THE NATURAL RATE OF UNEMPLOYMENT: REGIONAL ESTIMATES AND POLICY IMPLICATIONS*

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Introduction

Studies by Thirsk [17], Lazar [5], and, more recently, Riddell [12] conclude that the feasibility of regionalized fiscal stabilization policy must be very heavily discounted. This conclusion is based on an analysis of natural rates of unemployment for the regions that shows that the higher unemployment rates, which are typically observed over the business cycle in the Atlantic Provinces, Quebec and British Columbia in comparison to Ontario and the Prairie Provinces, are not caused by demand deficiency but reflect a higher degree of structural unemployment. Consequently, these studies see only a limited role for regionally differentiated fiscal policies in reducing regional unemployment rate disparities.

A limitation of these studies is that the natural rate estimates are based on data from the 1960s and the 1970s and are now badly out of date, so an attempt is made in this paper to obtain more recent estimates for the regions. The model used to make these estimates is described in the following section. The natural rate estimates are then presented and analyzed. The final section discusses the implications of these findings for the potential use of regionally discriminating fiscal

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policies in combatting unemployment in the 1982-83 recession—the worst recession to have been experienced in Canada in fifty years.

The Model

The following model was used to estimate natural rates of unemployment for the Atlantic Provinces, Quebec, Ontario, the Prairie Provinces and British Columbia:[1]

$$UR = a_0 + a_1 PDEVO + a_2 LNRR + a_3 LLFPYF + a_4 LRMW + \epsilon, \quad (1)$$

The unemployment rate (UR) depends on percentage deviations in regional output around its trend value (PDEVO), the natural log of the net replacement ratio (LNRR), the natural log of the combined labour force participation rates for young and female workers (LLFPYF) and the natural log of the relative minimum wage (LRMW).

The model assumes that cyclical changes in the regional unemployment rate are captured by percentage deviations in real output around its trend value, while changes in the natural rate of unemployment are explained by changes in the net replacement ratio, changes in youth and female participation rates, and changes in the relative minimum wage.

The variable PDEVO shows the relationship between the business cycle and unemployment. It is hypothesized that when the percentage increase in output exceeds its trend value the unemployment rate will fall and that it will rise when percentage increases in output fall below their trend of rate increase. It is predicted, therefore, that the sign of a_1 will be positive.

The variable NRR is included in the equation to capture the effect of amendments made to the Unemployment Insurance (UI) Act, particularly in 1971-72 and in 1979, on the unemployment rate. Under the 1971-72 amendments the UI benefit rate was increased significantly, eligibility requirements for drawing benefits were reduced, and the coverage of the program was expanded significantly. In addition, the program was regionally differentiated: shorter qualification periods and larger benefit entitlements were introduced in regions with high

[1] This specification of the unemployment rate equations follows the work of Craig Riddell [12] who uses both Phillips curve and unemployment rate equations to estimate natural rates of unemployment for Canada and for the provinces of Newfoundland and Ontario covering the period from 1953 to 1978. In the unemployment rate equations Riddell uses deviations of GNP from its trend rate of growth to capture the effects of cyclical changes in demand on the unemployment rate. This specification is unsatisfactory, since changes in the regional demand for labour are better explained by cyclical changes in regional rather than in national output.

unemployment. Further changes were introduced in 1979 that reduced the generosity of the UI scheme. The benefit rate was reduced and the qualification requirements for new entrants and re-entrants into the labour force and for repeat users were raised.

The effect of the 1971-72 changes reduced the costs of being unemployment to insured workers. This would be expected to increase unemployment by increasing both job turnover and the duration of job search. Similarly, the 1979 changes would be expected to reduce the natural rate of unemployment. Our expectation, therefore, is that the sign of a_2 will be positive.

Changes in government legislation governing provincial minimum wage laws would also be expected to affect the natural rate of unemployment. Increases in provincial minimum wages raised the relative minimum wage in all regions in the last half of the 1960s and in the early and middle years of the 1970s. Thereafter the ratio showed a significant decline, particularly during the period from 1980 to 1983.

Economic theory alone does not enable us to predict unambiguously what the impact of a change in the relative minimum wage would be on the unemployment rate. The effect on employment is predicted to be negative, since firms faced with paying higher wages for low wage, low productivity workers would be induced to replace these workers with relatively cheaper priced inputs. The effect on labour force participation, however, could go either way. On the one hand, workers who become unemployed because of the increase in the relative minimum wage may become discouraged and withdraw from the labour force. On the other hand, since the going price of labour is increased this may provoke a positive labour supply response if the supply curve of labour is positively sloped. There is, however, some reason to expect that the employment effect will dominate, thus leading to a positive sign on a_4 in the unemployment rate equation.

The final variable, LFPYF, is included in the equation to capture the effects on unemployment of demographic changes in the age-sex composition of the labour force. A key trend in the 1960s and 1970s in Canada has been a rise in the proportion of the working population composed of young and female workers and a decline in the proportion of adult male workers. It is expected that increased participation rates for young and female workers would produce an increase in the structural rate of unemployment. This would occur both because young workers represent new entrants to the labour market who lack job experience and change jobs frequently and because female workers often lack the job skills required to fill job vacancies. It is predicted, therefore, that the sign of a_3 will be positive.

Problems of Estimation

It was originally intended to estimate the model using ordinary least squares regression (O.L.S.) with annual data covering the period from 1966 to 1983. This estimation procedure can be criticized because the regression coefficients may be subject to simultaneous equation bias. This bias may occur because it is assumed that the explanatory variables in the unemployment rate equations are exogenous. This assumption is reasonable for the variables NRR and RMW, since the value of these variables is determined by forces outside the model; that is, by government legislation. It is also reasonable to assume that PDEVO determines UR rather than the reverse, since feedback effects of the unemployment rate on output are likely to be small. There is, however, a problem of endogeneity with respect to the participation rate variable (LLFPYF).[2] There is clearly a two way causation running between UR and LFPYF. Female workers, for example, may enter the job market to find more fulfilling careers outside the home, but they may also be forced to look for work to maintain family income if the prime-aged male breadwinner becomes unemployed. Estimating the unemployment rate equations under the assumption that LFYPYF is exogenous may, therefore, produce biased and inconsistent estimates of the regression coefficients. Consequently, the model was re-estimated using two state least squares to correct for simultaneous equation bias. In the first stage LLFPYF was regressed against the exogenous variables of the model (PDEVO, NRR and RMW) and a time trend. The R^2 for these first stage equations was very high, so that a large proportion of the variation in LLFPYF was accounted for.

In the second stage the calculated values of LLFPYF were substituted into the unemployment rate equations, and the equations were estimated using O.L.S. This two stage least squares estimation procedure yielded estimates of the natural rate of unemployment for the regions that were almost the same as those obtained from estimating the unemployment rate equations directly using O.L.S. These results suggest that simultaneous equation bias was not an important problem in the model. O.L.S. estimation of the unemployment rate equations was rejected, however, because of the likelihood that the disturbance terms in the equations were correlated. Such correlation is

[2]This problem has been recognized in several Canadian studies that have attempted to measure empirically, using data from the late 1960s and the early and the mid-1970s, the responsiveness of the participation rate, particularly for married women, to changes in unemployment. The results of these studies, which are summarized in Morley Gunderson [3], are somewhat mixed but, in general, they show that added worker effects have tended to dominate discouraged worker effects, although discouraged worker effects appear to have become increasingly important over time.

likely to occur, since the influence of exogenous shocks that are not correlated with the explanatory variables will be captured in the disturbance terms of the equations.[3]

If the disturbance terms are cross correlated, then separate estimation of the equations using O.L.S. will produce inefficient estimates of the regression coefficients. Consequently, in order to gain efficiency in the estimation, the five unemployment rate equations were estimated jointly using Zellner's method of seemingly unrelated regressions.[4]

Results

The Zellner regression results for the regions are reported in Table 1. As the table shows, the results are somewhat mixed. The coefficients of PDEVO and LLFPYF have the correct signs and are statistically significant at a 1 percent level in all regions. The coefficient of LRMW is significant at a 5 percent level in only three of the five regions, however, and has the wrong sign in the Prairies. In addition, while the LNRR is highly significant in four of the five regions, it is not significant in the Atlantic region. This latter result should be accepted with some caution, since there is a fair amount of evidence that indicates that the generosity of the unemployment insurance system has been a cause of higher unemployment in the Atlantic region, particularly in the province of Newfoundland.[5]

Tests of Equality of Coefficients

Chi-square tests of the joint equality of coefficients were conducted across regions to see if the coefficients were equal. These tests show that the coefficients were significantly different from zero in all regions at a 5 percent level.

With respect to the coefficients of LNRR, pairwise tests of the coefficients using the t distribution show that the source of the joint inequality of the coefficients was entirely caused by the coefficient of LNRR in the Atlantic Provinces. In the remaining regions the coefficients of LNRR were not significantly different from zero at a 5 percent level. Consequently, in order to achieve further gains in the efficiency of the estimation, the coefficients of LNRR in British Columbia

[3]Exogenous investment, oil and commodity price shocks have been an important influence in explaining structural unemployment in Canada, particularly in the 1982 recession. For an estimate of the extent to which these shocks contributed to higher unemployment in the recession see John McCallum [6].

[4]This estimation procedure was carried out using a computer subroutine available in TSP [18].

[5]See, for example, Craig Riddell [12] and, more recently, Newfoundland Royal Commission on Employment and Unemployment [9].

and the Prairie Provinces were set equal to the unrestrained estimate of this coefficient for Quebec. In addition, the coefficients of LRMW in Ontario and British Columbia were set equal to zero, since these coefficients were not statistically significant. Imposing these restrictions, the coefficients were freely estimated using Zellner regression. The results are shown in Table 2.

Table 1

UNRESTRICTED ZELLNER REGRESSION RESULTS, REGIONS, 1966-83*

Region	Results
Atlantic Provinces	UR = 0.35 + 0.17 PDEVO + 0.01 LNRR + 0.28 LLFPYF + 0.06 LRMW (12.4) (4.8) (0.45) (15.2) (2.8) DW = 1.12
Quebec	UR = 0.27 + 0.25 PDEVO + 0.05 LNRR + 0.21 LLFPYF + 0.03 LRMW (18.5) (7.4) (3.8) (15.3) (2.1) DW = 1.5
Ontario	UR = 0.14 + 0.15 PDEVO + 0.05 LNRR + 0.13 LLFPYF - 0.01 LRMW (9.6) (5.3) (3.6) (9.1) (-1.1) DW = 1.15
Prairie Provinces	UR = 0.03 + 0.25 PDEVO + 0.06 LNRR + 0.06 LLFPYF - 0.08 LRMW (1.5) (8.0) (5.4) (4.3) (-3.8) DW = 1.35
British Columbia	UR = 0.16 + 0.26 PDEVO + 0.06 LNRR + 0.10 LLFPYF (7.4) (7.0) (4.0) (6.0) DW = 1.37

* Symbols are defined in the appendix. The numbers in parentheses below the coefficients are the t ratios.

A comparison of the regressions results in Table 2 with the unrestricted results in Table 1 shows that fourteen of the twenty coefficients have t ratios that are higher than in the unrestrained estimation. In particular the t ratio for the coefficient of LNRR in the Atlantic region becomes significant at the 5 percent level, rising from .45 (Table 1) to 2.0 (Table 2). Constrained estimation of the unemployment rate equations, therefore, clearly produces gains in the efficiency of the estimation.

Table 2

RESTRICTED ZELLNER REGRESSION RESULTS, REGIONS, 1966-83*

Region	Results
Atlantic Provinces	UR = 0.36 + 0.20 PDEVO + 0.03 LNRR + 0.27 LLFPYF + 0.06 LRMW (11.7) (5.7) (2.0) (14.6) (2.5) DW = 0.99
Quebec	UR = 0.27 + 0.27 PDEVO + 0.06 LNRR + 0.21 LLFPYF + 0.02 LRMW (19.0) (8.2) (5.7) (15.0) (1.9) DW = 1.50
Ontario	UR = 0.15 + 0.19 PDEVO + 0.06 LNRR + 0.13 LLFPYF (19.4) (8.2) (9.9) DW = 1.14
Prairie Provinces	UR = 0.05 + 0.28 PDEVO + 0.06 LNRR + 0.06 LLFPYF - 0.06 LRMW (2.9) (9.9) (5.7) (5.7) (-3.7) DW = 1.30
British Columbia	UR = 0.17 + 0.29 PDEVO + 0.06 LNRR + 0.11 LLFPYF (16.5) (9.4) (5.7) (7.8)

* Symbols are defined in the appendix. The numbers in parentheses below the coefficients are the t ratios.

Estimates of the Natural Rate of Unemployment

The regional natural rates of unemployment (U^n) are calculated by setting PDEVO equal to zero in the unemployment rate equations in Table 2 and solving for the calculated value of U. The cyclical rate of unemployment (U^c) is then calculated residually by subtracting U^n from the measured rate (U^a).

Annual actual and estimated natural and cyclical rates of unemployment for each of the regions and for Canada for the period from 1966 to 1983 are shown in Table 3. As the figures in this table show, the natural rate estimates exhibit (with some minor variation) a clear upward trend both in the regions and in Canada over the sample period.

Following the more generous amendments made to the UI Act in 1971, the natural rate of unemployment increased sharply in the regions over the period from 1971 to 1973; the natural rate thus either exceeded or just fell short of the rise in actual unemployment

rates, causing the cyclical rate of unemployment to either fall sharply or to become negative in each of the regions over this period.

This behaviour of cyclical unemployment rates suggests that the rise in actual unemployment over the period from 1971 to 1973 was not caused by aggregate demand deficiency, but reflected an increasing amount of structural unemployment. Policy makers at the time, however, misinterpreted this rise in unemployment as representing an increase in cyclical unemployment and adopted very expansionary fiscal and monetary policies to combat it, thereby contributing to an acceleration of inflation in this period.[6]

The strong inflationary pressures which were evident in the early 1970s continued throughout the balance of the 1970s and into the early 1980s. This is indicated by the fact that, with the exception of the Atlantic Provinces, the rate of cyclical unemployment in each of the regions was either positive and small, or negative over this period. Over the decade from 1971 to 1981, therefore, the rise in actual unemployment rates was not caused by a rise in Keynesian (cyclical) unemployment but reflected an increasing degree of classical (structural) unemployment.

These trends, however, were sharply reversed in the 1982-83 recession. Measured unemployment rates climbed sharply and exceeded natural rates of unemployment, causing the cyclical rate of unemployment to become positive in every region. As the figures in Table 3 show, the rate of demand deficiency unemployment in the 1982 recession was highest in the Atlantic Provinces, Quebec, and British Columbia and lowest in Ontario and the Prairie Provinces. Thereafter, in spite of the fact that the regional economies recovered fairly strongly from the recession in 1983, unemployment rates rose in the Prairie Provinces and British Columbia and showed little decline in the other regions.

After a decade of strong inflationary pressures in the 1970s the regional economies were now characterized by a deflationary gap, with low rates of inflation and rising rates of cyclical unemployment.

Implications for Regional Fiscal Stabilization Policy

The natural rate of unemployment estimates for the regions suggest that the largest proportion of unemployment in the 1982-83 recession and recovery was caused by structural imbalances in labour markets

[6]This policy failure was noted in a much earlier study by Reid and Meltz [11], which analyzed the contribution of demographic changes, revisions to the UI Act in 1971, and other factors, to the rise in structural and functional unemployment in Canada from the mid-1960s to the mid-1970s.

Table 3
ACTUAL (U^a) AND ESTIMATED NATURAL (U^n) AND CYCLICAL (U^c) UNEMPLOYMENT RATES
CANADA AND THE REGIONS, 1966-1983
(percentages)

	Atlantic Provinces			Quebec			Ontario			Prairies Provinces			British Columbia			Canada*		
Year	U^a	U^n	U^c	U^a	U^n	U^c	U^a	U^n	U^c	U^a	U^n	U^c	U^a	U^n	U^c	U^a	U^n	U^c
1966	5.2	2.4	2.8	4.1	3.3	.8	2.6	2.0	.6	2.3	2.4	-.1	4.6	4.0	.6	3.4	2.7	.7
1967	5.3	2.3	3.0	4.6	4.2	.4	3.2	2.0	1.2	2.6	2.2	.4	5.1	4.2	.9	3.8	2.9	.9
1968	5.8	3.6	2.2	5.6	4.7	.9	3.6	3.3	.3	3.2	3.0	.2	5.9	5.5	.4	4.5	3.9	.6
1969	6.2	3.7	2.5	6.1	6.3	-.2	3.2	4.2	-1.0	3.3	4.1	-.8	5.0	6.6	-1.6	4.4	5.0	-.6
1970	6.0	3.7	2.3	7.0	5.9	1.1	4.4	3.9	.5	5.0	3.9	1.1	7.7	6.7	1.0	5.7	4.7	1.0
1971	7.0	4.5	2.5	7.3	7.8	-.5	5.4	5.9	-.5	5.2	5.0	.2	7.2	8.0	-.8	6.2	6.4	-.2
1972	7.6	6.4	1.2	7.5	7.7	-.2	5.0	5.6	-.6	5.3	4.6	.7	7.8	7.5	.3	6.2	6.2	0
1973	7.7	7.8	-.1	6.8	8.8	-2.0	4.3	5.9	-1.6	4.6	4.9	-.3	6.7	7.7	-1.0	5.5	6.9	-1.4
1974	8.3	8.7	-.4	6.6	8.9	-2.3	4.4	6.2	-1.8	3.4	4.8	-1.4	6.2	7.9	-1.7	5.3	7.1	-1.8
1975	9.8	9.0	.8	8.1	9.3	-1.2	6.3	6.3	0	4.0	4.6	-.6	8.5	7.8	.7	6.9	7.2	-.3
1976	10.8	8.9	1.9	8.7	9.5	-.8	6.2	6.1	.1	4.1	4.4	-.3	8.6	8.3	.3	7.1	7.9	-.8
1977	12.5	9.0	3.5	10.3	10.0	.3	7.0	6.5	.5	4.8	4.7	.1	8.5	8.5	0	8.1	7.5	.6
1978	12.5	9.7	2.8	10.9	10.6	.3	7.2	7.2	0	5.2	5.2	0	8.3	9.1	-.8	8.3	8.1	.2
1979	11.6	9.2	2.4	9.6	10.5	-.9	6.5	7.1	-.6	4.3	5.4	-1.1	7.6	8.7	-1.1	7.4	8.0	-.6
1980	11.1	9.6	1.5	9.8	10.8	-1.0	6.8	7.3	-.5	4.3	5.5	-1.2	6.8	8.8	-2.0	7.5	8.2	-.7
1981	11.5	10.1	1.4	10.3	11.0	-.8	6.6	7.6	-1.0	4.5	5.8	-1.3	6.7	9.1	-2.4	7.5	8.5	-1.0
1982	14.3	9.5	4.8	13.8	10.4	3.4	9.8	7.6	2.2	7.6	6.3	1.3	12.1	9.1	3.0	11.0	8.4	2.6
1983	15.0	10.5	4.5	13.9	11.6	2.3	10.4	8.4	2.0	9.7	6.6	3.1	13.8	10.0	3.8	11.9	9.2	2.7

* U^n for Canada has been calculated by taking a weighted average of U^n for the regions using the regional labour force as weights.

Source: Actual unemployment rates for the regions and for Canada are taken from Statistics Canada, *Historical Labour Force Statistics* (Cat. No. 71-201). U^n is the solution to the unemployment rate equations in Table 2 when PDEVO is set equal to zero and $U^c = U^a - U^n$.

rather than by aggregate demand deficiency. It is estimated, for example, that on average over the period 1982-83 the natural rate of unemployment amounted to about 68 percent of the actual rate of unemployment in the Atlantic Provinces, 79 percent in Quebec and Ontario, 75 percent in the Prairie Provinces, and 73 percent in British Columbia. Given this high amount of structural unemployment, a policy of stimulating aggregate demand to combat unemployment would only have served to drive up prices without doing very much to reduce unemployment. Under these circumstances, if the goal of regional policy had been to reduce unemployment in the high unemployment regions, concentration should have been on measures to reduce the equilibrium rate of unemployment rather than on measures to increase regional aggregate demand. Such measures might have included market oriented manpower retraining programs, programs to improve labour mobility, and perhaps also changes to tighten up the operation of the UI Act, including a reduction in the benefit rate, an increase in the eligibility requirements to draw benefits, and the elimination of the regional differentiation of the unemployment insurance program as recently recommended by the Macdonald Royal Commission in its *Final Report*.[7]

This is not to argue, of course, that cyclical unemployment in the recession was insignificant or unimportant. It is estimated, for example, that in the 1982 recession the cyclical rate of unemployment in the Atlantic region amounted to 4.8 percent, which was a third of the actual rate of unemployment recorded in that region. In the other high unemployment regions of Quebec and British Columbia, the corresponding figures were 3.4 and 3.0 percent respectively, which amounted to about one-quarter of the actual rate of unemployment recorded in these regions. While 3 and 4 percent cyclical rates of unemployment may seem small, the elimination of cyclical unemployment in the 1982 recession would have added 43,000 new jobs in the Atlantic Provinces, about 100,000 new jobs in Quebec, about 40,000 new jobs in British Columbia, and about 300,000 new jobs in Canada as a whole![8]

The magnitude of this loss in employment suggests that some scope may have existed for the temporary use of public works programs to combat cyclical unemployment. Such programs would have been better implemented by the provinces than by the federal government since, as Lacroix and Rabeau [4] have noted, the provinces and municipalities control 85 percent of Gross Fixed Capital Formations in

[7]See [13:601-612].

[8]These calculations are based on the assumption that the labour force does not change in response to the reduction in the rate of cyclical unemployment.

Canada.[9] This is a flexible form of expenditure whose multiplier effects are high and which is subject to low interregional import leakages. Moreover, more items of provincial expenditure are non-recurrent than are those at the federal level and, therefore, they can be varied more readily for counter-cyclical purposes. Finally, empirical estimates of dynamic government expenditure multipliers by Miller and Wallace [8] show that real expenditures can have a substantial short-run impact on provincial income. Their analysis shows that the first round and dynamic multipliers are high, with 80 percent of the effects appearing after three years for most provinces.

The implementation of public works expenditures by the provinces, however, would not have been entirely free of problems. One major difficulty is that the provinces could not have borrowed from the Bank of Canada to finance budget deficits. This means that expenditure increases would have had to be financed by borrowing in the capital market, which could have resulted in sharply rising interest rates and serious crowding out effects on the private sector. Some economists, however, like Pierre Fortin [2:30], have argued that these financial constraints on the ability of the provinces to borrow in order to finance stimulative demand measures have been exaggerated; that the costs and terms of credit available to the provinces do not differ significantly from those available to the federal government.[10] Even if this were true, however, provincial expenditure policies could have at best played only a supplementary role in combatting unemployment in the recession. The high levels of structural unemployment in the regions suggest that any significant effort to reduce unemployment to socially acceptable levels required that major emphasis be put on policies to improve the efficient performance of labour markets rather than on policies to stimulate regional aggregate demand.[11]

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[9]Apart from this consideration, it is generally agreed that the past growth of the accumulated public debt acted as a significant barrier to the federal government's ability to increase the size of the budget deficit to combat unemployment. Consequently, the burden of stabilizing the economy had to be assumed by the provinces.

[10]For a fuller discussion of the advantages and disadvantages of provincial involvement in stabilization policy, see Rabeau [10].

[11]This conclusion, therefore, supports the findings of Lazar [5:126], Thirsk [17:121] and Riddell [12:99].

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Appendix

The symbols used in the regression equations in Tables 1 and 2 are defined below, together with the data sources and, where applicable, the method of construction of the variables.

PDEVO: Percentage deviations in gross regional domestic product at factor cost in constant $ 1971 around its trend rate of increase. Real output data were obtained from the Conference Board in Canada [16].

LNRR: The natural logarithm of the net replacement ratio (NRR) which is defined to be equal to:

$$NRR = \frac{bW(1-t^1)}{W(1-c)(1-t)-E}$$

b = gross benefit rate as a proportion of the weekly wage

W = the average weekly wage

t^1 = marginal income tax rate applicable to unemployment insurance benefits

c = weekly rate of contribution to UI when employed and covered

t = marginal income tax rate

E = extra weekly expenses associated with employment, as compared to unemployment.

Provincial figures for the NRR were obtained from an unpublished study by Wilson and Vanderkamp [19]. To obtain regional estimates of the NRR for the Atlantic and Prairie provinces a weighted average of the provincial net replacement ratios was calculated using provincial annual average weekly wages as weights.

LLFPYF: The natural logarithm of the combined labour force participation rates for young (aged 15-24) and female workers (aged 24-55). These participation rates were calculated from data found in Statistics Canada [15]. The combined participation rates for these two groups of workers were used as an explanatory variable in the equations in Tables 1 and 2 because the problem of high multicollinearity between these participation rates made it impossible to estimate their separate influence on the unemployment rate.

LRMW: The natural logarithm of the relative minimum wage (RMW). RMW was calculated for each province as the ratio of average provincial minimum wages to average hourly earnings in manufacturing. Data on minimum wages were obtained from Canada Department of Labour [1]. The manufacturing wage data were obtained from Statistics Canada [14].

To obtain regional estimates for the Atlantic and Prairie provinces a weighted average of the provincial ratios was calculated using average hourly earnings in manufacturing as weights.