, we also estimate world price effects. Increases in the world import price index for the industry are associated with increased union employment. Increases in the world import price index for the industry are associated with increased union employment and lower wage settlements.

John M. Abowd
School of Industrial and Labor
Relations and Johnson Graduate
School of Management
264 Ives Hall
Cornell University
Ithaca, NY 14851-0952

Thomas Lemieux
Department of Economics
MIT
Cambridge, MA 02139

The decade of the seventies heralded the latest era of product and labor market globalization with renewed internationalization of the United States economy.¹ Canada, which has long been a very open economy, also experienced substantially increased internationalization during this decade.² The two countries have very substantial bilateral trading activity. Canada is the largest single destination of U.S. exports and the second largest source of U.S. imports (after Japan). In the seventies Canada was the largest destination and origin of U.S. traded goods.³

The growing importance of internationally traded goods in the United States economy and the continuing importance of such goods in the Canadian economy are displayed in Figure 1. The figure shows exports plus imports as a percent of Gross National Product in 1960, 1970 and 1980 for both countries. That the Canadian economy is three or four times more open than the U.S. economy is directly evident from examining Figure 1.⁴ The figure also indicates that the Canadian economy experienced very significant increases in its openness over this time period—imports plus exports grew from less than forty percent of GNP to almost sixty percent. In the United States imports plus exports grew from about seven percent of GNP to over twenty percent during this period. The sixties and seventies, therefore, represents a period of increasing international economic activity for both the U.S. and Canadian economies. Both countries experienced changes in economic openness during this period large enough to have detectable effects on the domestic labor market.

For the last two decades the highly unionized Canadian manufacturing sector⁵ and the less unionized United States manufacturing sector have become more integrated into both the North American and world markets. The share of imported manufactured goods in apparent Canadian consumption has increased

from 22 percent to 31 percent over this period. Similarly, exports as a share of Canadian manufacturing production have more than doubled. Much of the increased integration of the North American economy occurred in the transportation equipment industry, which is covered by a 1965 bilateral agreement between the U.S. and Canada that eliminates most tariffs in both directions. Canadian transportation equipment imports rose from 28 percent of apparent domestic consumption in 1960 to 51 percent in 1968 to 65 percent in 1983. Canadian transportation equipment exports also rose, from 14 percent of domestic production in 1960 to 48 percent in 1968 to 67 percent in 1983. In the United States transportation equipment imports increased from two percent of apparent domestic consumption in 1960 to 18 percent in 1983 while exports increased from six percent of domestic production to 14 percent in 1983. The increased bilateral trade in many other U.S. and Canadian industries, although not as substantial as the increased trade in transportation equipment, supports our premise of increased integration of the North American economy.

In Canada the effect of international competition on unionized domestic workers is regarded as a macroeconomic question susceptible to analysis using the tools of open economy international trade theory.⁶ In the United States, the effect is generally regarded as a microeconomic question susceptible to analysis on an "impacted industry" basis.⁷ This paper is an attempt to blend these two views. Like the Canadians, we will estimate equations for the average effect of international competition on unionized wages and employments.⁸ Like other U.S. researchers, we will model the microeconomic basis for the trade effects.⁹

Our study addresses the relations among international product market competition and the outcomes of domestic collective bargains. We have three specific goals. First, we quantify the effects of import and export

competition on the wages and employment of unionized domestic workers using comparable data for the U.S. and Canada. Second, we compare the magnitude of the estimated effects to a reference value—the effects of a comparable change in domestic shipments—to determine if the trade effects are relatively large. Finally, for Canada we compare the estimated effects of value-based measures of import and export activity to the estimated effects of price-based measures, which may be more appropriate from a theoretical viewpoint.

Using value-based trade measures, the estimated effect of an increase in import domestic market share, holding constant the rate of growth of the domestic market, is negative for employment in both countries and exceeds the effect of a comparable change in the size of domestic shipments. The import effect on realized real union wage rates is also negative for the United States but not for Canada. The import effect on real wage rates in the U.S. is also larger than the effect of a comparable change in the domestic market size. The estimated effect of increased export growth is positive for bargaining unit employment in both countries. The export effect on employment is comparable in magnitude to the effect of a change in the size of the domestic market. The export effect on real wage rates is mixed—weakly positive for the U.S. and ambiguous for Canada. Increases in world export price indices are associated with increased union employment in Canada. Increases in world import price indices are associated with increased union employment and lower wage settlements in Canada. All of the estimated world price effects on the Canadian unionized labor market are consistent with the estimated effects of based upon value-based export and import measures for that economy.

The Role of International Competition in Collective Bargaining

International competition may influence domestic collective bargaining in two ways. First, to the extent that foreign manufactured products are good substitutes for domestically manufactured products, domestic firms must compete for global market share. Within the domestic product market, import competition reduces the effective extent of union organization in an industry and may reduce the quasi-rents available to existing bargaining units. Within foreign product markets, exports work in the opposite direction to increase the effective extent of union organization in an industry and possibly to increase the quasi-rents available to domestic bargaining units. Second, as substitute foreign manufactured products gain market share within the domestic product market, complementary services—wholesale distribution, retail distribution, and repair—also gain market share. The expansion of service employment opportunities may create quasi-rents that could promote the formation of new bargaining units in these industries. This paper deals only with the direct competition effects of imports and exports on unionized workers in domestic labor markets. We do not consider the indirect effects of service sector expansion.¹⁰

The major direct effects of international competition on unionized workers occur because either the union wage rate falls (relative to what it would otherwise have been) or there are employment displacements, which may be associated with unusually long unemployment spells and/or wage reductions on re-employment. We consider only direct wage costs and direct bargaining unit employment effects. We do not examine unemployment spell length or re-employment wage rates. The major direct benefit to worldwide consumers is lower average product prices in the markets where there is substantial international competition. We do not measure this benefit to the consumer,

although this is certainly an essential component of any policy prescription arising from this research.

A bargaining unit is an ongoing relationship between a union and a financially viable employer.¹¹ The union represents the interests of the organized employees. The management represents the interests of the shareholders and other ultimate beneficial owners. For simplicity, the claims of other factors of production are ignored. During the negotiations that accompany the expiration of an existing collective bargaining agreement, management and the union use current information to form an estimate of the total value of the productive enterprise for which they represent competing interests. A collective bargaining outcome consists of explicit and implicit rules concerning the allocation of resources (employment) and the division of the resulting quasi-rent between union members and shareholders (wage rates) that is expected to remain in force for some fixed term.

If international competition is expected to have an adverse effect on the firm's future profitability,¹² then the current collective bargaining agreement will reflect that expectation. If the expected effects of international competition are too severe, the bargaining unit may disappear so that the evidence on surviving bargaining unit settlements will not reflect a complete analysis of either employment or wage effects. If the international competition is expected to improve the firm's future profitability, current bargaining units should be favorably affected.

In this paper we measure the expected effects of increased foreign competition on the future value of the firm using the relation between future revenues (of organized employers) and current information on domestic shipments, apparent domestic consumption, exports and imports in the employer's product market. We consider two collective bargaining

outcomes—bargaining unit employment and wage settlements. Bargaining unit employment is measured as the ex post growth rate of workers in the bargaining unit over the life of the new the collective bargaining agreement, excluding retirees and including members with recall rights.¹³ Wage settlements are measured as the realized growth rate of real wage rates over the life of the agreement for the largest group of workers in the bargaining unit. We measure the effects of predictable increases in international competition on bargaining outcomes by relating employment growth and real wage growth during a collective bargaining agreement to the growth of apparent domestic consumption, exports, and imports expected to prevail during the life of the agreement. We measure the effects of unpredicted changes in international competition by relating the same outcomes to unexpected changes in domestic consumption, exports, and imports over the life of the agreement.

In an open economy union employment and wage rates within internationally competitive industries should respond to changes in the world market for manufactured goods. In general, we would expect these changes to depend upon the world prices of traded goods. Although the importance of using world prices in modeling the effects of international trade on domestic labor markets has been recognized for some time,¹⁴ most empirical analyses of the United States use import penetration ratios and export supply ratios as the main indicators of changes in the international environment.¹⁵ In this paper we also consider the effects of changes in the world price of exports and imports on union employment and wage rates using our Canadian sample. We use Canadian data for two reasons. First, properly constructed price indices exist for a much longer time period in Canada than in the U.S. Second, the Canadian economy is substantially more open than the U.S. economy. Our analysis thus permits examination of the consequences of using a variety of

measures of international trade—value- and price-based—on the resulting estimates of employment and wage sensitivity.

A Model for the Effects of International Trade on Union Wages and Employment

We begin at the bargaining unit level. Consider the effects of increased international trade on the present value of the quasi-rents accruing jointly to the employer firm and union members. The quasi-rents are measured as the difference between net revenue¹⁶ and the cost of employment. The cost of employment is evaluated at an external or market wage rate and not at the negotiated wage rate. For firm j in year t let:

- R_{jt} = net revenue of firm j in year t
- L_{jt} = union employment of firm j in year t
- M_{jt} = total employment of firm j in year t
- w_{jt} = negotiated wage rate of firm j in year t
- z_{jt} = any exogenous variable for firm j in year t
- r_t = one year discount rate in year t
- x_t = annual opportunity cost of employment in year t
- q = length of collective bargaining agreement.

If year t is the initial year of a new collective bargaining agreement, then over the next q years the present value of the quasi-rents may be expressed as:

$$V_{jt} = \sum_{i=1}^q \frac{(R_{jt+i} - x_{t+i}M_{jt+i})}{(1 + r_t)^i}$$

Since V_{jt} measures the total quasi-rent available to the employer firm and union, if increased import or export activity affects V_{jt} , then wage settlements and union employment will be affected by this activity.

Alternatively, if increased international trade has no effect on V_{jt} , then neither wage settlements nor union employment should be affected. The present

value of the quasi-rents accruing to the bargaining unit captures the relevant total value of the enterprise, which may be divided among various claimants, including union members.¹⁷ If the total value increases because of increased export activity, then the potential exists for greater union employment or wage settlements as a consequence of this export activity. Alternatively, if increased import competition lowers V_{jt} , then there is a presumption that lower employment and/or wage settlements should occur.

To make these arguments concrete consider the effects of a change in real industry shipments. Changes in real industry shipments due to external demand shocks should cause industry employment and total quasi-rents to move in the same direction as industry shipments. If existing firms each represent a constant fraction of industry output, then firm level employment and total quasi-rents should also change in the same direction as the change in industry output. The effect of a change in industry output on the negotiated wage rate is less clear. An increase in industry output could be associated with an increase or decrease in quasi-rents per worker. Since the negotiated settlement divides the quasi-rents per worker between the firm and the union members, an increase in quasi-rents per worker ought to be associated with higher wage settlements while a decrease in quasi-rents per worker ought to be associated with lower wage settlements, all other things equal.

These predictions can be derived explicitly from a simple version of an efficient bargaining relation between the employer firm and the union members. Assume that the firm is fully unionized. Suppose the revenue that accrues to the firm is given by the function:

$$R(L) = \alpha L - \frac{\theta}{2} L^2$$

An efficient bargain chooses L to maximize $R(L) - xL$ and sets w to divide the maximized quasi-rents in the proportion γ to the union and $1 - \gamma$ to the owners

of the firm. The resulting values for total quasi-rents, employment, and the negotiated wage rate are:

$$V = \frac{\theta}{2} \left[\frac{\alpha - x}{\theta} \right]^2$$

$$L = \left[\frac{\alpha - x}{\theta} \right]$$

$$w = x + \frac{\gamma \theta}{2} \left[\frac{\alpha - x}{\theta} \right]$$

In this simple model any increase in demand for the firm's product would be modeled as an increase in α . As the equations for V , L , and w show, increases in α are associated with higher total quasi-rents, higher employment and higher negotiated wage rates. Notice that the wage settlement awards each union member the same percentage of the quasi-rents per worker (γ) as overall negotiation determined. In the quadratic revenue model an increase in quasi-rents is always associated with an increase in quasi-rents per worker so that the negotiated wage rate must increase; however, general functional forms for the revenue equation do not imply this particular result.

Consider next the effects of a change in the world prices of imports and exports on the output of a particular industry. Assume that the domestically produced goods are Hicks-substitutes for the imported goods and that the exported goods are identical to the domestically produced and consumed goods. Then, an increase in the world price of industry imports results in substitution away from the imported goods and into the domestically produced goods within the industry. This should increase domestic output within the industry. Hence, employment and total quasi-rents should increase for the existing firms within the industry. Negotiated wage rates will increase or decrease depending upon whether or not quasi-rents per worker increase or decrease. An increase in the world price of exports results in expansion of

domestic industry output along the industry supply curve. Hence, employment and total quasi-rents should increase for the existing firms within the industry. Again, the movement in negotiated wage rates will depend upon what happens to quasi-rents per worker.¹⁸

An Empirical Specification for Bargaining Unit Level Data

In order to give our model empirical content, we must specify relations connecting the exogenous economic factors (industry output, value-based trade measures, import prices and export prices) to the total quasi-rent, employment, and wage rate outcomes. We will not use comparable quasi-rent data for the United States and Canada; hence, our empirical models will consider only bargaining unit employment and wage rates. We deal with three important practical problems in developing our estimating equations.

First, since the model is developed for application to bargaining unit data, the employer firms may have heterogeneous shares of output within the domestic industries and may face heterogeneous industry demand elasticities with respect to import and export price changes. There are insufficient data to attempt estimation of separate elasticities for each major industry. Instead, we formulate the model to permit estimation of the employment-weighted average elasticities across all domestic manufacturing firms in the sample for each country.

Second, since nominal wage rates are renegotiated infrequently relative to changes in the economic environment, we distinguish between the effects of expected and unexpected changes in the exogenous variables. Expected changes in the exogenous variables are movements forecast in advance of the current negotiation. The effect of expected changes is captured by including the forecasted value of the exogenous variable, conditional on information available at the time of contract renegotiation, among the explanatory

variables in the wage and employment equations. Unexpected changes in exogenous variables are the difference between movements realized over the life of the new agreement and the forecast of these movements formed during the negotiation of the agreement. The effect of unexpected changes is captured by including the forecast error among the explanatory variables.

Third, since the important outcomes are not observed at frequent, equally-spaced, synchronous intervals, we specify a set of relations that can be estimated using observations on the relevant variables that are measured in contract time. This allows us to estimate the models using vector autoregressions linking the annualized rates of change in the dependent and exogenous variables.

In order to distinguish between the expected effects of economic factors on collective bargaining outcomes and the realized effects of these changes over the life of an existing agreement, we decompose exogenous economic variables into expected and unexpected components. For any exogenous variable z_{jt} , we assume that the level follows a discrete martingale, so that:

$$E[z_{jt+q} | z_{jt}] = z_{jt}$$

for any positive q . Then, write the logarithm of union employment, and wage settlements as of the end of a contract that begins at date t and expires at date $t + q$ as:

$$\ln L_{jt+q} = E[\ln L_{jt+q} | \ln L_{jt}, \ln w_{jt}, z_{jt+q}, z_{jt}] + u_{1jt+q}$$

$$\ln w_{jt+q} = E[\ln w_{jt+q} | \ln L_{jt}, \ln w_{jt}, z_{jt+q}, z_{jt}] + u_{2jt+q}$$

If the conditional expectations are log-linear in the levels of the underlying variables, then:

$$\begin{aligned} \ln L_{jt+q} = & \beta_{j11} + \beta_{j12} \ln L_{jt} + \beta_{j13} \ln w_{jt} + \beta_{j14} z_{jt} \\ & + \beta_{j15} (z_{jt+q} - z_{jt}) + u_{1jt+q} \end{aligned}$$

$$\begin{aligned} \ln w_{jt+q} &= \beta_{j21} + \beta_{j22} \ln L_{jt} + \beta_{j23} \ln w_{jt} + \beta_{j24} z_{jt} \\ &+ \beta_{j25} (z_{jt+q} - z_{jt}) + u_{2jt+q} \end{aligned}$$

where the average of the coefficients β_{jrs} must be estimated and the error vector u_{jt} should be vector white noise. Our specification allows for firm specific factors, summarized by the average elasticities in the log-level equations. We difference this specification across collective bargains for the same firm and correct for the differences in contract length. This produces the following estimating equations:

$$\begin{aligned} (1a) \quad \Delta \ln L_{jt} &= \bar{\beta}_{12} \Delta \ln L_{jt-q} + \bar{\beta}_{13} \Delta \ln w_{jt-q} \\ &+ \bar{\beta}_{14} \Delta z_{jt-q} + \bar{\beta}_{15} (\Delta z_{jt} - \Delta z_{jt-q}) \\ &+ \Delta u_{1jt} + (\beta_{j12} - \bar{\beta}_{12}) \Delta \ln L_{jt} + (\beta_{j13} - \bar{\beta}_{13}) \Delta \ln w_{jt} \\ &+ (\beta_{j14} - \bar{\beta}_{14}) \Delta z_{jt} + (\beta_{j15} - \bar{\beta}_{15}) (\Delta z_{jt+q} - \Delta z_{jt}) \\ (1b) \quad \Delta \ln w_{jt} &= \bar{\beta}_{22} \Delta \ln L_{jt-q} + \bar{\beta}_{23} \Delta \ln w_{jt-q} \\ &+ \bar{\beta}_{24} \Delta z_{jt-q} + \bar{\beta}_{25} (\Delta z_{jt} - \Delta z_{jt-q}) \\ &+ \Delta u_{2jt} + (\beta_{j22} - \bar{\beta}_{22}) \Delta \ln L_{jt} + (\beta_{j23} - \bar{\beta}_{23}) \Delta \ln w_{jt} \\ &+ (\beta_{j24} - \bar{\beta}_{24}) \Delta z_{jt} + (\beta_{j25} - \bar{\beta}_{25}) (\Delta z_{jt+q} - \Delta z_{jt}) \end{aligned}$$

where:

$$\begin{aligned} \bar{\beta}_{rs} &= \text{employment-weighted average of } \beta_{jrs} \\ \Delta \ln L_{jt} &= (\ln L_{jt+q} - \ln L_{jt})/q \end{aligned}$$

and similarly for $\Delta \ln w_{jt}$ and Δz_{jt} .

Equations (1a) and (1b) form the basic statistical model used in our analysis. The equations are a vector autoregression relating changes in union employment and wage settlements over the life of the agreement running from t to $t + q$ to lagged changes in these variables, lagged changes in exogenous variables and the innovation in exogenous variables that occurs between t and $t + q$. The last two lines of equations (1a) and (1b), respectively, show the complete error structure. We assume that the bargaining unit specific error

in each elasticity ($\beta_{jrs} - \bar{\beta}_{rs}$) is uncorrelated with all of the right hand side variables in each equation. Furthermore, we assume that the heteroscedastic error structure implied by equations (1a) and (1b) can be adequately corrected by a weighted least squares estimator in which the weight is the size of the bargaining unit at time t. We do not require that the effects of expected changes in exogenous variables and the effects of innovations in those variables be identical.

One of the key exogenous variables in the empirical analysis is industry shipments. The rate of growth of real industry shipments can be decomposed into a weighted combination of the rate of growth of real apparent domestic consumption, the rate of growth of real exports, and the rate of change of the import penetration ratio. This decomposition is given by:

$$(2) \quad \Delta \ln S_{jt} = \frac{(S_{jt} - X_{jt})}{S_{jt}} \Delta \ln D_{jt} + \frac{X_{jt}}{S_{jt}} \Delta \ln X_{jt} - \frac{D_{jt}}{S_{jt}} \Delta \ln IPR_{jt}$$

where S_{jt} is total real shipments for industry j in year t; X_{jt} is real exports; M_{jt} is real imports; D_{jt} is real apparent domestic consumption ($D = S + M - X$); IPR_{jt} is the import penetration ratio ($IPR = M/D$); and the discrete differencing operation is defined in the notes to equations (1).¹⁰ When the separate components of this decomposition (multiplied by the indicated weights) are used in the analysis instead of the rate of growth of real industry shipments, the coefficients on the rate of growth of real apparent domestic consumption and real exports should be the same and equal to the coefficient on real shipments. The coefficient on the change in the import penetration ratio should be equal in magnitude and opposite in sign to the coefficients on apparent domestic consumption and exports. The equations including the value-based international trade measures are interpreted as measuring the effects of increased export and import activity for a given level of apparent domestic consumption.

Description of Data

A detailed description of the methods used to form the bargaining outcome, international trade and other exogenous variables is contained in the Data Appendix and the references therein. Table 1 contains a summary of the primary data sources for the United States and Canada.

For the United States we used data from 2,515 collective bargaining agreements representing 250 bargaining pairs in the manufacturing sector for the years 1959 to 1984. The path of the realized nominal wage rate over the life of the collective bargaining agreement and the level of employment at the beginning of the agreement were extracted from the Major Collective Bargaining Agreements file developed by Vroman (1982, 1984, 1986) based on Current Wage Developments.

For Canada we used data from 2,258 collective bargaining agreements in Canadian manufacturing representing 299 bargaining pairs in the manufacturing sector for the years from 1968 to 1983. The path of the realized real wage rate over the life of the agreement and the level of employment at the beginning and end of the contract period were taken from a version of the Labour Canada wage tape based on the Collective Bargaining Review (see Card 1988).

Table 2 contains a summary of the basic definitions of the dependent variables—bargaining unit employment and real wage growth rates. Table 2 also contains summary definitions of the growth rates of real industry shipments, real apparent domestic consumption, and real exports. Finally, the table defines the change in the import penetration ratio.

The timing of our measures of collective bargaining outcomes and exogenous variables is based on the effective date of the current collective bargain. To measure a realized change we must observe bargaining unit

employment, real wage rates, and all exogenous variables at two points in time. Of necessity, there is some arbitrariness in the timing conventions used. In selecting intervals over which to calculate the realized changes we tried to use the available contract and exogenous information in a manner that permitted distinguishing the estimated effects of changes that were known prior to the settlement of the current contract and changes that occurred over the life of the current contract.

In order to understand the timing of the various measurements, Figure 2 shows a time line for an arbitrary three-year September contract effective in year t . The relative dates of measurement for all variables and the value labeled t , $t-3$, and $t+3$ are all shown on the figure. The figure illustrates that the change in the real wage rate is taken between the last month of the current contract (dated $t+q$) and the last month of the previous contract (dated t). Employment changes are measured between the effective month of the next contract (dated $t+q$) and the effective month of the current contract (dated t). Monthly exogenous data (average hourly earnings) are measured as of three months before the effective date of the current contract (dated t). Annual exogenous data are measured using the year that overlaps with the effective date of the current contract (dated t).

Table 3 presents comparative summary statistics for the United States and Canada. The period covered is longer for the United States. There are more Canadian bargaining units but fewer Canadian contracts. U.S. bargaining units are larger, reflecting both the prevalence of larger establishments and the difference in the BLS cutoff for inclusion in Current Wage Developments (1,000) versus the Labour Canada cutoff for inclusion in Collective Bargaining Review (500). Real wages grew faster in Canada but employment fell faster in the U.S. Although real exports and import penetration both increased faster

in Canada, the time series variability of the U.S. and Canadian international trade statistics swamps the difference in averages.

Results of Value and Price Analyses

Table 4 reports the estimated effects of value-based international trade measures on the bargaining unit employment growth rate in the U.S. and Canada. The estimated effect of the expected change in the log of real shipments on employment growth is much larger for Canada than for the United States indicating that the basic employment equation is more output sensitive in Canada. For both the United States and Canada the effect of an expected change in real exports is comparable in magnitude and direction to the same size change in shipments. Employment growth is not affected by the destination of domestic production. The estimated effect of import penetration on employment growth is negative, which is the expected direction from equation (2); however, the magnitude is greater than the magnitude of the effect of a change in real shipments. Employment growth is slowed more severely by import penetration than a comparable change in shipments.

The pattern of the estimated effects of unexpected changes in shipments and its components on employment growth is comparable to the effects of expected changes in these variables. In the United States, employment growth is somewhat more sensitive to unexpected changes in exports than to unexpected changes in shipments. Employment growth in the U.S. is substantially more sensitive to unexpected changes in import penetration than to unexpected changes in shipments generally. Employment growth in Canada responds with about the same sensitivity to unexpected changes in real shipments, real exports, and import penetration.

Table 5 reports the estimated effects of value-based international trade measures on bargaining unit real wage rate growth in the U.S. and Canada. The

estimated effect of the expected change in the log of real shipments on employment growth is positive for the United States but negative for Canada. The finding implies that quasi-rents per worker move in opposite directions when expected output growth increases in the manufacturing establishments of the two countries. For the United States the effect of an expected change in real exports is comparable in magnitude and direction to the same size change in shipments. For Canada the direction of the export effect is consistent with the shipments effect but the magnitude is larger. For the U.S. the estimated effect of an expected change in import penetration on real wage growth is negative and very substantially larger in magnitude than the comparable change in real shipments.²⁰ For Canada the estimated effect of import penetration on real wages has sign and magnitude consistent with the real shipments effect. Increased import competition in Canada is associated with increased, not decreased, real wage rates.

The pattern of the estimated effects of unexpected changes in shipments and its components on real wage growth is not generally comparable to the estimated effects of the expected changes. In the United States, real wage growth is less sensitive to unexpected changes in real industry shipments although the effect is still positive. In Canada, the estimated effect of unexpected changes in real industry shipments on real wage rates is positive. The finding implies that for both the U.S. and Canada quasi-rents per worker increase when there is an unexpected increase in output. The size and magnitude of the estimated effect of unexpected changes in real exports are comparable to the estimated effects of expected changes in exports for the U.S. For Canada unexpected increases in real exports are associated with higher real wage rates, which is consistent with the sign and magnitude of the unexpected change in real shipments. For both countries unexpected increases

in real imports are associated with decreased real wage growth. The magnitude of this effect in the U.S. is substantially larger than the effect of unexpected changes in shipments.

Table 6 reports the estimated effects of changes in world prices on collective bargaining outcomes in Canada.²¹ The estimated effect of increases in the expected world import and export prices is to increase bargaining unit employment. The same is true of the estimated effect of unexpected increases in the world prices on employment growth. All four of these results are consistent with Canada's position as a (relatively) small open economy. Increases in the world prices of Canadian exports stimulate Canada production, which increases employment. Increases in the world prices of Canadian imports also stimulate Canadian production (presumably in response to substitution in consumption away from the imported goods).

The estimated effect of world prices (both imports and exports) on real wage rates is negative. For the expected changes in world prices, these estimated effects are consistent with the negative effect of real shipments on real wage rates; however, for the unexpected changes in world prices, the negative estimated effect on wage rates is the opposite of the estimated effect of unexpected changes in real shipments.

Conclusions

We have estimated very comparable bargaining unit level models for the effects of international competition on union employment and wages in the United States and Canada. In the U.S. and Canada union employment increases when exports increase by about the same amount as one would predict from the estimated effect of industry shipments on union employment. On the other hand, union employment declines in response to an increase in import competition by substantially more than one would predict from the estimated

industry shipment effect and the identity connecting shipments, domestic consumption, imports and exports. The result suggests that import competition has large employment effects in unionized establishments—larger than the effects one would predict by mechanically assuming all imports replace domestic production dollar for dollar.

In the United States real union wage rates are equally sensitive to increased shipments or exports; however, real union wage rates fall more in response to an increase in import penetration than one would predict from the knowledge of the shipment effect on real union wage rates.²² In Canada, real wage rates move in the opposite direction in response to expected and unexpected changes in shipments, exports and imports. The estimated export and import effects on real wage rates in Canada are consistent with the shipments finding. The effects of exports on Canadian real wage rates are larger than the effects of imports. The pattern and relative magnitude of the estimated price effects for Canada is very consistent with the estimated value-based effects.

The major similarity between the U.S. and Canadian experience, as summarized by the statistical evidence presented here, is in the employment effects of import competition. For bargaining units in both countries, increased import penetration is associated with very large employment effects. The major dissimilarity between the U.S. and Canada can be found in the effects of expected changes in international competition on real wage rates. For the U.S. increase import competition is associated with relatively large decreases in real wage rates but increased export activity is associated with real wage changes of modest magnitude. For Canada, the import competition effects on real wage rates are modest but the export effects are relatively large and in the opposite direction of the estimated effects for the U.S.

Although we have not provided all the pieces required to analyze whether the consumers benefit enough from the increased trade to offset the effects of that trade on the domestic labor market, it is clear from all of our analyses that the union employment effects of increased import penetration are substantial. The finding certainly explains the widespread protectionist sentiment within union leadership. Furthermore, for the U.S. at least import competition does appear to have created competitive pressures that resulted in lower union real wage rates. In Canada, the openness of the economy makes the domestic labor market susceptible to changes in the world prices of many manufactured goods.

The estimated responses of Canadian bargaining units to world price changes are predictable from the small open economy international trade model. Furthermore, the Canadian results using the value-based and price-based international trade measures are essentially the same. This suggests that although working with price data is theoretically preferable, the biases associated with the value-based measures may not be severe. Given the similarity of the estimated U.S. and Canadian employment responses to changes in the value-based international trade measures, bargaining units in the United States may now be operating in a more open economy than in previous decades.

Data Appendix

United States Data

Import and Export Values by Industry

Imports as a percent of apparent domestic consumption for the period from 1958 to 1984 were derived from the Bureau of Labor Statistics Trade Monitoring System and the Bureau of the Census biennial report U.S. Commodity Exports and Imports as Related to Output. For the period from 1972 to 1981 the Bureau of Labor Statistics maintained a collection of times series called the Trade Monitoring System that was designed to provide current information on U.S. imports, the ratio of imports to domestic shipments plus imports, exports, and the ratio of exports to domestic shipments on a detailed industry basis. See Schoepfle (1982) for a report on the development and uses of these data. His appendix contains numerous details of the calculations. See Bennett (1982, available on request from the Department of Labor) for details of the data base construction. We used the NBER Trade and Immigration Data Files (Abowd, this volume) for the period from 1958 to 1971 and 1982 onward.

Output Prices and Quantities by Industry

Industry output was measured at the four digit SIC level using the value of shipments from the Annual Survey of Manufactures Statistics for Industries and Industry Groups. The basic data file, prepared by Wayne Gray for the NBER is documented in the discussion of the NBER Trade and Immigration Data Files (Abowd, this volume).

Average Hourly Earnings, Gross National Product, and the Consumer Price Index

Average hourly earnings for private non-agricultural employment, Gross National Product, and the Consumer Price Index-All Urban were all extracted from the CITIBASE machine readable data file in seasonally unadjusted form.

Contract Data

Bargaining unit wage rate and employment information were taken from the data file on 250 major bargaining situations developed by Wayne Vroman from the Bureau of Labor Statistics Current Wage Developments (CWD) printed reports. The realized nominal wage increase over the life of the contract, stated as an annualized percentage rate, was calculated from the periodic wage change reports in CWD and Vroman's imputation of the average scale wage at the beginning of the contract. See Vroman (1982, 1984 and 1986) for a discussion of the methods. The basic situation number list from the Bureau of Labor Statistics was linked to four digit establishment SIC's for the bargaining unit, available from the BLS as unpublished data. The SIC-based trade data was linked using to the contract file using the BLS establishment SIC. See Vroman and Abowd (1988) for a discussion of the link to international trade data.

The wage rate reports in the CWD summarize scheduled fixed increases and realized cost of living adjustments as they occur. The bargaining unit size and average bargaining unit wage rate are reported (by the employer) at the time a new contract settlement was recorded in the basic (confidential) Current Wage Developments data file, which is used to prepare the summary information on new collective agreements published quarterly. The printed CWD reports the bargaining unit size but not the average wage rate.

Canadian Data

Import and Export Prices and Values by Industry

The Laspeyres price indices and the trade value measures were derived using CANSIM data supplemented for 1967 and prior years from the Bank of Canada Review. The system of classification closest to standard industrial classifications (SIC), which is used by Labour Canada to classify the

bargaining units, is the System of National Accounts (SNA) classification used to construct the Canadian Input-Output tables. International trade price and value data are available using the SNA classification; however, all source and destination countries are aggregated. Since we wanted to eliminate trade with the United States from the world price measures, we used the price and value measures available on CANSIM under the import commodity classification (MCC) and the export commodity classification (XCC), which are disaggregated by major countries. Unlike the SIC, the MCC and XCC classifications are systems of classification for products and not for industries. Using the Canadian Input-Output tables to provide the connection between products and industries, we developed a concordance between two-digit SIC industries and the international trade measures obtained from the MCC and XCC.

Data on imports and exports for industrial sectors where the international trade flows are not very substantial are very aggregated. Only an aggregated measure of import (and export) prices and values was available for knitting industries, clothing industries, furniture and fixtures, publishing and printing and miscellaneous industries. For exports, only an aggregated measure was available for leather industries, fabricated metal and non-metallic mineral products. Data for only seven and five aggregated sectors were available for imports and exports before 1968 (in the Bank of Canada Review).

The import price index is a combination of transaction prices and unit values. The short description given in CANSIM is "The Laspeyres price indexes are based on fixed weights derived from shipments 1971 quantities and hence reflect changes in prices alone. Most of the non-end product indexes are based on average prices derived from commodity import value and quantity data. The end product indexes are based on wholesale price indexes from Canadian,

U.S. and foreign sources as proxies for import prices. For further details see the September 1976 supplement to the summary of external trade catalogue 65-001." (CANSIM 1984, matrix 003681). The technical documentation may be found in Statistics Canada 1976.

The series description for the export prices is "The Laspeyres price indexes are based on fixed weights derived from shipments 1971 quantities and hence reflect changes in prices alone. Most of the non-end product indexes are based on average prices derived from commodity export value and quantity data. The end product indexes are based on Canadian industry selling price indexes as proxies for export prices. For further information see September 1976 supplement to the summary of external trade catalogue 65-001" (CANSIM 1984, Statistics Canada 1976)..

Value of imports and exports by country of origin/destination is collected as a part of the System of National Accounts. Combining data from all sources produced the price and value measures for imports and exports for the period from 1961 to 1984.

Input and Output Prices and Quantities by Industry

Data on output and input price and values by industry were obtained from two publications of Statistics Canada: Real Domestic Product per Sector 61-71 and Gross Domestic Output per Industry (1978 and 1984 issues).

Average Manufacturing Wage

Average hourly earnings in manufacturing obtained from the CANSIM University Data Base and the Bank of Canada Review. See Card (1988).

GNP, Unemployment, and the Consumer Price Index

Basic monthly, quarterly, and annual time series data were extracted from the CANSIM University Data Base from 1961 to 1984 and from the Bank of Canada Review thereafter.

Contract data

We used 2,258 collective bargaining agreements for 299 bargaining pairs in the manufacturing sector of Labour Canada's Wage Tape. The wage measure used is a base wage rate. For a description of the data set and of how the wage settlement variable was constructed, see Card (1988).

The employment variable provided on the Wage Tape is actually a measure of how many workers were covered by the collective bargaining agreement on the day of the agreement. Inspection of the data suggested that the employment data were substantially contaminated by measurement error. In an effort to reduce those measurement problems, we systematically compared the employment data from the Collective Bargaining Review to the numbers from the Wage Tape for all pairs where the employment was changing by 10% or more in absolute value between two agreements at some point of time. In cases of discrepancies between the two numbers, the employment from the Collective Bargaining Review was used. More information is available from the Collective Bargaining Review about the structure of the bargaining pair (for example, which plants and which union locals are involved).

Two levels of correction were performed. The first level consisted of using the number of employees from the Collective Bargaining Review when the only identifiable source of discrepancies between the two data sources was reporting error. Employment data for 175 contracts was corrected on this criterion. Employment from 28 contracts was discarded because of major changes in the definition of the bargaining pair.

Second, when the information from the Collective Bargaining Review indicated that the structure of the bargaining pair changed over time, the following rule was applied: if enough information was available from the Collective Bargaining Review to construct a consistent series for a specific

pair, such information was used. Otherwise, the changes in employment that could have been explained by changes in the structure of the bargaining pair, e.g. one local drops off, were eliminated. Employment data for 131 contracts were adjusted and employment data for 176 contracts were discarded due to this correction.

References

- Abowd, John M. 1989. The Effect of Wage Bargains on the Stock Market Value of the Firm. *American Economic Review* 79 (4, September): 774-800.
- Abowd, John M. 1990. The NBER Immigration, Trade, and Labor Markets Data Files. In *Immigration, Trade, and Labor Markets*, ed. J. Abowd and R.B. Freeman, Chicago: NBER.
- Bank of Canada. Monthly. *Bank of Canada Review*. Ottawa: Minister of Supply and Services (December 1984-86).
- Bennett, Norman. 1982. Trade Monitoring System, Technical Note, Import Penetration and Export Proportion Data Bases. Bureau of Labor Statistics, Division of Foreign Labor Statistics and Trade, Washington, D.C., November.
- Card, David. 1988. Strikes and Wages: A Test of a Signaling Model. NBER Working Paper No. 2550 (April).
- Christofides, Louis N. *et al.* 1980a. A Microeconomic Analysis of the Canadian Wage Determination Process. *Economica* 47 (May): 165-78.
- Christofides, Louis N. *et al.* 1980b. A Microeconomic Analysis of Spillovers within the Canadian Wage Determination Process. *Review of Economics and Statistics* 62 (May): 213-21.
- CITIBASE 1978. Citibank economic database (machine-readable magnetic data file). 1946-present New York: Citibank, N.A.
- Cousineau, Jean-Michel. 1987. The Impact of International Trade Shocks on Wage Adjustments in Canada. In P. Chinloy and E. Stromsdorfer *Labor Market Adjustments in the Pacific Basin*, Boston: Kluwer-Nijhoff, pp. 61-78.
- Dickens, William T. with Laura Tyson and John Zysman. 1985. The Employment Effects of International Trade: A Review of the Literature. Report to the Office of Technological Assessment. Berkeley: Univ. of California.
- Farber, Henry S. 1986. The Analysis of Union Behavior. In O. Ashenfelter and R. Layard (eds.) *Handbook of Labor Economics*, Volume 2, Amsterdam: North Holland, pp. 1039-90.
- Freeman, Richard B. and Lawrence Katz. 1990. Wages and Employment in an Open Economy. In *Immigration, Trade and Labor Markets*, ed. J. Abowd and R.B. Freeman, Chicago: NBER.
- Grossman, Gene. 1982a. The Employment and Wage Effects of Import Competition in the United States. NBER Working Paper No. 1041. Cambridge, Mass: NBER.
- Grossman, Gene. 1982b. Import Competition from Developed and Undeveloped Countries. *Review of Economics and Statistics* 64: 271-81.
- Grossman, Gene. 1986. Imports as a Cause of Injury: The Case of the U.S. Steel Industry. *Journal of International Economics* 20: 201-223.

- Hamermesh, Daniel S. 1970. Wage Bargains, Threshold Effects, and the Phillips Curve. *Quarterly Journal of Economics* 85 (August): 501-17.
- Heywood, John S. 1985. Imports and Domestic Wage Levels. Department of Economics, University of Michigan (November).
- Hufbauer, Gary C., Diane T. Berliner and Kimberly A. Elliot. Trade Protection in the United States: 31 Case Studies. Washington, DC: Institute for International Economics.
- Kahn, Shulamit. 1986. Trends in Union Membership in the Postwar Period: The Case of the ILGWU. IRRA Proceedings of the Thirty-Eighth Annual Meeting, pp. 279-86.
- Kumar, Pradeep et al. 1986. The Current Industrial Relations Scene in Canada. Kingston, ON: Industrial Relations Centre, Queen's University.
- Labour Canada. Monthly. Collective Bargaining Review. Ottawa: Minister of Supply and Services (1969-86).
- Leonard, Jonathan and Rachel McCulloch. 1990. Wages and Employment in Foreign Owned U.S. Businesses. In *Immigration, Trade and Labor Markets*, ed. J. Abowd and R.B. Freeman, Chicago: NBER.
- Riddell, W. Craig. 1979. The Empirical Foundations of the Phillips Curve: Evidence from Canadian Contract Data. *Econometrica* 47 (January): 1-24.
- Riddell, W. Craig (coordinator). 1986a. *Adapting to Change: Labour Market Adjustment in Canada*. Toronto: University of Toronto Press in cooperation with the Royal Commission on the Economic Union and Development Prospects for Canada.
- Riddell, W. Craig. 1986b. *Dealing with Inflation and Unemployment in Canada*. Toronto: University of Toronto Press in cooperation with the Royal Commission on the Economic Union and Development Prospects for Canada.
- Riddell, W. Craig (coordinator). 1986c. *Labour Management Cooperation in Canada*. Toronto: University of Toronto Press in cooperation with the Royal Commission on the Economic Union and Development Prospects for Canada.
- Schoepfle, Gregory. 1982. Imports and Domestic Employment: Identifying Affected Industries. *Monthly Labor Review* (August): 13-26.
- Statistics Canada. 1976. *The 1971-Based Price and Volume Indexes of Canada's External Trade*. Ottawa: Minister of Supply and Services (December).
- Statistics Canada. 1978. *Real Domestic Product per Sector: 61-71*. Ottawa: Minister of Supply and Services.
- Statistics Canada. 1984a. *Cansim University Base*. Ottawa: Minister of Supply and Service.

- Statistics Canada. 1984b. The Input-Output Structure of the Canadian Economy in Current Dollars 1971-1981. Ottawa: Minister of Supply and Services (and earlier editions).
- Statistics Canada. 1984c. Gross Domestic Output per Industry. Ottawa: Minister of Supply and Services.
- Statistics Canada. 1987. CANSIM Main Data Base. Ottawa: Minister of Supply and Services.
- U.S. Department of Commerce. Bureau of the Census. Biennial. U.S. Commodity Exports and Imports as Related to Output. Washington, DC: GPO (1965/64 and 1972/71).
- U.S. Department of Commerce. Bureau of the Census. Annual. Annual Survey of Manufactures Value of Product Shipments. Washington, DC: GPO (1982, 1983, and 1984).
- U.S. Department of Commerce. Bureau of the Census. 1988. Statistical Abstract of the United States. Washington, DC: GPO.
- U.S. Department of Labor. Bureau of Labor Statistics. Monthly. Current Wage Developments. Washington, DC: GPO (1955-1987).
- Vroman, Wayne. 1982. Union Contracts and Money Wage Changes in U.S. Manufacturing. Quarterly Journal of Economics 97 (November): 571-94.
- Vroman, Wayne. 1984. Wage Contract Settlements in U.S. Manufacturing. Review of Economics and Statistics 66 (November): 661-5.
- Vroman, Wayne. 1986. Union Wage Settlements, Incomes Policy and Indexation. Washington, D.C.: The Urban Institute.
- Vroman, Wayne and John M. Abowd. 1988. Disaggregated Wage Developments. Brookings Papers on Economic Activity (1:1988): 313-46.

Footnotes

1. See Abowd and Freeman (this volume) for an overview of the changes in the United States.
2. See Riddell (1986b) for a recent discussion of Canadian labor market responses to increasing global competition.
3. In 1986 Canada accounted for \$45 billion of \$217 billion total U.S. exports and \$68 billion of \$370 billion total imports. In 1975 Canada accounted for \$22 billion of \$108 billion total U.S. exports and \$22 billion of \$97 billion total U.S. imports. (Statistical Abstract of the U.S. 1988, page 770.)
4. The openness measure (imports + exports)/GNP is used by Abowd and Freeman (this volume) to characterize the growing internationalization of the U.S. labor market.
5. Seventy-five percent of non-office employees in manufacturing industries were covered by collective bargaining agreements in 1984 (Kumar, 1986).
6. See Cousineau (1987) and Riddell (1986a, 1986b, 1986c).
7. See, in particular, Hufbauer et al. (1986). Other examples in the same style as the current research include Heywood (1985) Kahn (1986).
8. See, for example, Riddell (1979) and Christofides (1980a, 1980b). These relations are sometimes called "micro Phillips curves" (Hamermesh 1970).
9. See Farber (1986) for a review of these models.
10. See Leonard and McCulloch (this volume).
11. When unions and employers engage in industry-wide bargaining we assume that the multiple employer bargaining unit consists entirely of employers with positive expected quasi-rents. When an employer has negative or zero expected quasi-rents, we assume that the firm withdraws from the industry-wide bargaining unit.
12. Profitability is measured using quasi-rents. It includes the portion of the return on the enterprise that goes to the unionized workforce. See Abowd (1989).

13. It is difficult to state precisely the definition of number of workers in the bargaining unit. The reason for this is the absence of standards within the Department of Labor Office of Wages and Industrial Relations for determining the "number of workers covered" by a particular collective bargaining agreement. The definition in the text is the usual interpretation of this number. It includes all current employees and those former employees who are on layoff but who could return to work before they lose the right to vote on the contract settlement.
14. See Grossman (1982a, 1982b and 1986).
15. See Schoepfle (1982), Vroman and Abowd (1990) and Freeman and Katz (this volume). Dickens et al. (1985) reviews the employment effects literature.
16. Net revenue is the difference between net sales (gross sales less the value of discounts and other promotions) and the cost of all inputs except labor.
17. See Abowd (1989) for a more complete development of this argument.
18. The world price of Canadian exports stated in terms of the Canadian dollar is equal to the product of the world price stated in terms of a basket of foreign currencies and the exchange rate between those currencies and the Canadian dollar. The Canadian dollar world price can increase either because the world price stated in terms of the trading partner currencies increases at a given exchange rate or because the Canadian dollar depreciates relative to the trading partner currencies at a given trading partner price. In this paper we do not distinguish between these sources of price change, although we intend to do so in future work.
19. See Freeman and Katz (this volume) for U.S. results using this decomposition.
20. This finding should be contrasted with the finding in Vroman and Abowd (1988) that nominal wage growth was only weakly affected by import penetration in the same data.
21. The world price effects shown in Table 6 were estimated using price indices that exclude trade with the U.S. The sign and magnitude of the price effects are generally not affected by using a world price index that includes trade with the U.S.; however, the estimates in Table 6 are more precise.
22. The finding is consistent with the Freeman and Katz (this volume) result that the estimated effects of import penetration on average wage rates in the industry is largest for heavily unionized industries in the United States.

Table 1
A Comparison of Data Sources for the United States and Canada

Variable	United States	Canada
Contract wage rates	Vroman Agreements File from Current Wage Developments (CWD)	Labour Canada Wage Tape from Collective Bargaining Review
Bargaining unit employment	Report to BLS at settlement in CWD	Report to Labour Canada at settlement
Industry shipments	Annual Survey of Manufactures ^a	System of National Accounts (SNA) ^b
Industry prices	BLS shipments deflator	Implicit deflator (SNA)
Industry Imports	BLS trade monitoring system ^c	Input-Output tables
Industry Exports	BLS trade monitoring system	Input-Output tables
Import prices	Not available	CANSIM data files ^d
Export prices	Not available	CANSIM data files

Notes:

^aRevisions in the industrial coding for the Annual Survey of Manufactures have been resolved to 1972 standards.

^bRevisions in the industrial coding for the Canadian System of National Accounts have been resolved to 1971 standards.

^cBLS trade monitoring system data are only available for 1972 to 1981. The same methods have been applied to construct data for the periods 1958 to 1971 and 1982 to 1984.

^dImport and export prices from the Canadian data files are Laspeyres indices (1971=100) based primarily on end use prices. Comparable U.S. are not available for all manufacturing industries until 1980.

Table 2
Summary of the Definitions of Key Variables

Variable	Detailed Definition ^a
Bargaining unit employment growth rate	Annualized rate of growth of bargaining unit employment between the end of the previous contract and the end of the current contract.
Bargaining unit real wage growth rate	Annualized realized rate of nominal wage growth between the end of the previous contract and the end of the current contract minus the annualized growth rate of the Consumer Price Index over the same period.
Real shipments growth rate	<p>Annualized rate of growth of industry shipments over the life of the current contract minus the annualized growth of the industry shipments deflator over the same period.</p> <p>Expected part: rate of growth over the previous contract.</p> <p>Unexpected part: difference between the rate of growth over the current contract and the rate of growth over the previous contract.</p>
Real apparent domestic consumption growth rate	<p>Shipments plus imports minus exports, annualized growth rate over the life of the current contract minus the annualized growth rate of the industry shipments deflator over the same period.</p> <p>Expected and unexpected parts defined in the same manner as real output growth.</p>
Real export growth rate	<p>Exports from all sources to the destination country (U.S. or Canada, respectively), valued free alongside ship (value at the point of exportation), annualized growth rate over the life of the current collective bargaining agreement.</p> <p>Expected and unexpected parts defined in the same manner as real output growth.</p>

(continued)

Table 2 (continued)
Summary of the Definitions of Key Variables

Variable	Detailed Definition ^a
Import penetration ratio	<p>Imports for consumption (customs value at port of entry, usually foreign port value) divided by shipments plus imports, annualized change over the life of the current collective bargaining agreement. Shipments have been reclassified at the product class code level to conform more closely to the SIC based imports.</p> <p>Expected part: annualized change over the previous contract (not a growth rate).</p> <p>Unexpected part: difference between the change over the current contract and the change over the previous contract (not a difference in growth rates).</p>

Note:

^aAll annualized growth rates were constructed using the difference in the logarithms of the appropriate variable at two points in time divided by the length of time intervening.

Table 3
Comparison of the United States and Canadian Collective
Bargaining Contract Samples with Selected Summary Statistics
(Standard Deviations in Parentheses)

Description	United States	Canada
Industrial coverage	All Manufacturing 4-digit SIC's	All Manufacturing 2 or 3-digit SIC's
Period covered	1959-1984	1968-1983
Bargaining units	250	299
Total observations	2,515	1,280
Average bargaining unit size	8,881	1,644
Average annual real wage growth rate (size weighted) ^a	1.15% (7.25)	2.66% (4.52)
Average annual employment growth rate (size weighted)	-2.76% (43.5)	-1.91% (16.7)
Average annual industry real shipments growth rate (size weighted)	3.57% (24.1)	4.66% (6.55)
Average annual industry real apparent domestic consumption growth rate (size weighted) ^b	3.77% (23.2)	2.96% (4.43)
Average annual industry real export growth rate (size weighted) ^c	.48% (4.21)	1.85% (4.57)
Average annual industry import penetration change (size weighted) ^d	.55 (3.53)	.70 (2.11)

Notes:

^aSize weighted statistics were weighted by employment in the bargaining unit.

^bThe growth rate of real apparent domestic consumption is multiplied by (shipments-exports)/shipments.

^cThe growth rate of real exports is multiplied by (exports/shipments).

^dThe change in import penetration is multiplied by (apparent domestic consumption/shipments).

Sources: See Table 1 and Data Appendix.

Table 4
 Estimated Effect of Value-Based International Trade Measures on the
 Change in the Logarithm of Bargaining Unit Employment

Independent Variable	United States ^a	Canada ^b
Expected change in log of industry real shipments ^c	.311 (.058)	.703 (.124)
<u>Decomposed:</u> ^d		
Change in log real apparent domestic consumption	.087 (.048)	.581 (.194)
Change in log real exports	.292 (.289)	.733 (.171)
Change in import penetration ratio	-1.408 (.308)	-1.176 (.319)
Unexpected change in log of industry real shipments ^c	.339 (.038)	.379 (.090)
<u>Decomposed:</u> ^d		
Change in log real apparent domestic consumption	.182 (.034)	.400 (.124)
Change in log real exports	.645 (.191)	.276 (.099)
Change in import penetration ratio	-1.667 (.212)	-.473 (.214)
Change in log bargaining unit employment during previous contract	-.048 (.020)	-.136 (.034)
Change in log real wage rate during previous contract	.750 (.136)	.087 (.135)
Standard error of equation	.403	.160
R ²	.149	.061
Residual degrees of freedom	2,455	1,007

Notes:

^aCoefficients (and standard errors in parentheses) were estimated from a sample of 2,515 contracts using weighted least squares with bargaining unit size as the weight. The equation also included an intercept and the expected and unexpected change in both the log of real average hourly earnings and the log of real gross national product.

^bCoefficients (and standard errors in parentheses) were estimated from a sample of 1,019 contracts using the same method and controls as note a.

^cCoefficients (and standard errors) in this row were estimated from a restricted equation in which this variable replaces its decomposition (the three variables that follow in the table).

^dThe components are weighted; see notes to Table 3.

Sources: See Table 1 and Data Appendix.

Table 5
 Estimated Effect of Value-Based International Trade Measures on the
 Change in the Logarithm of the Bargaining Unit Real Wage Rate

Independent Variable	United States ^a	Canada ^b
Expected change in log of industry real shipments ^c	.052 (.009)	-.052 (.025)
<u>Decomposed:</u> ^d		
Change in log real apparent domestic consumption	.023 (.008)	-.179 (.040)
Change in log real exports	.058 (.046)	-.163 (.035)
Change in import penetration ratio	-.372 (.048)	.010 (.065)
Unexpected change in log of industry real shipments ^c	.019 (.006)	.033 (.018)
<u>Decomposed:</u> ^d		
Change in log real apparent domestic consumption	-.009 (.005)	-.062 (.025)
Change in log real exports	.058 (.030)	.041 (.020)
Change in import penetration ratio	-.221 (.033)	-.010 (.044)
Change in log bargaining unit employment during previous contract	.004 (.003)	.027 (.007)
Change in log real wage rate during previous contract	.203 (.021)	-.134 (.028)
Standard error of equation	.064	.033
R ²	.237	.510
Residual degrees of freedom	2,455	1,007

Notes:

^aCoefficients (and standard errors in parentheses) were estimated from a sample of 2,515 contracts using weighted least squares with bargaining unit size as the weight. The equation also included an intercept and the expected and unexpected change in both the log of real average hourly earnings and the log of real gross national product.

^bCoefficients (and standard errors in parentheses) were estimated from a sample of 1,019 contracts using the same method and controls as note a.

^cCoefficients (and standard errors in parentheses) in this row were estimated from a restricted equation in which this variable replaces its decomposition (the three variables that follow in the table).

^dThe components are weighted; see notes to Table 3.

Sources: See Table 1 and Data Appendix.

Table 6
 Estimated Effects of World Import and Export Prices on
 Bargaining Unit Employment Growth and Real Wage Growth in Canada

Independent Variable	Employment ^a	Real Wages ^a
Expected change in log real world import price (excluding U.S.) ^b	.186 (.082)	-.028 (.018)
Unexpected change in log real world import price (excluding U.S.) ^b	.198 (.046)	-.022 (.010)
Expected change in log real world export price (excluding U.S.) ^b	.249 (.079)	-.022 (.017)
Unexpected change in log real world export price (excluding U.S.) ^b	.092 (.050)	-.045 (.011)
Change in log bargaining unit employment during previous contract	-.131 (.031)	.011 (.007)
Change in log real wage rate during previous contract	.119 (.122)	-.142 (.026)
Standard error of equation	.162	.035
R ²	.063	.433
Residual degrees of freedom	1,321	1,321

Notes:

^aCoefficients (and standard errors in parentheses) were estimated from a sample of 1,331 contracts using weighted least squares with bargaining unit size as the weight. The equation also included an intercept and the expected and unexpected change in both the log of real average hourly earnings and the log of real gross national product.

^bThe Laspeyres price index has been reweighted to exclude trade with the U.S.

Sources: See Table 1 and Data Appendix.

Openness of the U.S. and Canadian Economies

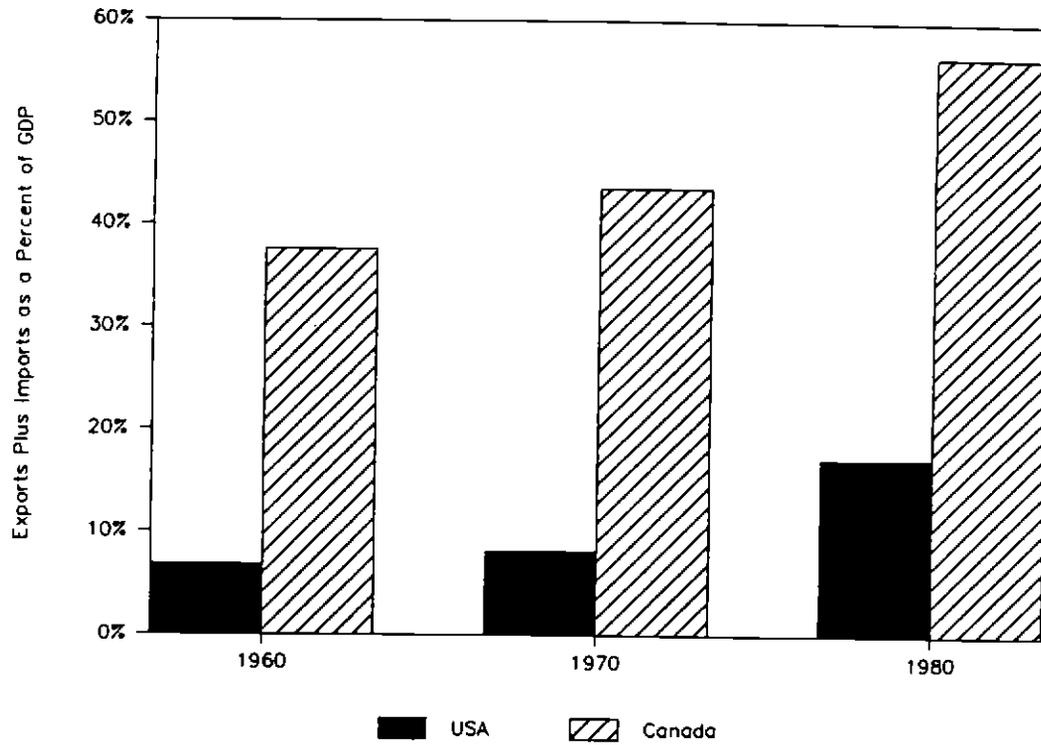


Figure 1

Calendar/Contract Dating of Variables

(For a Three Year September Contract)

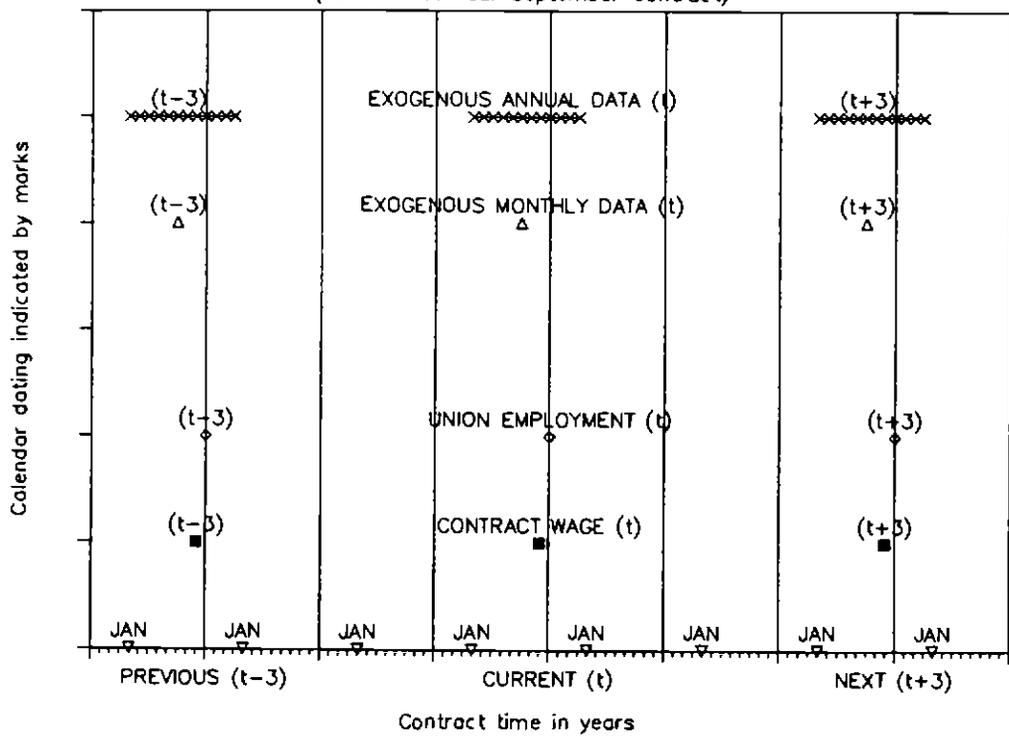


Figure 2