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Structural Determinants of the Natural Rate
of Unemployment in Canada

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Authorized for distribution by
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April 6, 1989

Abstract

This paper presents empirical estimates of the policy and structural determinants of the natural rate of unemployment in Canada. The paper begins with a discussion of structural features of the economy which impinge on the adjustment of real wages to their equilibrium level. Estimates are presented showing how the generosity of the unemployment insurance system is related to past levels of unemployment. The empirical results indicate that government policies have been largely responsible for changes in the natural rate, and hence can contribute to a reduction in the natural rate in the medium term.

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Summary

This paper attempts to assess empirically how policy variables and other structural aspects of the Canadian economy may have affected the natural rate of unemployment since the early 1970s. Such an assessment provides a basis for judging the extent to which economic policies can contribute to a reduction of the natural rate in the medium term.

The paper begins with a general discussion of the structural determinants of the natural rate. It argues that although supply shocks and demographic changes may increase unemployment if real wages do not adjust, the ultimate determinants of the natural rate are those features of the economy that impinge on the adjustment of real wages.

An important structural feature relevant to the natural rate is the unemployment insurance system. Changes in the Canadian unemployment insurance system over the last two decades have made qualifying and benefit periods dependent on the level of the regional and national unemployment rates. One of the innovative features of this paper is the calculations demonstrating the extent to which the "generosity" of the unemployment insurance system in Canada is related to past developments in unemployment rates.

A number of equations are estimated relating the unemployment rate to cyclical and structural variables. Given the hiring and firing practices of firms, few constraints are placed on the dynamic response of the unemployment rate to its determinants. Estimates of the natural rate of unemployment are then derived from one of the dynamic unemployment equations by solving for the long-run, steady-state relationship between the unemployment rate and its structural determinants. The results suggest that important determinants of the natural rate are the generosity of the unemployment insurance system, relative minimum wages, payroll taxes, and the degree of unionization of the labor force. Estimates of how each of these has contributed to changes in the natural rate since 1971 are presented. The estimated equations also incorporate a hysteresis-type mechanism whereby the natural rate is related to past levels of the unemployment rate through the working of the unemployment insurance system.

Since economic policies are largely responsible for past changes in the natural rate, they can contribute to reductions in the natural rate in the medium term. This would ease the constraints on macroeconomic policies by reducing inflationary pressures while at the same time tending to lower unemployment and increase output.

I. Introduction

There are two important policy issues concerning the natural rate of unemployment. The short-run macroeconomic issue concerns the level of the natural rate as an indicator of likely inflationary or disinflationary pressures emanating from the labor market. The long-run issue concerns the structural determinants of the natural rate and the extent to which economic policies can contribute to a reduction of the natural rate.

The aim of this paper is to assess empirically how policy variables and other structural aspects of the Canadian economy may have affected the natural rate since the early 1970s. Such an assessment provides a basis for judging the extent to which structural policies might contribute to a reduction in the natural rate in the medium term. A reduction in the natural rate is an important goal as it would ease the constraints on macroeconomic policies by reducing inflationary pressures while at the same time tending to increase employment and output.

The paper is organized as follows. Section II presents a general discussion of the structural determinants of the natural rate. One of the more important structural determinants is the generosity of the unemployment insurance system which is discussed in Section III. Section IV presents estimated unemployment rate equations and derives an equation for the natural rate. Section V discusses changes in the natural rate and policy implications.

II. Structural Determinants of the Natural Rate

Friedman's definition of the natural rate of unemployment ^{1/} provides a convenient starting point:

The 'natural rate of unemployment', in other words, is the level that would be ground out by the Walrasian system of general equilibrium equations, provided there is imbedded in them the actual structural characteristics of the labor and commodity markets, including market imperfections, stochastic variability in demands and supplies, the cost of gathering information about job vacancies and labor availabilities, the costs of mobility, and so on.

Many of the structural characteristics of labor markets will be relatively stable and hence will not contribute to changes in the natural rate. The following discussion focuses on those structural or institutional features of the Canadian labor market which have changed over the last 15 to 20 years and for which data, or reasonable proxies, are available.

^{1/} Friedman, M., 1968, "The Role of Monetary Policy," American Economic Review, Vol. 58, No. 1, pp. 1-17.

Market imperfections include those structural features of the economy which might prevent or impede real wages from adjusting to levels consistent with full employment. The deleterious effects of these imperfections on unemployment are likely to be more apparent when there are large shocks, a point returned to below. Two structural aspects of the labor market which might distort real wages, and thereby affect the natural rate, are minimum wages and the degree of unionization of the labor force, both of which have changed substantially since 1971 in Canada (Chart 1): from the mid-1970s to the mid-1980s, the level of minimum wages as a percent of average commercial wages declined from about 50 percent to less than 40 percent; the proportion of the labor force which is unionized rose from about 33 percent in 1971 to almost 40 percent in the early 1980s, and has declined somewhat in the subsequent period.

Taxes are another structural feature of the economy which might affect the natural rate either (i) by increasing the cost of labor relative to other factors, thereby affecting the demand for labor; (ii) by affecting the decision to invest and produce; or (iii) by distorting the choice between work and leisure. In Canada, average indirect and personal tax rates have been broadly stable since 1971. There have, however, been large increases in employers' contributions for social security and pensions, particularly in the period from the early 1970s to the early 1980s (Chart 1). Similar increases in payroll taxes have occurred in other industrialized countries and the possible impact on the natural rate has often been stressed in analyses of European employment. ^{1/}

The role that variability in demands and supplies of goods and labor may have played in increasing the natural rate has received considerable attention. ^{2/} In the empirical work discussed below, two measures of variability have been used: the coefficient of variation of employment across industries, which has increased since the mid-1970s, and the coefficient of variation of employment across provinces, which declined from the early 1970s to the early 1980s before rising subsequently (see Chart 1). Changes in occupational or geographical mobility

^{1/} See, for example, Bean, C.R., P.R.G. Layard and S.J. Nickell, 1986, "The Rise in Unemployment: A Multicountry Study," *Economica*, Vol. 53, supplement, pp. S1-S22. For an international comparison of developments in nonwage labor costs as a percent of wages and salaries from the mid-1960s, see Table 5 in Chan-Lee, J.H., D.T. Coe, and M. Prywes, 1987, "Microeconomic Changes and Macroeconomic Wage Disinflation in the 1980s," *OECD Economic Studies*, No. 8, pp. 121-157.

^{2/} See Lillien, D.M., 1982, "Sectoral Shifts and Cyclical Unemployment," *Journal of Political Economy*, Vol. 90, No. 4, pp. 777-793; and Samson, L., 1985, "A Study of the Impact of Sectoral Shifts on Aggregate Unemployment in Canada," *Canadian Journal of Economics*, Vol. 18, No. 3, pp. 518-530.

would also be expected to have an impact on the natural rate of unemployment. The variability of employment across industries might serve as a proxy for occupational mobility. Geographical mobility can be measured by gross interprovincial labor force flows (see Chart 1).

There are empirical as well as conceptual problems with these measures of variability and mobility. One issue is that some form of wage rigidity would seem to be necessary for changes in the variability of output to affect the natural rate. Another is that increased measured mobility may accompany, or be a manifestation of, increased variability, in which case the impact on the natural rate would be uncertain. Finally, measured variability or mobility may be highly correlated with the business cycle and have little to do with structural changes in the economy. Perhaps for these reasons, there does not appear to be a consensus on the empirical significance of mobility or structural dispersion in determining the natural rate in Canada.

Information on the cost of job search, a structural characteristic noted by Friedman, is not readily available. Data are available, however, for some important aspects of the unemployment insurance system which can be expected to affect the reservation wage, and hence job search. As discussed in the following section, there have been important changes in many aspects of the unemployment insurance system which may have contributed to changes in the natural rate in Canada.

As in other countries, there have been relatively large changes in the composition of the labor force in Canada (see Chart 1), and demographic factors are often emphasized as important structural determinants of the natural rate. Although increases in specific segments of the labor force--such as traditionally high unemployment groups or groups with a weak attachment to the labor force--may tend to increase the natural rate, calculations holding labor market shares constant indicate that the magnitude of this compositional effect is small. ^{1/} For demographic changes to have large impacts on the natural rate, some form of rigidity preventing the real wages of the various demographic cohorts from adjusting would seem to be necessary.

This highlights a general point referred to above. Supply or demand shocks such as changes in oil prices or the demographic composition of the labor force may be associated with changes in unemployment which may last for some time if real wages fail to adjust. Should there be an impact on the natural rate, however, the ultimate cause would not be the shocks per se, rather it would be those structural aspects of the economy which prevent the adjustment of real wages. In the empirical analysis which follows, emphasis is placed on identifying structural features of the economy which might directly impinge on the flexibility with which real wages adjust to shocks.

^{1/} Ford, R. and D.E. Rose, 1988, "Estimates of the NAIRU Using an extended Okun's Law", Bank of Canada Working Paper, forthcoming.

There are, of course, other possible determinants of the natural rate, although those most often included in empirical studies for Canada have been discussed above. 1/ The possibility that the natural rate of unemployment is positively related to the past history of unemployment--in which case the natural rate is said to have the property of hysteresis--has received increasing attention in discussions of European unemployment. 2/ A casual examination of the unemployment rate data suggests hysteresis may also be important in Canada: from 1966 to 1974, the annual unemployment rate averaged less than 5 percent and never exceeded 5 1/2 percent; since 1975, the annual unemployment rate in Canada has averaged almost 9 percent and has remained well above 7 percent in the current sustained expansion of output. Recent empirical analyses suggest that hysteresis may account, at least in part, for the persistence of high unemployment in Canada. 3/ This conclusion is supported by the empirical analysis reported below whereby the natural rate of unemployment is related to the generosity of the unemployment insurance system, which in turn depends on past rates of unemployment.

III. Unemployment and Unemployment Insurance

1. Changes in the unemployment insurance program 4/

There have been significant changes to the Canadian unemployment insurance (UI) system. In 1971 the coverage of the UI program was increased from about 67 to 90 percent of the labor force, and the ratio of the average benefit to earnings was raised by about 50 percent. The maximum unemployment replacement rate adjusted for the proportion of the labor force covered by the system is shown in the top panel of Chart 2. The other changes which were made to the UI program in 1971 and in 1977

1/ Empirical studies of the natural rate in Canada are discussed in Rose, D.E., 1988, "The NAIRU in Canada: Concepts, Determinants and Estimates," Bank of Canada Technical Report No. 50, December.

2/ See, for example, Lindbeck, A. and D.J. Snower, 1988, "Cooperation, Harassment, and Involuntary Unemployment: An Insider-Outsider Approach," American Economic Review, Vol. 78, No. 1, pp. 167-188; and Blanchard, O. and L.H. Summers, 1988, "Hysteresis and the European Unemployment Problem," in R. Cross (ed.), 1988, Unemployment, Hysteresis & the Natural Rate Hypothesis, Oxford: Basil Blackwell.

3/ See Milbourne, R.D., D.D. Purvis, and W.D. Scoones, 1988, "Unemployment Insurance, Unemployment Dynamics and the Natural Rate(s)," Queens University, mimeo, October; and Coe, D.T., 1988, "Hysteresis Effects in Aggregate Wage Equations," in Cross, op. cit., pp. 285-305.

4/ The following discussion is based on Green, C. and J.-M. Cousineau, 1976, Unemployment in Canada: The Impact of Unemployment Insurance, Economic Council of Canada; Milbourne, et al., op. cit.; and Ashenfelter, O. and D. Card, 1986, "Why Have Employment Rates in Canada and the U.S. Diverged?" NBER Working Paper, No. 1840, February.

concerned the number of weeks of work required to qualify for UI benefits and the number of weeks in the benefit period.

The minimum work requirement to qualify for UI benefits was lowered in 1971 from 30 weeks in the preceding two years to 8 weeks in the preceding year. The basic benefit period of 15 weeks was replaced with a four-phase benefit period, which was conditional on both the national and the regional unemployment rates. The first two phases, which had to be applied for separately, provided 18 weeks of benefits. Phase III provided for an additional four weeks if the national unemployment rate exceeded 4 percent, and an additional eight weeks if it exceeded 5 percent. Phase IV extended the benefit period in those regions where the unemployment rate exceeded the national average: benefits were extended by 6 weeks if the regional unemployment rate was 1-2 percentage points higher than the national average, by 12 weeks if it was 2-3 percentage points higher, and by 18 weeks if it was more than 3 percentage points higher. From 1971 to 1977, the national unemployment rate was always above 5 percent so the basic benefit period was 26 weeks. This could be extended to 44 weeks in regions where the unemployment rate exceeded the national average by 3 percentage points.

In 1977 the UI program was changed to its current form. Both the qualifying and the benefit periods were made to depend upon the level of regional unemployment rates, rather than the differential between regional and the national unemployment rates. Benefits became payable in three phases for a maximum of 50 weeks in a year. A variable work requirement of from 10 to 14 weeks was introduced, depending on the unemployment rate in the region: 10 weeks if the regional unemployment rate was 9 percent or more, 14 weeks if the regional unemployment rate was 6 percent or less. Repeat claimants were required to work for 16 to 20 additional weeks to qualify for further benefits, a requirement which was waived in regions with unemployment rates over 11.5 percent. As regards the benefit periods, in the first phase the claimant receives 1 week of benefits for each week worked, up to a maximum of 25 weeks of benefits. In the second phase, the claimant receives 1 week of benefits for every 2 weeks of employment over 26 weeks, up to a maximum of 13 weeks of benefits. In the third phase, the claimant can receive 2 to 32 weeks of regional extended benefits, depending on the regional unemployment rate--2 weeks of benefits for every 0.5 percentage points that the regional unemployment rate exceeds 4 percent.

2. Unemployment and the generosity of the unemployment insurance system

These changes have made the "generosity" of the unemployment insurance system dependent on past developments in national and regional rates of unemployment. For example, a claimant with 10 weeks of insurable employment in a region with an unemployment rate over 11.5 percent would be eligible for 42 weeks of benefits (10 under Phase I and 32 under Phase III), while a claimant with over 50 weeks of previous work

in a region with an unemployment rate less than 4 percent could receive benefits for 38 weeks (25 under Phase I and and 13 under Phase II).

The way in which the UI system interacts with actual unemployment to affect the length of the work requirement and the benefit periods is illustrated in the second panel of Chart 2 which presents estimates of the minimum work requirement needed to qualify for UI benefits (MINQ), the extended regional benefits (ERB), and the maximum benefit period for someone meeting the minimum work requirement (MAXB), all measured in weeks per year. The estimates in Chart 2 are a weighted average of calculations for each of the ten provinces with the weights based on provincial shares of total unemployment. ^{1/} For each province (denoted by an "i") the calculations are as follows, where U is the aggregate national unemployment rate and U_i is the provincial unemployment rate, both in the preceeding quarter:

$$\begin{array}{ll} \text{prior to 1971} & \text{MINQ}_i = 15 \\ & \text{ERB}_i = 0 \\ & \text{MAXB}_i = 15 \\ \\ \text{1971 to 1977} & \text{MINQ}_i = 8 \\ & \text{ERB}_i = \begin{cases} 0 & \text{if } U_i - U < 1 \\ 6 & \text{if } 1 \leq U_i - U < 2 \\ 12 & \text{if } 2 \leq U_i - U < 3 \\ 18 & \text{if } U_i - U \geq 3 \end{cases} \\ & \text{MAXB}_i = 26 + \text{ERB}_i \\ \\ \text{from 1978} & \text{MINQ}_i = \begin{cases} 10 & \text{if } U_i \geq 9 \\ 12 & \text{if } 6 < U_i < 9 \\ 14 & \text{if } U_i \leq 6 \end{cases} \\ & \text{ERB}_i = \begin{cases} 0 & \text{if } U_i \leq 4 \\ (U_i - 4) * 4 & \text{if } 4 < U_i \leq 12 \\ 32 & \text{if } U_i > 12 \end{cases} \\ & \text{MAXB}_i = \text{MINQ}_i + \text{ERB}_i \end{array}$$

Although these calculations are only approximations to average lengths of qualifying and benefit periods, it is clear that after 1978 developments in extended regional benefits, and hence the maximum benefit period, were closely related to developments in the unemployment rate.

The number of weeks which must be worked in a year to qualify for unemployment insurance benefits (MINQ) and the maximum number of weeks in a year for which a person fulfilling the minimum work requirements would be eligible (MAXB) are important dimensions of the generosity of the unemployment insurance system. To incorporate these into the

^{1/} The UI system is administered in 48 regions rather than 10 provinces used in the claculations presented here.

estimated equations presented in the next section, the UI replacement rate adjusted for the proportion of the labor force covered by the unemployment insurance system has been multiplied by the adjustment factor $(52-MINQ)/(52-MAXB)$. ^{1/} If $MINQ=MAXB$, as it did prior to 1971, the adjustment factor is one; if $MAXB$ is greater than $MINQ$, the adjustment factor is greater than one indicating an increase in the generosity of the UI system; and vice versa for $MAXB$ less than $MINQ$. The UI replacement rate with and without this adjustment factor is shown in the top panel of Chart 2. From 1982 to 1984, the extension of regional benefits, linked to increases in the unemployment rate, had the effect of sharply increasing the generosity of the UI system. Since 1984, the average weeks of regional extended benefits has declined with the drop in unemployment rates.

IV. Unemployment Rate Equations

1. Estimation results

There are a number of ways to estimate the natural rate. Perhaps the most common method is to estimate a wage and/or price equation as a function of the unemployment rate and then solve for the implicit natural rate as that unemployment rate which is consistent with stable inflation. A second, somewhat more direct, approach is to estimate an unemployment rate equation, sometimes for specific sectors of the labor market, as a function of cyclical and structural variables and estimate the natural rate from its structural determinants. This approach can be extended to estimate simultaneously the labor- and product-market gaps. ^{2/}

The analysis below follows the second approach based on an aggregate unemployment rate equation estimated on quarterly data from 1971:I to 1988:II, a period during which there were large changes in the Canadian unemployment rate. The estimation procedure, however, differs somewhat from most empirical studies in the literature. ^{3/} The strategy was to start with a general autoregressive distributed lag specification (of up to four quarters) and then test down by dropping insignificant variables. Given the hiring and firing practices of firms, the unemployment rate can be expected to react to changes in its cyclical and structural determinants with a lag. Accordingly, few restrictions were

^{1/} If either the difference or the ratio of $MAXB$ and $MINQ$ are used as the adjustment factor, the estimation results are very similar.

^{2/} The sensitivity of natural rate estimates to alternative methodologies and data is discussed in Pelletier, J., 1988, "Estimations du NAIRU avec la Courbe de Phillips," Bank of Canada Working Paper, forthcoming.

^{3/} For a review of the empirical literature see Rose, op. cit.

placed on the lag distributions, although in some cases the free estimation suggested obvious patterns (e.g., first differences and moving averages) which were imposed to conserve degrees of freedom. 1/

A number of alternative equations, estimated by ordinary least squares, are reported in Table 1. The variable definitions are: 2/ U is the unemployment rate; CU is capacity utilization in goods-producing industries; GDPGAP is the logarithm of the ratio of real GDP to its quadratic trend; RELPREN is the logarithm of the consumer price of energy relative to the total CPI; RELPREX is the logarithm of the deflator for exports relative to the deflator for imports; UIRR is the maximum unemployment insurance replacement rate adjusted for the proportion of the labor force covered (in equation 1 there is also an adjustment for work requirements and benefit periods as described above); RELMW is the logarithm of the minimum wage relative to the average commercial wage; LF%UNION is the percent of the labor force which is unionized; TAXSIP is the average payroll tax rate for employers' contributions for social security and pension funds; MOBILITY is the average of interprovincial labor force inflows and outflows as a percent of the labor force; DISPROV is the coefficient of variation of employment across provinces; and DISIND is the coefficient of variation of employment across industries. The policy and structural variables are displayed in Charts 1 and 2.

The estimated equations explain developments in the unemployment rate in Canada well. All of the equations pass the diagnostic tests for the absence of serial correlation (except equation 4) and for parameter constancy over time. More importantly, the equations contain a relatively large number of policy variables and other structural determinants of the natural rate. This reflects, in part, the relatively unconstrained estimation procedure. The pattern of the estimated coefficients on the two lagged dependent variables means that the impact

1/ When alternative lag specifications gave conflicting signals as to the significance of specific variables, for example because of multicollinearity between the relatively large number of explanatory variables, preference was given to keeping in structural variables.

2/ Variables expressed as the logarithms of ratios have been multiplied by 100 so that all variables are entered in what are effectively percentage terms. UIRR and TAXSIP are entered as two-period moving averages. Data sources are as follows: The unemployment insurance replacement rate adjusted for coverage, minimum wages, and commercial wages are from the Bank of Canada. The average rate for employers' contributions (employers' contributions for social security and pension funds as a percent of total wages and salaries) is from OECD Standardized National Accounts and is interpolated from annual data. The percent of the labor force which is unionized is from the Directory of Labor Organizations in Canada and is interpolated from annual data; the 1979 observation is not available and was set equal to the average of 1978 and 1980. All other data are from CANSIM.

of each of the independent variables declines then rises somewhat before tailing off to zero. 1/

The cyclical movements of the unemployment rate are determined by two indicators of capacity utilization: the deviation of output from trend, 2/ which is for the total economy, and capacity utilization in the goods-producing sector. The cyclical variables are supplemented by the relative price of energy and the terms of trade in order to capture additional short-run impacts on unemployment from supply shocks. Although these supply shock variables may have temporary impacts on the rate of unemployment consistent with stable inflation, i.e. on the NAIRU, they have not been used in the calculation of the natural rate. 3/ To the extent that these variables fully account for the cyclical changes in the unemployment rate, the secular movements in the natural rate will be determined by the structural variables.

The estimation results point to the importance of four structural determinants of the natural rate: the unemployment insurance replacement rate adjusted for coverage and qualifying and benefit periods, the relative minimum wage, the percent of the labor force which is unionized, and payroll taxes. 4/ Of these structural determinants, only the degree of unionization of the labor force is not under the direct influence of government policy. Equations 1 and 2 are identical except that the unemployment insurance replacement rate is not adjusted for the minimum number of weeks of work required to qualify for unemployment benefits relative to the maximum number of weeks of unemployment benefits in

1/ That is, the lag distribution initially resembles a third-order polynomial, with the peak in the third quarter, before asymptotically approaching zero.

2/ When the squares of the quadratic gap variable were added to the equation, in order to test for nonlinearities, its estimated coefficient was marginally significant but there was little difference in the overall estimation results. Using a linear trend with a break in 1973, rather than a quadratic trend, also had little overall effect although the significance of the estimated coefficient on the unemployment replacement rate was reduced somewhat.

3/ The impact of these types of supply shock variables were incorporated in the calculations of the NAIRU in Canada in Adams, C., P.R. Fenton, and F. Larsen, 1987, "Potential Output in Major Industrial Countries," Staff Studies for the World Economic Outlook, August, pp. 1-38.

4/ Entering separate tax rates for employers' contributions for social security and for pension funds resulted in significant estimated coefficients of almost identical magnitude on each variable but had little impact on the overall regression results. The significance, but not the sign, of the estimated coefficients on relative minimum wages and the replacement rate was sensitive to the inclusion of the employers contribution variable.

equation 2. ^{1/} Possible effects from effective personal income taxes and indirect taxes were also tested but the estimated coefficients were insignificant. This suggests that a revenue-neutral tax change reducing payroll taxes and increasing other taxes would tend to lower the natural rate of unemployment.

Various demographic variables also were tried. The percent of the labor force which is young (aged 15 to 24) and/or female gave either insignificant or perversely signed (that is negative) estimated coefficients. Equation 3 includes the percent of the labor force aged 55 and older and excludes the terms-of-trade variable. The estimated coefficient is positive implying that an increase in the share of older workers will be associated with increased structural unemployment. This may reflect less flexibility on the part of older workers in responding to changes in output and demand, but seems inconsistent with the greater experience and human capital associated with an older work force.

Equation 4 includes measures of geographical mobility and the dispersion of industrial and provincial employment. The estimated coefficient on the mobility variable is correctly signed but not significantly different from zero. The estimated coefficient on the variation of employment across provinces is positive and significant and on the variation of employment across industries negative and significant. ^{3/} Entered separately, however, neither variable was significant.

2. An equation for the natural rate

An equation for the natural rate can be extracted from the dynamic equations reported in Table 1 by solving for the long-run steady-state relationship between the unemployment rate and its structural determinants. This long-run focus seems particularly appropriate for an equation describing one of the key structural features of the economy. Applying this procedure to equation 1, the natural rate can be calculated as:

$$\begin{aligned} \text{natural rate} &= 0.007 \text{ UIRR} + 0.034 \text{ RELMW} \\ &\quad (2.7) \qquad (2.1) \\ &+ 0.289 \text{ LF\%UNION} + 0.627 \text{ TAXSIP} + \text{constant} \\ &\quad (3.8) \qquad (4.1) \end{aligned}$$

^{1/} The smaller estimated coefficient on the UIRR variable in equation 1 compared to equations 2-4 reflects the fact that the adjustment factor for qualifying and benefit periods increases the level and variance of the UIRR variable, cf. Chart 2.

^{3/} Increased dispersion across industries may be a proxy for occupational mobility tending to decrease the natural rate, whereas increased dispersion across provinces may represent a proxy for structural changes tending to increase the natural rate.

t-statistics reported in parentheses are based on approximate large-sample standard errors. 1/

The constant can be calculated by making explicit assumptions about the cyclically neutral level of the GDP gap variable and the shock-free levels of the two supply shock variables. Two assumptions have been made: in the first case these variables were set at their sample period averages; in the second case the GDP gap was set to its average value from mid-1987 to mid-1988, a period when most observers consider output to be at or near full capacity.

The two resulting estimates of the natural rate, which bracket the current unemployment rate, are shown in Chart 3. Taking the average of the two estimates suggests a natural rate of about 8 percent in 1988:II. This estimate of the level of the natural rate--which is sensitive to the assumptions used concerning the cyclical and supply shock variables--is broadly consistent with recent estimates of the natural rate in Canada which suggest a range of 7 to 9 percent. 2/ Needless to say, large confidence intervals are likely to be associated with any point estimate of the natural rate.

V. Changes in the Natural Rate and Policy Implications

The estimation results suggest that there were steady increases in the natural rate of unemployment in Canada from 1971 to 1978. After cyclical movements in 1973 and 1974, the increases in the Canadian unemployment rate from the mid-1970s to the late 1970s were largely a reflection of increases in the natural rate. Although the time profile of both the actual and the natural rates were similar in the following decade, the large increase and subsequent decline in unemployment during the 1981 to 1987 period were primarily a reflection of cyclical factors rather than changes in the natural rate.

The contributions which each of the structural determinants is estimated to have made to changes in the natural rate since 1971 are shown in Chart 4. The main factors affecting the natural rate are estimated to have been the following:

- The increase in unemployment benefits relative to wages, adjusted for coverage and qualifying and benefit periods, is estimated to have increased the natural rate by almost 1 percentage point from 1970 to mid-1972. From 1977 to 1981,

1/ See Kmenta, J., 1971, Elements of Econometrics, MacMillan, p. 444.

2/ See Rose, op. cit., and the references cited therein. The higher estimate in Chart 3 is based on sample period averages for the cyclical and supply shock variables. If the average relative price of energy from 1979-88 were used instead of the sample period average, the estimate of the level of the natural rate would be correspondingly higher.

the natural rate may have declined by about 0.3 percentage points due to reductions in the adjusted replacement rate. Increases in the adjusted replacement rate, primarily due to large increases in extended regional benefits, are estimated to have increased the natural rate by about 1 percentage point from 1981 to 1983. Thereafter, the decline in regional benefits associated with the decline in unemployment rates may have lowered the natural rate by about 0.5 percentage points. The net effect of changes in the adjusted unemployment replacement rate from 1970 to 1988 may have been to increase the natural rate by about 1 percentage point.

- The steady decline in minimum wages relative to commercial wages is estimated to have reduced the natural rate by about 1 percentage point from the mid-1970s to the mid-1980s. Since the mid-1980s relative minimum wages have been roughly stable.
- The increased unionization of the labor force from 1971 to 1978 is estimated to have increased the natural rate by 1.5 to 2 percentage points. The degree of unionization moved cyclically from 1978 to 1983 and the net effect may have been to increase the natural rate by almost 0.5 percent. Subsequent declines in unionization may have lowered the natural rate of unemployment by about 1 percentage point.
- The rise in payroll taxes is estimated to have increased the the natural rate by about 1.5 percentage points from 1971 to the late 1970s, and by about another 1 percentage point since then.

The factors accounting for the drop in the natural rate since the early 1980s are the continuing decline in the proportion of the labor force which is unionized and the reduction in the generosity of unemployment insurance benefits. The latter is related to the shortening of extended regional benefits associated with the decline in unemployment rather than to reductions in the unemployment insurance replacement rate or the proportion of the labor force covered by the unemployment insurance system. This hysteresis-type effect whereby the natural rate is dependent on past levels of unemployment through the working of the unemployment insurance system may have increased the natural rate by as much as 1 percentage point in 1982 and 1983 when unemployment rates were at postwar highs; and while the subsequent decline in the actual unemployment rate served to reduce the adverse effect of the extended regional benefits, it is estimated that the natural rate is still almost 0.5 percentage points higher at present than it would be in the absence of such benefits.

The policy implications can be summarized briefly. If government policies contributed to increases in the natural rate during the 1970s, and there seems to be broad agreement that they did, 1/ policies should be able to contribute to decreases in the natural rate in the period ahead. 2/ Government policies, of course, have multiple objectives, including the reduction of fiscal deficits. This suggests that emphasis might be placed on reductions in the generosity of the unemployment insurance system, particularly through the elimination or reduction of extended regional benefits, and on continued declines in relative minimum wages. These types of structural policies, by reducing the natural rate, would ease the constraints on macroeconomic policies by contributing to lower unemployment and inflation in the medium term.

1/ See, for example, Rose, op. cit.

2/ The estimation results suggest, for example, that each of the following policies might contribute to lowering the natural rate by about one half percentage points in the 1989 to 1993 period: continued gradual declines in relative minimum wages at the same rate as occurred on average from the mid 1970s to 1988; the elimination of regional extended benefits for unemployment insurance benefits; or the gradual reduction in payroll taxes to about their 1982 level.

Table 1. Canada: Unemployment Rate Equations 1/

	1	2	3	4
Constant	-3.767 (1.8)	-2.875 (1.3)	-10.810 (2.8)	-15.883 (2.4)
CU - CU ₋₁	-0.097 (4.0)	-0.110 (4.4)	-0.103 (3.9)	-0.109 (4.8)
GDPGAP ₋₁	-0.193 (6.3)	-0.203 (6.3)	-0.171 (5.3)	-0.234 (7.6)
RELPREN	0.029 (3.7)	0.031 (3.7)	0.018 (2.4)	0.035 (4.9)
RELPREX ₋₁	-0.042 (4.1)	-0.039 (3.9)		-0.025 (2.8)
UIRR 2/	0.004 (2.4)	0.014 (2.3)	0.020 (2.7)	0.013 (1.9)
RELMW ₋₁	0.020 (2.2)	0.025 (2.4)	0.023 (2.1)	
LFZUNION	0.169 (3.3)	0.141 (2.6)	0.096 (1.7)	0.144 (2.3)
TAXSIP ₋₁	0.367 (3.5)	0.317 (3.2)	0.631 (3.8)	0.533 (4.3)
LFZ55+			0.493 (2.8)	
MOBILITY ₋₁				-0.106 (1.2)
DISPROV ₋₂				0.053 (3.4)
DISIND ₋₂				-0.041 (3.9)
U ₋₁	0.737 (6.3)	0.779 (7.0)	0.900 (8.1)	0.680 (6.5)
U ₋₂	-0.322 (3.8)	-0.269 (3.0)	-0.317 (3.4)	-0.210 (2.5)
RBSQ	0.988	0.988	0.987	0.991
SE	0.238	0.238	0.251	0.214
F-statistics:				
Auto correlation (1-4) (CV = 2.5)	1.96	2.20	1.59	2.81
ARCH (4) (CV = 2.6)	2.65	1.87	1.01	0.58
Break 84Q1 (CV = 2.0)	0.88	0.92	1.00	0.98
Break 82Q2 (CV = 1.8)	1.83	1.65	1.65	1.33

1/ All equations are estimated by ordinary least squares on quarterly data from 1971:I to 1988:II (70 observations) using PC-GIVE 5.0. All variables are defined in the text and are expressed in units of percent. Absolute values of t-statistics appear in parentheses. ARCH refers to a test for autoregressive conditional heteroscedasticity. Critical values (CV) at the 5 percent level are given in parentheses below the F-statistics.

2/ In equation 1 the unemployment insurance replacement ratio (UIRR) is adjusted for the proportion of the labor force covered by the unemployment insurance system and for the length of the qualifying and benefit periods; in equations 2-4 UIRR is only adjusted for coverage.

CHART 1
CANADA

STRUCTURAL ASPECTS OF THE LABOR MARKET

Percent

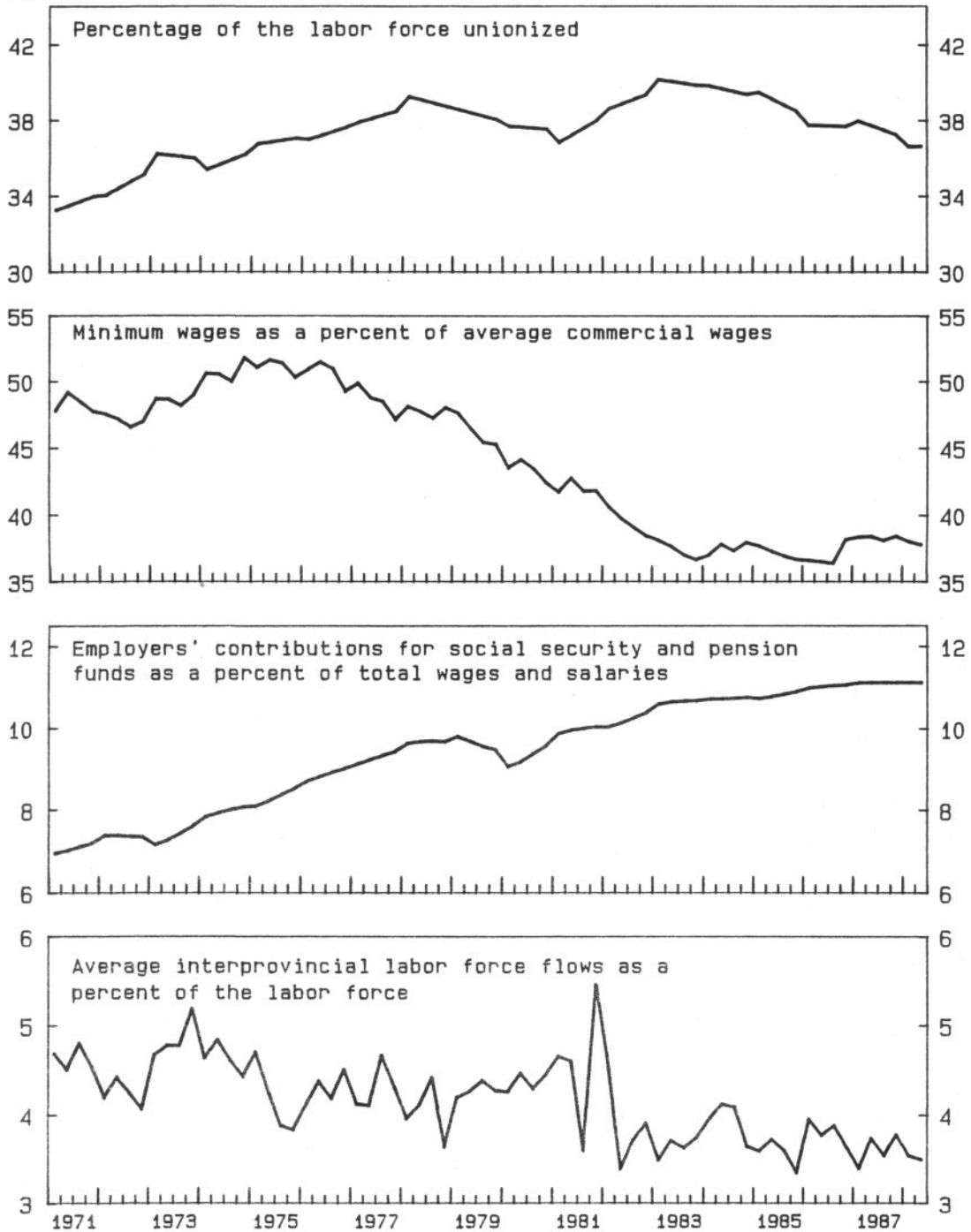


CHART 1, Continued

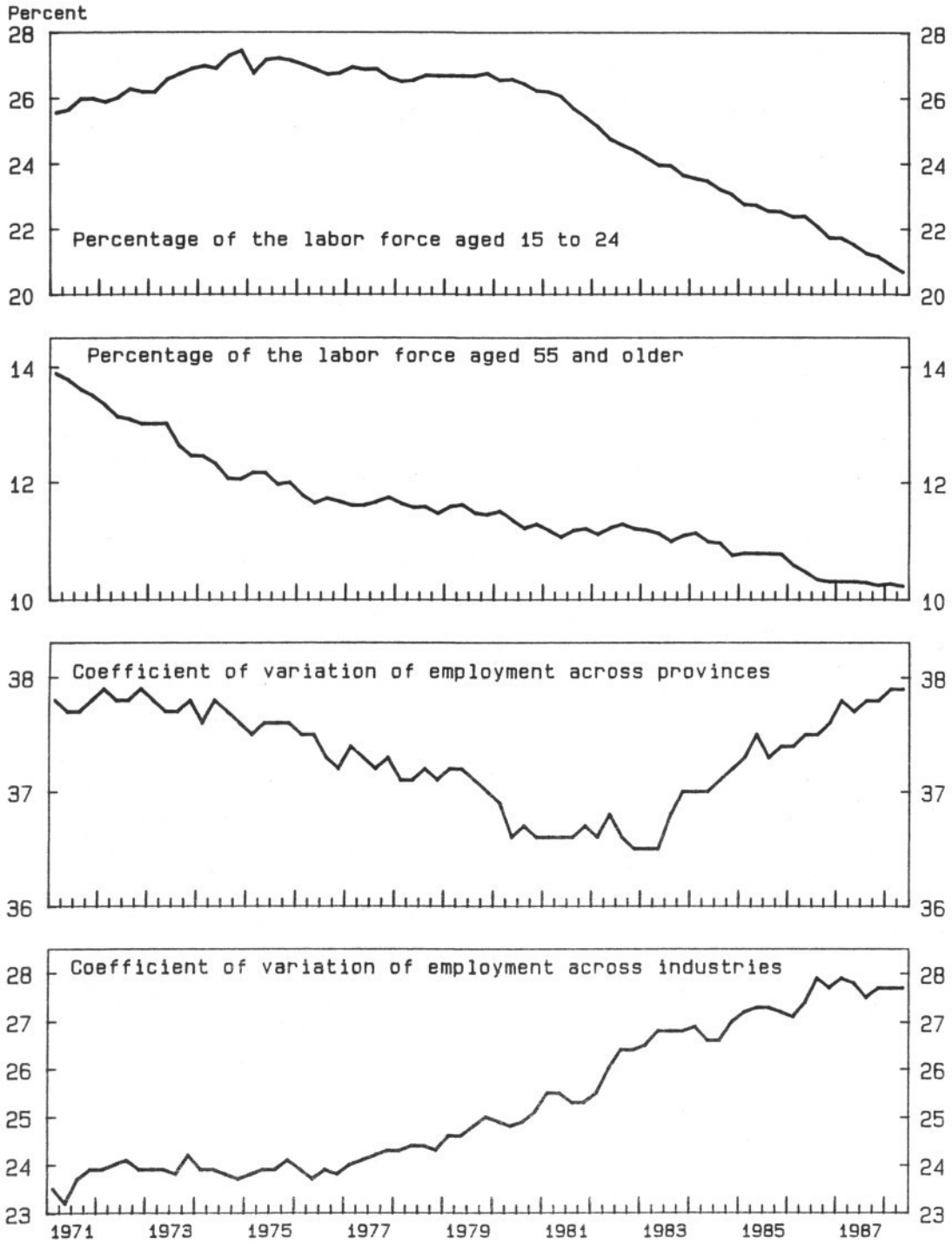
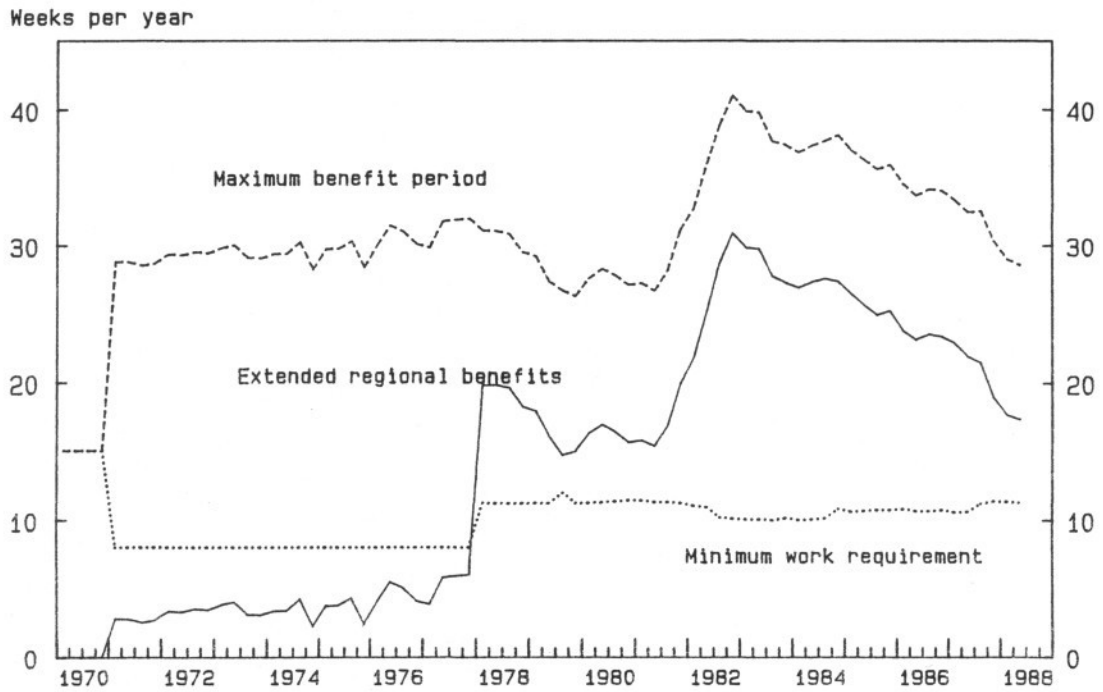
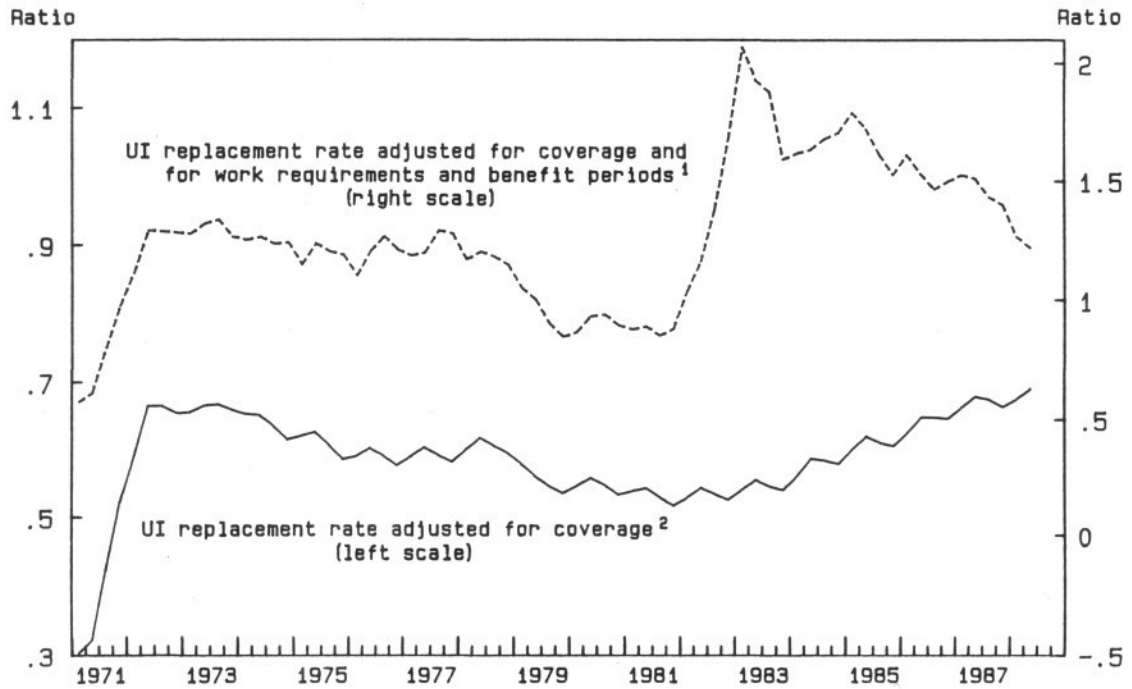


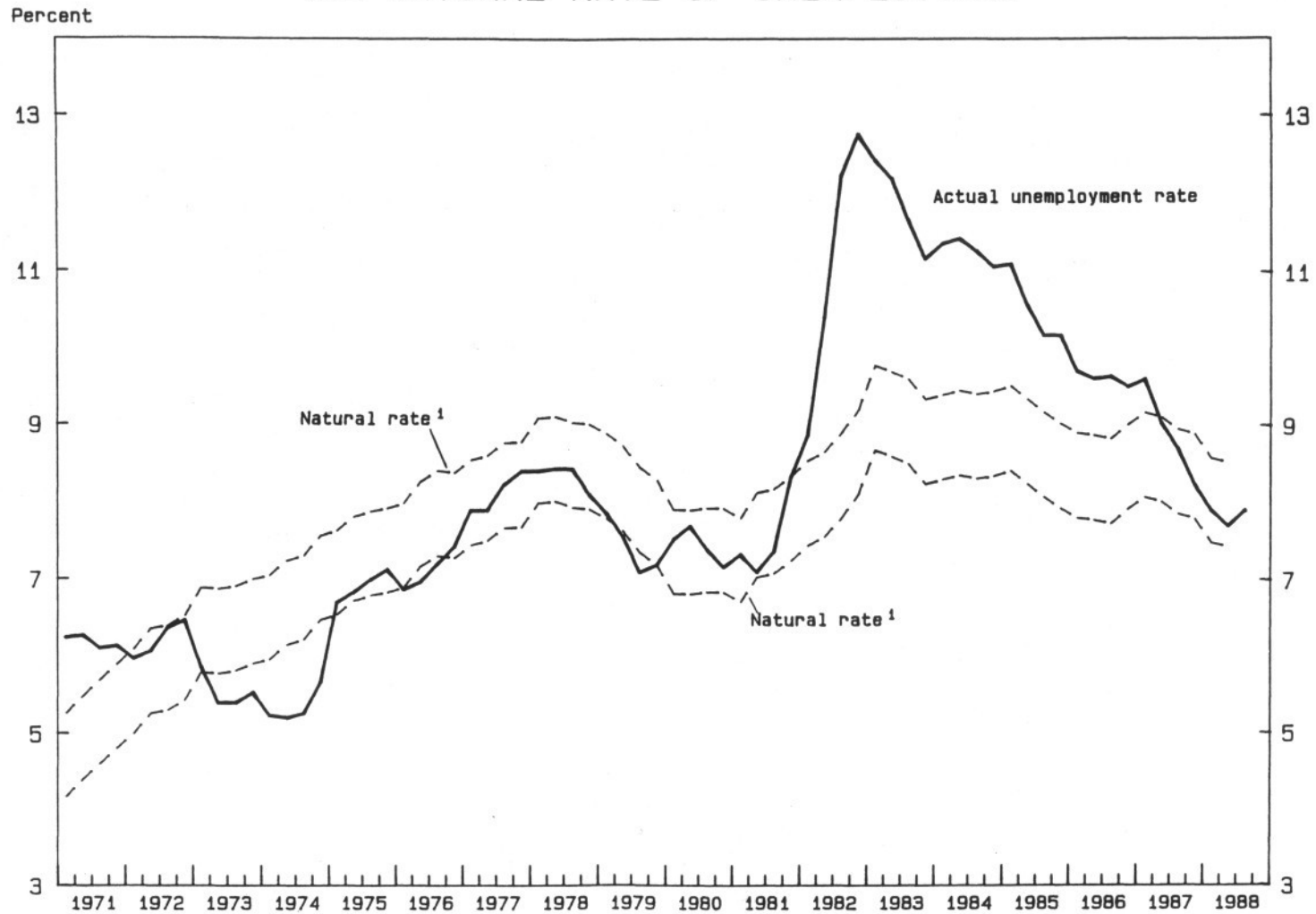
CHART 2
CANADA

MEASURES OF THE GENEROSITY OF THE UI SYSTEM



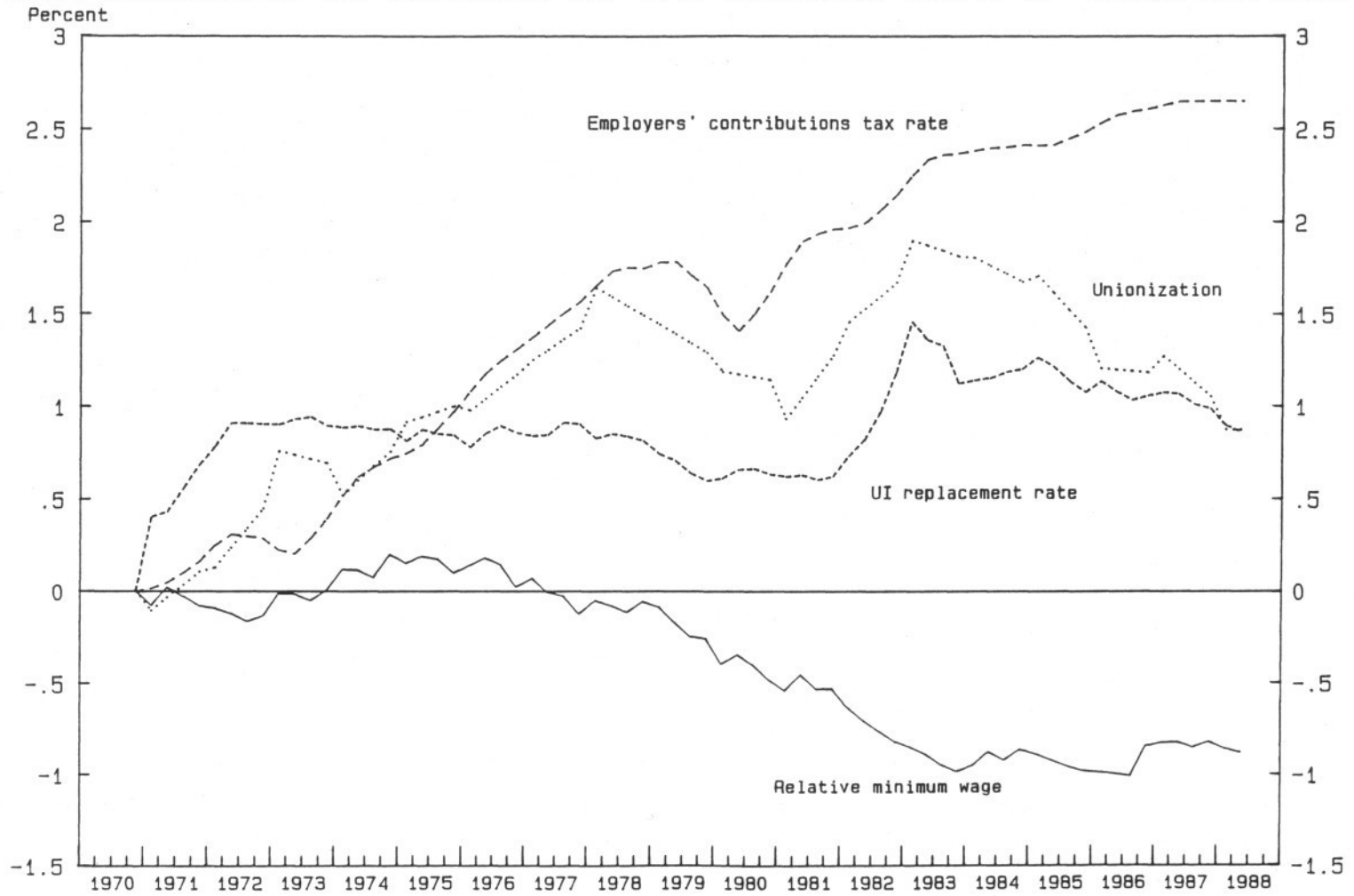
¹The calculation of the adjustment for work requirements and benefit periods is discussed in the text.
²Two period moving average.

CHART 3
 CANADA
 THE NATURAL RATE OF UNEMPLOYMENT



¹The two estimates of the natural rate are based on alternative assumptions of the GDP gap variable and the cyclically-neutral levels of the supply shock variables. The higher estimate is based on sample period averages; the lower estimate is based on the average value of the GDP gap from mid-1987 to mid-1988.

CHART 4
CANADA
CONTRIBUTIONS TO CHANGES IN THE NATURAL RATE OF UNEMPLOYMENT¹



¹The contribution of each variable to changes in the natural rate of unemployment has been normalized to be zero in 1970: IV.

