Can Freer Intra-Industry Trade Raise Wages?

Evidence from Canada

Revised September 2003

K.C. Fung
University of California
Santa Cruz, CA 95064
and
HIEBS
University of Hong Kong

Harry P. Huizinga
Department of Economics
Tilburg University
P.O. Box 90153
5000 LE Tilburg
The Netherlands

We thank Richard Freeman, Dan Trefler and seminar participants at Stanford University for very helpful comments. We are grateful for Statistics Canada for providing us with the data and research assistance. K.C. Fung receives partial support from the UC Santa Cruz Academic Senate Research Grant. All errors are ours.

Abstract

Will the formation of free trade areas lead to lower wages? Much of the literature on linking globalization and the labour market suggest that increased openness can lead to lower wages. In this paper we investigate empirically the case of Canada, which signed a free trade agreement with the United States in 1988. A significant portion of trade between the United States and Canada is intra-industry in character. In Krugman's (1981, 1982) monopolistically competitive intra-industry model, trade liberalization actually has an ambiguous impact on wages. Based on Krugman's model, we provide an empirical study relating Canadian wages to workers' characteristics, industry characteristics, and tariff and non-tariff barriers. Among other findings, we show that freer intra-industry trade can raise workers' wages. This result persists even after the endogeneity of trade barriers is taken into account.

1. Introduction

In recent years, many trade economists have focused their attention on the linkage of international trade and wages. Lawrence and Slaughter (1993), Krugman and Lawrence (1993), and Bhagwati and Dehejia (1994) argue that the impact of trade on wages has been small, while Leamer (1994) and Feenstra and Hanson (1994) suggest that the effects of trade on wage formation can be large. Richardson (1995) takes an intermediate stand, pointing out that trade can be a factor even if it is not the primary cause.

The theories used in most studies are the most fundamental theorems in trade: the factor price equalization and the Stolper-Samuelson theorems. While the use of these theorems in studying the link of trade to wages is both natural and eminently reasonable, one can argue that the Heckscher-Ohlin-Samuelson model which underlies these theorems does not capture some of the important stylized facts about trade. As summarized in Krugman (1981) and elsewhere, there are several important "facts" concerning the expansion of trade after the Second World War. First, much of world trade is between countries with similar factor endowments. Second, a large part of trade is intra-industry in character, especially trade in manufactured goods. Third, much of the expansion of trade seems to have taken place without significant income-distribution effects.

We take the first two stylized facts as given and argue that it is at least sometimes appropriate to look at the question of trade and wages in the context of an intra-industry trade model. In particular, given that our data set is for Canada, which is in a free trade area with another advanced industrialized country, the United States, it is even more appropriate to examine the linkage of trade and wages in the context of intra-industry trade. We leave the third "fact" as a hypothesis and want to examine the potential impact of a reduction of trade barriers on Canadian wages.

The remainder of this paper is organized as follows. Section 2 briefly reviews Krugman's (1981, 1982) model to motivate the subsequent empirical analysis. Section 3 describes the estimating equation and the data. Section 4 presents the empirical results. Section 5 discusses the possible endogeneity of trade policies and Section 6 concludes. An appendix describes the data sources.

2. Can Freer Intra-Industry Trade Raise Wages?

In general, there is a significant amount of intra-industry trade between Canada and the United States. For example, in 1995, Canada exported $66.8 billion of machinery and transport equipment to the United States, while importing $60.28 billion of the same category of goods from the United States (WTO 1996). Using the standard Grubel-Lloyd index of two-way trade, this would translate into an index of 0.95. Similarly the 1995 Grubel-Lloyd indices of intra-industry trade for chemicals, office and telecommunication equipment, and automotive products are, respectively, 0.92, 0.97, and 0.80. The point is that in looking at Canadian trade liberalization, an intra-industry trade model seems appropriate.

Let us look at a standard monopolistically competitive intra-industry trade model by Krugman (1981, 1982).[1] Consumers have identical tastes, each with a two-level CES utility function:

$$U = \left[\sum_{j=1}^{N_i} a_i \, C_i^{\alpha}\right]^{\frac{1}{\alpha}} \qquad C_i = \left[\sum_{j=1}^{n_i} C_{ij}^{\beta_i}\right]^{\frac{1}{\beta_i}}$$

where there are N_i industries and C_{ij} is a consumer's consumption of the j^{th} product of industry i, n_i is the number of potential products in the i^{th} industry. $1/(1-\alpha)$ is the inter-industry elasticity of substitution, and $1/(1-\beta_i)$ is the intra-industry elasticity of substitution.

Labor is the only input and is specific to an industry. The production function is $l_{ij} = \gamma_i + \theta_i X_{ij}$, where X_{ij} is the output of the j^{th} product of industry i and γ_i and θ_i are constant. There is full employment in the economy. Free entry implies that economic profits of the monopolistically

competitive firms are zero. With trade liberalization of industry i (e.g., removal of tariffs of industry i), the impact on the wage rate is

$$\Delta \ln W_i = k\,(1-\alpha) + (\beta_i - \alpha)\,(\ln \mu_i)\,/\beta_i \qquad (1)$$

where k is a constant. μ_i, a measure of the relative factor endowment, is an index of comparative advantage in industry i. Equation (1) is the equation that will motivate our empirical work. One key thing to note is that a priori, trade liberation can have a positive or negative impact on wages, i.e., $\Delta \ln W_i \gtrless 0$.

3. Data and Methodology

The basic estimation equation is inspired by an augmented version of Krugman's wage equation in (1).

$$\ln W = a_n + a_{nx} X + a_{ny} Y + a_{nz} Z + U\,[(a_u - a_n) + (a_{ux} - a_{nx})\,X + (a_{uy} - a_{ny})\,Y + (a_{uz} - a_{nz})\,Z] + \epsilon \qquad (2)$$

ln W is the logarithm of the hourly wage rate, X is the set of exogenous industry characteristics, reflecting among other things degree of product differentiation and index of comparative advantage (see equation 1). To make the empirical implementation of (1) more comprehensive, we also include in the regressors a set of individual and job characteristics Y. Z represents a set of Canadian tariff and non-tariff barriers. The coefficients on Z measure the impact of trade liberalization on Canadian wages (Δ ln W). As discussed earlier, Krugman's model of intra-industry trade shows that wages can go up or down.

The wage data are from the Canadian Labour Market Activity Survey (LMAS). The LMAS provides a rich set of personal, firm, and establishment characteristics for each worker. Importantly, the survey provides an industry coding at the 3-digit Canadian 1980 Standard Industrial Classification (SIC) level for each job. This coding enables us to use micro wage data to investigate the impact of trade on wages.[2]

The hourly worker wage W is inclusive of non-standard types of compensation such as tips, commissions, and bonuses. The industry level variables X include the industry's top four firms' sales ratio, capital industry, the percentage of Canadian-owned firms, and rate of industry unionization. The industry's four firm concentration ratio roughly proxies for the degree of market power, and proxies indirectly the value the consumers place on product diversity.[3] Capital intensity captures the conventional notion of comparative advantage.

We include the variable that indicates the percentage of firms that is Canadian-owned because there is some evidence that foreign multinationals (particularly U.S. multinationals) seem to pay different wages compared to domestically-owned firms (Caves 1982). In addition, we have a measure of the extent of unionization in each industry.

The individual characteristics variables include age, sex, education, tenure, location of the workers (whether in Ontario or Quebec, etc.), marital status, whether English is the first language, whether the worker is an immigrant, union status of the worker, whether the worker works part time, and whether the worker is a minority.

Job characteristics include plant size and a dummy indicating whether the firm operates multiple plants in Canada. Plant size can proxy for economy of scale which, in a monopolistically competitive equilibrium, is related to the degree of monopoly power and product differentiation.[4]

The trade policy variables Z contain three industry level variables. The tariff variable represents the average rate of tariff protection against U.S. imports for the industry. The non-tariff variable stands for the estimated tariff equivalent of non-tariff protection against the U.S., and, in particular, quotas and preferential government procurement. The total variable is computed as the sum of the tariff and non-tariff variables. These variables are also good proxies of overall Canadian trade protection, as Canada conducts about 75 percent of its trade with the United States.

The tariff variable, from Lester and Morehen (1988), has been aggregated from roughly 3,500 individual tariff commodity classifications or tariff lines. Production rather than import

weights have been used where possible to prevent tariffs that severely restrict trade from being weighted lightly. For the most part, the tariff lines used in the aggregation are the maximum tariffs permitted under the GATT. In the aggregation, actual 1985 tariff rates are used instead of the maximum rates allowed for 1987 if the former are less than the latter. Lester and Morehen (1988) report that this is the case for around 2 percent of imports. The measure of non-tariff protection, also from Lester and Morehen (1988), has been constructed by the Institute for Research on Public Policy.[5] The data on Canadian tariffs and non-tariff barriers include only permanent measures, but they exclude measures such as countervailing duties and anti-dumping duties, which are generally temporary in nature.

In our view, the exclusion of the contingent measures should not affect significantly our results. Between 1980 and mid-1987, there were 26 cases of contingent protection measures in Canada against the U.S. The value of trade (in 1986 dollars) affected by such protection amounted to 403 million dollars of U.S. exports. However, in 1986 alone, the U.S. exports 56.5 billion dollars of goods and services to Canada. Thus Canadian contingent protection has only a small effect on U.S.-Canada trade. Table 1 provides a complete list of the variables and summary statistics. All data in this study are for 1987.[6] A detailed description of data sources is provided in the Appendix.

Wage and protection data are available for 36 Canadian manufacturing industries that correspond to 3-digit 1980 SIC industries. No service industries are represented, as they generally do not benefit from explicit tariff or non-tariff protection. Table 2 provides a list of the industries used in the study and summary statistics on wages, employment, unionization, and trade protection in these industries. Average industry wages vary widely from a low of $3.31 per hour in the fish products industry to $8.06 per hour for petroleum refineries. Total employment in the 36 manufacturing industries amounts to 745,835. The rate of industry unionization, constructed from responses to the LMAS survey, ranges from 3.6 percent for the toilet preparations industry to 75.2 percent in coal mines, with an average industry rate of unionization of 43 percent. Interestingly, the correlation between unionization and the tariff variable is –0.34,

significant at the 5 percent level, which is contrary to the notion that only highly unionized industries have high tariffs. The union status dummy, U, represents all people who hold a job covered by a union contract and thus includes some people who earn union wages without actually being a union member.

From the LMAS survey, we construct a sample of 3,933 workers employed in the 36 manufacturing industries. This means our sample coverage is around 0.5 percent. All regressions are estimated using weighted least squares to adjust for the non-random sampling of workers. The weights, provided with the LMAS survey data, adjust for differences between the survey and Canada as a whole with respect to geographical location, age, sex, and whether the workers live in a rural or urban area. Specifically, the weighing procedure corrects for the undersampling of workers in the large provinces of Quebec and Ontario.[7]

4. Empirical Results

Table 3 presents the results. The three regressions only differ in the trade policy variables that are used as explanatory variables: these equations include the tariff and non-tariff variables separately and then together.

Let us first look at the set of industry variables. Wages are positively related to plant size, as measured by the plant employment dummies ($L \geq 500$ and $L < 100$), for both union and non-union workers. As discussed earlier, plant size which proxies for economy of scale is related to product differentiation. So there is some evidence that wages are positively related to higher degree of product differentiation. Also, wages tend to be higher at firms that operate multiple plants within Canada, as indicated by the positive estimated coefficient for the multi-plant dummy (plants).

Wages are also positively related to the seller concentration ratio (S4) for union and non-union wages. The four firm concentration ratio is tied to the market power of firms and in Krugman's models, also to the degree of product diversity. Wages are thus found to be again positively related to product diversity. Wages tend to be lower in industries that to a large extent are Canadian controlled. This is consistent with the results in Caves (1982) that show that

multinationals tend to pay more than domestic firms. One possible explanation of this result is that firms that are foreign controlled tend to hire more qualified workers, which is not accounted for in the regression equation.

Wages are positively related to the ratio of assets to employment in an industry, which proxies capital intensity and a notion of comparative advantage, for union and non-union workers alike. Unionization increases union wages, but there is no evidence of a trickle-down of higher union wages, achieved by powerful unions, to non-union workers in the same industry.

Next we examine the impact of individual characteristics on wages. First, the geographic dummies, which distinguish wages in the Atlantic provinces from wages in other parts of Canada, show that workers in the Atlantic provinces tend to be less well remunerated. The metropolitan area dummy is significantly positive for non-union workers, but not for union workers. This may be because union contracts are not specific enough to allow for different union wages in rural and urban areas. As expected, the male dummy enters positively, and the wage schedule slopes up with age. However, again, union wages appear to differ less with age than non-union wages. The secondary and post-secondary education dummies are associated with higher pay, but again less for union workers than for non-union workers.

The coefficient on the job tenure variable is negative because it measures tenure on the same job rather than with the same employer, which suggests that job tenure is an indicator of non-promotability rather than of work experience. The marital status dummy is positive, but again less so for union workers. Interestingly, English as a childhood language leads to higher wages for non-union workers, but not for union workers.

Finally, let us turn to the impact of trade protection on wages. As discussed earlier, monopolistically competitive intra-industry trade models predict that wages can increase or decrease with open trade such as the formation of a free trade area. Our empirical analysis can help us pinpoint which direction wages can go. Essentially we have three results. First, tariff reductions will raise non-union wages. Regression 1 shows that a 1 percent tariff cut translates into around 0.6 percent increase in wages for non-union workers. Roughly similar results are

obtained for total level of trade barriers (the sum of tariffs and non-tariff barriers, see regression 2). Second, tariff cuts reduce union wages by 0.5 percent (see regression 1).[8] Third, cuts in non-tariff variables will reduce both union and non-union wages.

From the above, we see that tariffs can have differential impact on union and non-union wages. This may be because highly unionized industries tend to be in old basic industries such as coal mines, aluminum rolling, and pulp and paper (see Table 2) where the scope for product differentiation is small. But for industries such as pharmaceuticals and scientific and professional equipment, only 9.1 percent and 10.5 percent of the industries are unionized. These non-unionized industries tend to have higher degree of product differentiation, which leads to an increase in wage with trade liberalization (see (1)).[9]

Tariffs and non-tariff barriers also have different effects on wages. It is well known that in the presence of intra-industry trade, tariffs and non-tariff barriers can have different impacts on prices (Helpman and Krugman 1989). These differential impacts on prices can translate into differential impacts on wages.

The most interesting point from the above results is that, at least in some instances, trade liberalization can raise wages. This general point has been independently documented using U.S. microdata: Gaston and Trefler (1996) found that tariff reductions in the U.S. can raise U.S. union workers' wages.

5. Endogenous Trade Policy

This section discusses the possibility that trade policy is endogenous to the wage setting process, which necessitates re-estimation of the wage equation to control for trade policy endogeneity. Baldwin (1985) surveys the literature on the political economy determination of tariffs in developed countries. Caves (1976), Helleiner (1977), and Simpson (1985) provide estimates of the tariff setting process for the case of Canada. Pugel and Walter (1985) use U.S. corporate characteristics to explain a company's trade policy stance. They show that a company is more protectionist if it faces greater pressure from import competition, benefits less from access to

foreign markets, and is less diversified in its portfolio of products. These papers together provide the basis for the instrumental variable estimation of the wage equation in this section.

As stated earlier, Canadian tariffs for 1987 are largely the maximum tariffs allowed by the Tokyo round of the GATT, which a priori suggests that at least the cuts in tariffs protection brought on by consecutive GATT rounds are exogenous to internal Canadian affairs.[10] Non-tariff barriers, and in particular government procurement policies, may be more at the authorities' discretion in pre-1987 trade pact, which suggests this type of protection can be endogenous to industry wage differences. These policies, for example, can be used to indirectly assist certain classes of low-skilled and low-paid workers.

To allow for possible endogeneity of the trade policy variables, we re-estimate the wage equations of Table 3 using two stage least squares. The instruments used include industry sales, and the number of firms per industry, and these variables times the union status variable. These instruments are used as proxies for industry lobbying power. The literature on the political economy of tariff determination in Canada, including Caves (1976), Helleiner (1977), and Simpson (1985), provides evidence that industry tariff levels are indeed related to such indices of industry lobbying power. The results of the two stage regressions are in Table 4. Regressions 1 through 3 correspond to regressions 1 through 3 in Table 3. Regressions 4 and 5 include both the Tariff and Non-Tariff variables, instrumenting for the Non-Tariff and Tariff variables, respectively. Estimates of coefficients for individual, job, and industry characteristics are not reported, as they are largely as before.

The regression results in Table 4 confirm the results in Table 3. In particular, tariff cuts lead to a rise in non-union wages, even after endogenous trade policy variables are taken into account.

Table 5 reports the results of Hausman specification tests where residuals of the first stage regressions are included as explanatory variables in the second stage regressions. A test of the endogeneity of a trade policy variable is a test of the joint significance of the residuals of the first stage regressions of the trade policy variable and the trade policy times union status variable.

Tests 4 and 5 reject the exogeneity of the non-tariff variable residuals for the two cases where the tariff variable is and is not instrumented for. Hence, non-tariff trade policy is concluded to be endogenous to the wage setting process. Assuming non-tariff policy is endogenous and thus should be instrumented for, we see that test 3 does not reject the hypothesis that tariff policy is exogenous to the wage setting process. Non-tariff trade policy appears to be endogenous, while tariff policy appears to be exogenous. Nonetheless, no matter whether tariff and non-tariff barriers are endogenous or not, the results in Table 3 and Table 4 show that our conclusions are robust.

6. Conclusions

Does free trade lead to lower wages? To attempt to answer this question, this paper reminds readers of three "stylized facts" concerning the expansion of trade since the Second World War (Krugman 1981). First, a large share of world trade is between countries with similar factor endowments. Second, much of world trade is intra-industry trade. Third, it is believed that much of the expansion of intra-industry trade seems to have taken place without major income distribution effects.

We take the first two statements as empirical facts but treat the third "fact" as a hypothesis to be tested. Theoretical models of intra-industry trade (Krugman 1981, 1982) predict that trade liberalization indeed has an ambiguous effect on wages. To implement our econometric tests, we utilize a microdata set from Canada for the year 1987. We feel that this data set is interesting and appropriate because in trade of manufactured products, Canada has substantial intra-industry trade with its major trading partner, the United States. 1987 is the year right before a major trade liberalization, the U.S.-Canada Free Trade Agreement, took place.

As discussed earlier, theoretical models of monopolistically competitive intra-industry trade predict that wages can increase or decrease with free trade. More specifically, theory predicts that wages tend to go up in industries with higher degrees of product differentiation. Using our microdata set, we can empirically identify when wages will rise and when they will fall.

Empirically, we find that tariff cuts will raise non-union wages, but union wages will decrease with a reduction of tariffs. Non-unionized industries (e.g., scientific and professional equipment industry) tend to be industries that produce highly differentiated products, while highly unionized industries (e.g., coal mines) tend to be old, basic industries where the scope for product diversity is small. Our finding that tariff cuts raise non-unionized wages but lower unionized wages thus is consistent with predictions by Krugman (1981, 1982). Furthermore, we find that our results are robust even when we take the endogeneity of trade barriers into account. Finally, we note one general interesting result that emerges: trade liberalization may lower wages in some instances, but it can also raise wages.

Appendix: Description of Data Sources

The following five data sources are used in this study.

Lester and Morehen [1988], Table E-1, for industry level data on exports and production for 1981. Recent export and industry data by SIC industries is not available.

Lester and Morehen [1988], Table C-1, for industry level data on trade barrier variables.

Employment, Earnings and Hours, Statistics Canada (Catalogue # 72-002), March 1988, for industry level data on wages and employment displayed in Table 2.

Calura/Labor Union, Statistics Canada (Catalogue # 71-202), August 1989, for industry level data on number of firms, assets, and sales.

LMAS Master File for all other data, including derived industry data on unionization. For reasons of confidentiality only the master file contains a detailed 3-digit Canadian SIC industry code for each worker. For this reason, this research was carried out on site at Statistics Canada in Ottawa. A description of the public use LMAS file, and of the exact differences between the master file and public use files is provided in LMAS Microdata User's Guide, Statistics Canada, Ottawa, 1989.

Unfortunately, the different data sources use disparate industry aggregations. LMAS identifies industries with a 3-digit 1980 Canadian SIC code. Lester and Morehen use a separate 93-industry code. Calura uses the 3-digit 1960 Canadian SIC code. Employment, Earnings and Hours uses the 1970 SIC. Only the industries with corresponding classifications are used in this study.[11] To find these, all industry codes are translated into 3-digit 1970 Canadian SICs. Lester and Morehen's list is converted into 3-digit 1970 SICs using their Appendix C [1988a]. The 1980 SIC is converted to 1970 SICs using the "Convertibility Table 1970 SIC - 1980 SIC" at the end of Standard Industrial Classification 1980, Statistics Canada, Ottawa, 1989. Finally, 1960 SICs are converted into 1970 SICs with Standard Industrial Classification Manual, Dominion Bureau of Statistics, 1970.

Notes

[1] Our exposition follows closely that of Krugman's work. Our intention is not to make a contribution to the theory of intra-industry trade, but to use Krugman's models to motivate our subsequent empirical work.

[2] An earlier version of this paper was first circulated as UC Santa Cruz Working Paper 225 in 1991. One innovation of our paper at the time the paper was written was the use of micro-level wage data rather than industry-level wage data to examine the relationship between trade and wages. There are only three other studies that use a similar methodology to study the relationship between protection and wage determination. These studies are Gaston and Trefler (1994, 1996) and MacPherson and Stewart (1990), all of which use U.S. microdata rather than Canadian microdata.

[3] See Krugman (1982), p. 206.

[4] See Gros (1987).

[5] For a description of the estimation procedure, see Annex D in Lester and Morehen (1988).

[6] The free trade agreement between the United States and Canada was signed on January 2, 1988. 1987 was the last year before Canadian trade protection against the U.S. was to be significantly lowered.

[7] As is standard (see Judge, etc. [1985]), each observation is weighted by the inverse of the standard deviation of the corresponding error term. The generalized least squares estimator is the one that minimizes the sum of squares of the weighted residuals.

[8] The coefficient on Tariff *U variable is $(a_{uz} - a_{nz})$, the difference between the union and non-union coefficients.

[9] For $\beta_i > \alpha$, ln Δ W is positive, see Krugman (1982).

[10] Though the tariffs variable is primarily those that are permitted by the GATT, tariff rates can still be endogenous because tariffs could be set according to political economy reasons before the various GATT rounds of tariff reductions. Several important rounds of tariff negotiation cut tariff across the board using particular formulas (e.g., the Swiss formula in the Tokyo Round). This could preserve the original political economy characteristics of the Canadian tariff structure.

[11] The exception is where a 1980 SIC industry is a subset of a 1970 SIC industry. In this instance, workers in the 1980 SIC industry are taken to represent the old 1970 SIC industry.

References

Baldwin, R., 1985, "Trade Policies in Developed Countries," in R. Jones and P. Kenen, eds. Handbook of International Economics, vol. 1, North-Holland.

Bhagwati, J., and V. Dehejia, 1994, "Freer Trade and Wages of the Unskilled — Is Marx Striking Again?," in Trade and Wages: Leveling Wages Down?, ed. by J. Bhagwati and M. Kosters, AEI Press, Washington, DC.

Caves, R., 1976, "Economic Models of Political Choice: Canada's Tariff Structure," Canadian Journal of Economics, 9: 278-299.

Caves, R., 1982, Multinational Enterprise and Economic Analysis, Cambridge University Press.

Feenstra, R., and G. Hanson, 1994, "Foreign Investment, Outsourcing and Relative Wages," mimeo.

Gaston and D. Trefler, 1994, "Protection, Trade, and Wages: Evidence for U.S. Manufacturing," Industrial and Labor Relations Review, forthcoming.

Gaston and D. Trefler, 1996, "Union Wage Sensitivity to Trade and Protection: Theory and Evidence," Journal of International Economics, March.

Gros, D., 1987, "A Note on the Optimal Tariff, Retaliation and the Welfare Loss from Tariff Wars in a Framework with Intra-Industry Trade," Journal of International Economics, 23: 357-367.

Helleiner, G. K., 1977, "The Political Economy of Canada's Tariff Structure," Canadian Journal of Economics, 10: 318-327.

Judge, G. G., G. W. Griffiths, C. Hill, H. Lutkepohl, and T. C. Lee, 1985, The Theory and Practice of Econometrics, second edition, John Wiley and Sons.

Krugman, P., 1981, "Intra-industry Specialization and the Gains from Trade," Journal of Political Economy, 89.

Krugman, P., 1982, "Trade in Differentiated Products and the Political Economy of Trade Liberalization," in Import Competition and Response, ed. by J. Bhagwati, NBER Conference Volume, University of Chicago Press.

Krugman, P., and R. Lawrence, 1993, "Trade, Jobs and Wages," National Bureau of Economic Research Working Paper No. 4478.

Lawrence, R., and M. Slaughter, 1993, "International Trade and American Wages in the 1980s: Giant Sucking Sound or Small Hiccup?," Brookings Papers on Economic Activity, 2.

Leamer, E., 1994, "Trade, Wages and Revolving-Door Ideas," NBER Working Paper No. 4716.

Lester, J., and T. Morehen, 1988, "New Estimates of Canadian Tariff Rates by Industry and Commodity," Department of Finance WP No. 88-2, Ottawa.

MacPherson, D., and J. Stewart, 1990, "The Effect of International Competition on Union and Nonunion Wages," Industrial and Labor Relations Review, 43: 434-446.

Pugel, Thomas, and I. Walter, 1985, "U.S. Corporate Interests and the Political Economy of Trade Policy," The Review of Economics and Statistics, 67: 465-473.

Richardson, J. David, 1995, "Income Inequality and Trade: How to Think, What to Conclude," Journal of Economic Perspectives, Summer.

Simpson, W., 1985, "The Impact of Unions on the Structure of Canadian Wages: An Empirical Analysis with Microdata," Canadian Journal of Economics, 18: 164-181.

WTO (World Trade Organization), 1996, Annual Report, Vol. 2.

Table 1. Data Definitions, Means, and Standard Deviation

Variable Name	Definition	Mean	Standard Deviation
BC	Dummy variable = 1 if resident in British Columbia	0.083	0.275
Quebec	Dummy variable = 1 if resident in Quebec	0.148	0.355
Ontario	Dummy variable = 1 if resident in Ontario	0.282	0.450
Prairies	Dummy variable = 1 if resident in prairies provinces	0.142	0.349
CMA	Dummy variable = 1 if resident in 1 of 22 census metropolitan areas	0.363	0.487
Male	Dummy variable = 1 if male	0.709	0.454
Age	Age in years	35.697	11.851
Educ1	Dummy variable = 1 if 8 or more years of schooling	0.823	0.381
Educ2	Dummy variable = 1 if at least some postsecondary education	0.278	0.448
Tenure	Years of current job	7.918	13.633
Married	Dummy variable = 1 if married	0.696	0.460
English	Dummy variable = 1 if first childhood language is English	0.687	0.464
Immigrant	Dummy variable = 1 if born outside Canada	0.143	0.350
Minority	Dummy variable = 1 if member of visible minority	0.058	0.135
Part time	Dummy variable = 1 if part time worker	0.078	0.268
U	Dummy variable = 1 if job is union job	0.467	0.499
$L < 100$	Dummy variable = 1 if less than 100 persons employed at location	0.402	0.490
$L \geq 500$	Dummy variable = 1 if more than 500 persons employed at location	0.218	0.413
Plants	Dummy variable = 1 if employer operates at more than one plant in Canada	0.606	0.489
S4	Top 4 seller concentration ratio in industry	0.423	0.186
Canadian	Percentage of firms in industry that is Canadian controlled	69.875	25.601
Union rate	Percentage of workers in industry that have union job	45.151	18.338
Assets/ Employment	Industry assets divided by industry employment (thousands)	208.92	351.37
Tariff	Tariff barrier in industry	3.929	3.716
Non-Tariff	Tariff equivalent of non-tariff barriers in industry	0.342	0.710
Total	The sum of tariff and non-tariff	4.271	4.060

Table 2. Wage, Employment, Unionization, and Trade Policy

Industry	Wage	Employment	Unionization	Tariff	Non-Tariff
Coal mines	756.19	10,813	75.2	0.0	0.0
Fish products	331.04	28,395	36.5	1.9	0.0
Fruit & vegetable products	500.43	36,634	41.7	9.5	0.0
Carpet, mat and rug	490.89	5,701	72.7	2.6	0.0
Household furniture	362.41	35,517	24.2	13.1	0.1
Pulp & paper	727.30	80,739	75.4	1.7	0.0
Asphalt roof info prod.	567.33	1,720	44.4	1.9	0.0
Paper box & bags	538.22	25,458	48.2	9.5	0.0
Other paper products	505.74	16,623	33.3	8.7	0.0
Steel, pipe and tube	656.87	5,777	61.6	7.6	0.0
Smelting and refining	687.82	26,093	63.1	1.5	0.1
Aluminum rolling	613.31	6,416	82.5	1.4	0.0
Copper allay rolling	525.89	3,203	67.7	2.9	0.0
Other metal rolling	553.28	6,207	36.7	2.0	0.1
Boiler and plate	618.67	8,204	55.0	7.4	0.7
Metal Stamping	488.66	37,234	41.6	7.2	0.6
Wire	540.23	17,279	40.6	6.6	0.1
Agricultural machinery	522.93	8,649	46.5	0.5	0.0
Industrial machinery	555.56	62,241	34.1	6.2	2.5
Aircraft and parts	640.92	39,569	51.8	0.5	0.1
Motor vehicle parts	571.43	70,578	53.0	1.1	0.0
Ship building	618.10	8,175	60.5	10.1	1.3
Small electric appliances	451.32	4,393	48.0	7.7	0.1
Communication equipment	589.12	49,619	32.3	8.8	1.7
Electrical indus, equip	539.55	22,642	29.7	6.5	1.8
Electrical wire and cable	640.61	9,862	38.4	8.5	0.0
Glass & glass products	554.18	14,100	54.9	8.4	0.0
Petroleum refineries	806.56	18,664	26.7	0.5	0.0
Other pet & coal products	574.91	1,045	44.2	0.8	0.0
Mixed fertilizer	540.84	1,425	21.9	0.2	0.0
Plastics & synthetic resins	690.29	6,142	45.7	7.5	0.0
Pharmaceutical	580.73	17,969	9.1	4.4	0.0
Paints and varnish	489.95	7,969	20.8	9.0	0.0
Soaps and cleaning comp.	586.65	8,540	7.4	8.4	0.0
Toilet prep.	458.12	8,447	3.6	10.1	0.0
Sci. & prof. equip.	478.31	33,823	10.5	4.0	0.3

Note: Wages are hourly wages in Canadian dollars cents. Non-Tariff denotes the tariff equivalents of quotas and preferential government procurement.

Table 3. Wage Regressions with Actual Trade Policy Variables

	1	2	3
C	6.007 (129.11)	6.008 (129.33)	5.990 (128.98)
BC	0.277 (10.40)	0.272 (10.22)	0.273 (10.29)
Quebec	0.194 (7.92)	0.186 (7.60)	0.192 (7.90)
Ontario	0.201 (9.42)	0.194 (9.08)	0.202 (9.48)
Prairies	0.190 (6.87)	0.184 (6.66)	0.193 (7.00)
CMA	0.061 (3.77)	0.060 (3.68)	0.056 (3.48)
CMA*U	–0.056 (2.41)	–0.055 (2.36)	–0.050 (0.15)
Male	0.242 (19.34)	0.242 (19.36)	0.236 (18.83)
Age	0.009 (13.33)	0.009 (13.31)	0.009 (13.33)
Age*U	–0.005 (5.29)	–0.005 (5.33)	–0.005 (5.47)
Educ1	0.078 (4.48)	0.076 (4.40)	0.073 (4.21)
Educ2	0.232 (15.12)	0.233 (15.18)	0.228 (14.87)
Educ2*U	–0.139 (5.69)	–0.142 (5.79)	–0.140 (5.73)
Tenure	–0.001 (2.91)	–0.001 (2.85)	–0.001 (2.88)
Married	0.179 (10.74)	0.181 (10.86)	0.176 (10.58)
Married*U	–0.086 (3.28)	–0.088 (3.36)	–0.083 (3.19)
English	0.045 (2.71)	0.044 (2.66)	0.046 (2.77)
English*U	–0.046 (2.06)	–0.046 (2.05)	–0.047 (2.10)
Part time	–0.116 (3.79)	–0.115 (3.74)	–0.114 (3.72)

Part time*U	0.172 (2.99)	0.176 (3.05)	0.170 (2.98)
U	0.198 (3.26)	0.186 (3.05)	0.185 (3.04)
L < 100	–0.119 (9.15)	–0.120 (9.21)	–0.118 (9.11)
L ≥ 500	0.068 (4.48)	0.070 (4.60)	0.067 (4.46)
Plants	0.101 (6.68)	0.102 (6.70)	0.104 (6.86)
Plants*U	–0.058 (2.53)	0.176 (3.05)	0.170 (2.98)
S4	0.113 (3.88)	0.117 (4.00)	0.135 (4.63)
Canadian	–0.001 (3.59)	–0.001 (4.14)	–0.001 (2.84)
Union rate*U	0.004 (6.55)	0.004 (6.95)	0.004 (7.09)
Assets/Employment	0.0001 (3.79)	0.0001 (4.00)	0.0001 (3.78)
Assets/Employment*U	0.0001 (3.11)	0.0001 (3.12)	0.0001 (3.12)
Tariff	–0.006 (3.12)		–0.009 (4.23)
Tariff*U	0.011 (3.17)		0.010 (2.97)
Non-Tariff			0.040 (4.59)
Non-Tariff*U			0.002 (0.12)
Total		–0.004 (2.02)	
Total*U		0.010 (3.18)	
Sample size	3933	3933	3933
R^2	0.47	0.47	0.48

Note: The dependent variable is the hourly wage. Variables are described in Table 1. Data sources are described in the Appendix. The regression technique is weighted least squares. Absolute t-statistics are in parentheses.

Table 4. Wage Regression Using Two Stage Least Squares

	1	2	3	4	5
Tariff				–0.008 (3.69)	
Tariff*U				0.012 (3.51)	
Pred. Tariff	–0.007 (1.87)		–0.011 (2.88)		–0.009 (2.53)
Pred. Tariff*U	0.013 (1.75)		0.016 (2.06)		0.013 (1.72)
Non-Tariff					0.035 (4.04)
Non-Tariff*U					0.008 (0.54)
Pred. Non-Tariff			0.054 (3.26)	0.049 (3.10)	
Pred. Non-Tariff*U			–0.055 (1.97)	–0.049 (1.80)	
Pred. Total		–0.004 (1.23)			
Pred. Total*U		0.011 (1.53)			
Sample Size	3933	3933	3933	3933	3933
R^2	0.47	0.47	0.48	0.48	0.48

Note: Pred. means the variable has been instrumented.
Others notes as for Table 3.

Table 5. Hausman Specification Tests

Test	Residuals Included	Regression	Test Statistic
1	Tariff Res., Tariff*U Res.	1	F(2,3897) = 2.23
2	Total Res., Total*U Res.	2	F(2,3897) = 1.85
3	Tariff Res., Tariff*U Res.	3	F(2,3895) = 0.74
4	Non-Tariff Res., Non-Tariff*U Res.	3	F(2,3895) = 9.33
5	Non-Tariff Res., Non-Tariff*U Res.	4	F(2,3895) = 13.40
6	Tariff Res., Tariff*U Res.	5	F(2,3895) = 5.61

Note: Residuals are the first stage residuals in the two stage regressions of Table 4. The F-tests are tests of the joint significance of these residuals in the second stage regressions. Regression numbers refer to Table 4. The 5% critical value for the F Statistic is 4.61.