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A COMPARISON OF THE U.S. AND CANADIAN WAGE ADJUSTMENT MECHANISMS : 1948-1967

BENJAMIN S. MEYER

The determinants of money wage changes in both the U.S. and Canada have been the subject of considerable discussion and analysis. [1] As the major concern of these studies was the formulation of policy regarding the wage-price « trade-off », no study has been made attempting to compare the wage adjustment mechanisms of the two countries using the same variables over identical time period. The latter comparison will be our primary concern.

The study will first develop a Canadian wage change model, then, a similar model for the U.S. and finally a joint model consisting of both U.S. and Canadian observations. We will use these models to see if there is any similarity in the wage adjustment mechanisms of the two labour markets, and compare the wage changes that would exist in each country under identical conditions. Among other things, we will examine the use of the U.S. model to predict Canadian wage change compared with the Canadian model's ability to predict Canadian wage change.

The study itself will cover the period 1948 to 1967. This time period was selected because 1968 was the start by Canadian Labour of a serious push for parity with their counterparts in the U.S. In 1968, the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America fought for and won contracts with the Big Three Auto-Making companies of Canada (Chrysler, Ford and General Motors) containing wage parity provisions. Since this push for parity could alter any similarity that might have previously existed between the wage adjustment mechanism, the study will examine the pre 1968 period.

THE MODEL

The model is developed along the standard Phillips [2] type of analysis with additional explanatory variables. The explanatory variables used

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1 e.g., for U.S. : PERRY (1964), BHATIA (1961, 1962), and for Canada: BODKIN, et al (1967), REUBER (1964), VANDERKAMP (1966) and ZAIDI (1969).

2 PHILLIPS (1958).

will be unemployment, price changes and a dummy variable representing government « intervention » in wage change. [3]

Since the independent variables in the model have undergone considerable scrutiny in the literature, our discussion of the justification of their use will be brief.

WAGES AND UNEMPLOYMENT

Unemployment is often used as a proxy for excess demand. The expected relationship between excess demand and unemployment and thus unemployment and wage change is developed fully by Lipsey. [4] Certain authors [5] have criticized the use of unemployment as a proxy for excess demand. Smyth and Holmes conclude that « . . . the familiar disequilibrium adjustment model cannot provide a functional relationship between the operational concept of unemployment and excess demand and supply . » [6] As an alternative to unemployment, Phelps [7] and Rothschild [8] contend that job vacancies minus unemployment is a better measure of excess demand. Regarding the sole use of unemployment data, Rothschild states that « This is done for pratical reasons. Statistics of unfilled vacancies are frequently non-existent, and even where they exist they are often of doubtful quality. Unemployment figures, on the other hand, are regarded as 'hard' statistics on which more reliability can be placed. » [9] Therefore, support exists for the idea that unemployment is the best available empirical measure of excess demand despite its inherent weaknesses.

The relationship between unemployment and wage change is usually a non-linear one and that practice will be followed here. [10]

WAGES AND PRICES

Prices play a role in wage determination in that a change in prices, (cost of living) affects the attitude of negotiators in collective bargaining. An increase in the cost of living will tend to make the unions more aggressive in their bargaining position, while a decrease would have the opposite impact.

A second and more direct impact of prices on wages is through the escalator clause. This clause, included in some contracts, ties a portion

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[3] A profit variable was not included because of the unavailability of comparable data in the form required. We will be using quarterly data and there was no quarterly profit figures available for Canada for the early years of our study.

[4] LIPSEY (1960).

[5] e.g., HOLMES and SMYTH (1970).

[6] HOLMES and SMYTH (1970, 315).

[7] PHELPS (1970).

[8] ROTHSCHILD (1971).

[9] ROTHSCHILD (1971, 253).

[10] e.g., PERRY (1964), LIPSEY (1960), ZAIDI (1969).

of wage rate changes directly to changes in the cost of living. Therefore, if the cost of living goes up during the course of the contract, the wage rate will automatically go up.

WAGES AND GOVERNMENT

The government can affect wage changes through either direct or indirect involment. Direct intervention (through wage controls) is normally a characteristic of a war-time economy, [11] and did not occur during our time period. However, in the U.S. we had two examples of indirect government involvent. The first « involvement » occurred in September 1950 when President Truman established the Wage Stabilization Board which lasted until February 1953. [12] The second involment was the imposition of the Wage-Price Guideposts which was in existence from 1962 to 1967. The idea was to « persuade » workers and employers to keep wages and prices down without actually imposing any direct controls. There was no corresponding Canadian government policy during this time period.

Thus, according to the actions taken by the U.S. Government, the net effect of the policy would be to lower wage changes.

SPECIFICATION OF THE FORM OF THE VARIABLES

WAGE CHANGE

We will use as our dependent variable the change in the average hourly earnings of manufacturing production workers. The variable will take the following form : [13]

$$w_{c_t} = \frac{W_{c_t} - W_{c_{t-4}}}{W_{c_{t-4}}} \qquad (1)$$

The assumption is that wages are set on an annual basis. [14] Equation 1 represents the percentage change in wages in time period t over wages 4 time periods ago. This will be one year as we will be using quarters as our time periods. [15]

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[11] It is difficult to say whether or not the recent wage freeze by President Nixon was a « war-time » measure.

[12] For a detailed discussion of the Board, see GITLOW (1953).

[13] This would be the Canadian wage change. The U.S. would have the same form except the subscript will be us rather than c.

[14] Longer term contracts should not be significant if they are randomly distributed.

[15] The use of quarterly data should give us better responses to variables than annual data. Also, it will give us the opportunity to select more accurate lags.

UNEMPLOYMENT

Unemployment is a proxy for excess demand, where higher unemployment represents less excess demand or conversely more excess supply. More excess demand (or less unemployment) would then lead to higher wage change. Therefore we would expect to find $\frac{\partial w}{\partial U} < 0$.

Following the pattern established in the previously mentioned studies, unemployment was entered in a nonlinear form. Our unemployment value is simply the average of the unemployment over the four quarters and is entered in the form $U_{c_t}^{-1}$ for Canadian unemployment, and $U_{us_t}^{-1}$ for the U.S. As w_{c_t} and U_{c_t} are inversely related, w_{c_t} and U_{c_t} are directly related.

PRICES

Higher prices induce workers to demand higher wages. Therefore prices and wages are directly related $\frac{\partial w}{\partial p} > 0$.

The price variable was computed in the same manner as the wage variable as follows (for the Canadian price change) :

$$c_{c_t} = \frac{C_{c_t} - C_{c_{t-4}}}{C_{c_{t-4}}} \qquad (2)$$

At the same time, there are disadvantages to using overlapping quaterly data. One difficulty is that the overlap creates some amount of autocorrelation. This occurs because each four quarter observation incorporates three quarters from the previous observation. Thus the error term is a moving average of the errors of the components of our equation (equation 3.1 or 3.2). This autocorrelation in the residuals could be eliminated if we used nonoverlapping data. This could be done by using one quarter wage change e.g., $\frac{W_t - W_{t-1}}{W_{t-1}}$ rather than $\frac{W_t - W_{t-4}}{W_{t-4}}$ However, despite the fact the use of this form of the dependent variable may eliminate the autocorrelation, it has its own problems. The use of this form of the variable frequently leads to unstable results because of the inability to match the time of the impact of the variable. We therefore, like many of the other writers in this field, accept this shortcoming of our dependent variable but choose it over alternatives and « hope » that the bias will not greatly affect our result.

It is assumed that negotiations and contracts are randomly distributed over the year. This assumption was tested by adding dummy seasonal variables to both the U.S. and Canadian equations. In all cases, the dummy variables were highly insignificant as explanatory variables.

It was decided that a lagged price chance $c_{c_{t-1}}$ was to be used in place of C_{c_t}. There was not any appreciable difference in our results. However, it is believed that the use of a lag is preferable as it makes allowance for the expected lag adjustment of wages to changes in living costs.

GOVERNMENTS

As the existence of government « action » signifies an attempt to hold down wages, the government variable will be inversely related to wage change $\frac{\partial w}{\partial Gp} < 0$.

As mentioned, the U.S. government took an active part in the wage change question during two distinct time periods in the post-World War II period. The first active role was played during the Korean War and was characterized by the creation of the Wage Stabilization Board. The second involvement was from 1962 thru 1967 when the President's Council of Economic Advisors established the Wage-Price Guideposts. In both cases, the obvious desire was to keep down wage settlements.

It was decided to use a dummy variable to represent direct government policy. The variable will have a value of one during any quarter that such a policy was in effect. As our variables run over four quarters, the variable will be the average value over the four quarters. Thus, the first quarter (Quarter I, 1951) in which the policy is instituted will have a value of .25, [16] the second .50, the third .75, and the fourth (where the policy has been in effect for the entire year) will have a value of one, the next four values will be one and then will decrease to .75, .50, and .25 in successive observations. The process begins again in the first quarter 1962 when the value is .25, increasing to .50, .75 and finishing off with a value of one for the remaining 21 periods.

The logic of this is as follows: the first quarter in which the policy was in effect was the first quarter of 1951, however, our wage variable for the first quarter 1951 is a variable which spans four quarters. Therefore, our data covers the entire year ($W_t - W_{t-1}$, $W_{t-1} - W_{t-2}$, $W_{t-2} - W_{t-3}$, $W_{t-3} - W_{t-4}$) but the government policy is effective only during the last quarter. Thus in the first quarter 1951 the dummy variable should have 25 percent the impact it would have had it been in effect the entire four quarters. This

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[16] This is derived from the following:

1950 Quarter II = 0
1950 Quarter III = 0
1950 Quarter IV = 0
1951 Quarter I = 1

Average over four quarters $\frac{0+0+0+1}{4} = .25$.

process can be used to explain the .50 value in the second quarter 1951, etc. The analysis continues to use our previously discussed assumption that wage changes are randomly distributed over the year.

EMPIRICAL RESULTS

A wage change model will be developed for Canada, then for the U.S. and finally a combined model.

In the estimation of the parameters of the models, simple least-square regressions will be used.

The time period covered will be that of 1948 to 1967. [17] As annual data based on the four previous quarters will be used, each year will have four « annual » figures. Therefore, our twenty year period will generate 80 observations.

CANADIAN MODEL

Wages and Unemployment

Using the inverse of the Canadian unemployment rate, $U_{c_t}^{-1}$, gives

$$w_{c_t} = -.018 + \underset{(.018)}{.279}\ U_{c_t}^{-1} \qquad R^2 = .764 \qquad (3)$$

Wages, Unemployment, and Prices

We now add, to w_{c_t} and $U_{c_t}^{-1}$, the lagged price variable $c_{c_{t-1}}$.

Our results is

$$w_{c_t} = -.00013 + \underset{(.015)}{.155}\ U_{c_t}^{-1} + \underset{(.041)}{.493}\ c_{c_{t-1}} \qquad R^2 = .91 \qquad (4)$$

In both equations the variables are all significant at the 99.9 percent level. The addition of $c_{c_{t-1}}$ has explained 65.6 percent of the previously unexplained variance.

As there was no government involvement the value would be zero throughout and obviously would not affect Equation 4.

U. S. MODEL

Wages and Unemployment

Running $U_{us_t}^{-1}$ on w_{us_t} we find

$$w_{us_t} = -.004 + \underset{(.037)}{.215}\ U_{us_t}^{-1} \qquad R^2 = .306 \qquad (5)$$

Wages, Unemployment, and Prices

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[17] We previously explained the reason for the selection of this period. data based on the four previous quarters will be used, each year will have four « annual » figures. Therefore, our twenty year period will generate 80 observations.

Adding $c_{us_{t-1}}$ to Equation 5 produces,

$$w_{us_t} = .007 + \underset{(.031)}{.114}\ U^{-1}_{ust} + \underset{(.068)}{.514}\ c_{us_{t-1}} \qquad R^2 = .599 \quad (6)$$

Wages, Unemployment, Prices, and Government

The previously discussed dummy variable representing the government's role (GP) is added. The result is,

$$w_{us_t} = .006 + \underset{(.030)}{.139}\ U^{-1}_{us_t} + \underset{(.064)}{.515}\ c_{us_{t-1}} - \underset{(.003)}{.011}\ GP \quad R^2 = .653 \ (7)$$

All variables in the U.S. models are significant at the 99.9 percent level.

A JOINT U.S.–CANADIAN MODEL

This model was developed by using all 160 observations (80 U.S. and 80 Canadian).

The resulting regression was

$$w_t = .003 + \underset{(.013)}{.146}\ U^{-1}_t + \underset{(.036)}{.505}\ c_{t-1} - \underset{(.002)}{.010}\ GP \quad R^2 = .850 \ (8)$$

Once again, all our variables are significant at the 99.9 percent level.

In all of our equations (Equations 3-8), the sign of the coefficient was as anticipated.

A COMPARISON OF OUR U.S. AND CANADIAN MODELS

The objective of the development of the U.S. and Canadian models was the determination of the similarity of the responses of the two labour markets to the same variables. The results lead us to the conclusion that they are highly similar if not almost identical. Various factors lead us to this conclusion. Comparing Equations 4 and 7, it can be seen that there is no significant difference in the coefficient of the two Equations as they are less than one standard deviation apart. Entering specific values for lagged price change and unemployment into Equations 4 and 7 results in Table 1 and Table 2. From the tables it appears that if both the U.S. and Canada had identical unemployment rates and price changes then the maximum difference in wage changes would be one-half of a percentage point, with the norm being about one-fifth of a percentage point (the maximum occurs in periods of high unemployment *and* high price change). None of these differences is significantly different (as the standard error of the estimate is .01278).

Another way to determine the similarity of the two wage adjustment mechanisms is to see how well the U.S. model is able to predict Canadian Wage Change. This is done by entering the Canadian values into the U.S. model. The logic behind this is that if the two labour markets are highly dissimilar, then the ability of the U.S. model to predict Canadian

wage change should be negligible. Having entered the Canadian values into Equation 7, these results were compared with those from Equation 4 (the Canadian model). Our results show that there is a high degree of similarity in the two wage adjustment mechanisms. Out of the 80 observations, the U.S. model predicts Canadian wage change better than does the Canadian model 36 times and for an additional ten observations the Canadian model is more accurate by less than .1 percent. [18]

TABLE 1

Canadian Wage Change – Derived from Equation 4 – (All values are percentage rates)

Price Change \ *Unemployment rate*	2	3	4	5	6
0	7.7	5.2	3.9	3.1	2.6
1	8.2	5.6	4.4	3.6	3.1
2	8.7	6.1	4.9	4.1	3.6
3	9.2	6.6	5.3	4.6	4.1
4	9.7	7.1	5.8	5.1	4.5
5	10.2	7.6	6.3	5.6	5.0
6	10.7	8.1	6.8	6.0	5.5
7	11.2	8.6	7.3	6.5	6.0
8	11.7	9.1	7.8	7.0	6.5

The reason the combined model (Equation 8) was developed was for the same basic reason as above — to see how it predicts Canadian wage change. By combining the two models we have 160 observations and therefore if the models are highly similar the combined should improve the accuracy of the separate models. [19] Equation 8 predicts

[18] Looking at the results, an interesting fact appears. The accuracy of the U.S. model in predicting Canadian wage change was a bit higher prior to 1962. The results were as follows: Equation 7 predicts 34 out of 56 observations the same (within .1 percent) or better prior to 1962 and 12 out of 24 after 1962. The results after 1962 derived from the U.S. model tend to overstate the Canadian wage change. This was the period of guideposts in the U.S. so it appears that there might have been some leakage back to Canada of the impact of the guideposts. The first 18 observations (1st quarter 1962 up to 3rd quarter 1966) are overstated while the last 6 observations are understated. (This could be because the impact of the guideposts were lessening.)

[19] The logic of this is that if the two separate models are highly dissimilar, then there should be no reason to believe that a model derived by adding the U.S. observations will in any way improve (or keep relatively constant) the ability of this combined model to predict Canadian wage change; rather there should be a marked decrease in the relative accuracy of the combined model as compared to the Canadian model. Therefore, if they are similar in their ability to predict the two separate models would be similar.

TABLE 2

U.S. Wage Change (Derived from Equation 7) – (All values are percentage rates)

Price Change \ *Unemployment rate*	2	3	4	5	6
0	7.5	5.2	4.1	3.4	2.9
1	8.0	5.7	4.6	3.9	3.4
2	8.6	6.2	5.1	4.4	3.9
3	9.1	6.8	5.6	4.9	4.4
4	9.6	7.3	6.1	5.4	5.0
6	10.1	7.9	6.6	5.9	5.5
6	10.6	8.3	7.1	6.4	6.0
7	11.1	8.8	7.7	7.0	6.5
8	11.6	9.3	8.2	7.5	7.0

Canadian wage change better, than does Equation 4, 41 out of 80 times with 15 other observations less accurate by less than .1 percent.

In conclusion, it appears that during the post-World War II period (at least up to 1968), the U.S. and Canadian labour markets responded in a very similar way to the variables which determined wage change. Also, the variables influencing the two labour markets were the same.

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APPENDIX

SOURCES OF THE DATA USED IN MODELS

For U.S. :

Wages : Average hourly earnings for manufacturing production workers appears in *Employment and Earnings and Monthly Report on the Labor Force* and *Employment and Earnings Statistics for the United States 1909-1968*, published by the U.S. Department of Labor, Bureau of Labor Statistics.

Unemployment : Percentage unemployed of total civilian labour force as appears in *Monthly Labor Review*, U.S. Department of Labor, Bureau of Labor Statistics.

Prices : Consumer Price Index, *Consumer Price Index* (monthly) Department of Labor, Bureau of Labor Statistics.

For Canada :

Wages : Average hourly earnings for manufacturing production workers — data in *Review of Man-Hours and Hourly Earnings* (annual), Statistics Canada (formerly Dominion Bureau of Statistics).

Unemployment : Percentage unemployed, data in *The Labour Force* (monthly), Statistics Canada.

Prices : Consumer Price Index — data in *Prices and Price Indexes*, (monthly), Statistics Canada.