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WAGE AND PRICE DYNAMICS IN CANADA

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ABSTRACT

This paper examines wage and price dynamics in Canada with a view towards testing the implications of a standard model of wage-price dynamics, according to which unit labour costs are determined by a wage Phillips curve while prices are set as a markup over unit labour costs. This model is compared to an alternative model in which excess demand conditions influence prices directly, rather than indirectly through a wage Phillips curve. The empirical results indicate that, contrary to the standard model, Granger-causality runs from the rate of change of prices to the rate of change of (productivity-adjusted) wages, and not vice versa. Moreover, excess demand influences prices directly, rather than only indirectly through wages as the strong form of the standard model would predict. There is evidence that prices and unit labour costs are cointegrated, as theory would predict. We find that price adjustment is well described by an aggregate supply curve in price-output space, that is, a price Phillips curve. Wage adjustment can be described by an error-correction model in which wages adjust to clear disequilibria between the levels of the actual and equilibrium wage.

RÉSUMÉ

Dans cette étude, l'auteur procède à l'analyse de la dynamique des salaires et des prix au Canada en vue de tester les implications d'un modèle type, où les coûts unitaires de main-d'oeuvre sont déterminés par une courbe de Phillips appliquée aux salaires et où les prix sont égaux aux coûts unitaires de main-d'oeuvre plus une marge. À cette fin, le modèle en question est comparé à un autre où la demande excédentaire influe sur les prix directement plutôt que par l'entremise d'une courbe de Phillips appliquée aux salaires. Les résultats empiriques font ressortir que, contrairement à ce que l'on observe dans le modèle type, le lien de causalité à la Granger qui existe entre le taux de variation des prix et celui des salaires (corrigé pour tenir compte de la productivité) va du premier au second, et non l'inverse; en outre, la demande excédentaire agit sur les prix directement, et non pas seulement par le truchement des salaires comme le laissent croire les prédictions de la version la plus stricte du modèle type. Les résultats obtenus semblent aussi corroborer la théorie qui veut que les prix et les coûts unitaires de main-d'oeuvre soient cointégrés. Par ailleurs, l'ajustement des prix semble être correctement décrit par une courbe d'offre globale définie dans le plan prix-production, c'est-à-dire une courbe de Phillips appliquée aux prix. L'ajustement des salaires, quant à lui, peut être formalisé par un modèle de correction des erreurs où les salaires s'ajustent de manière à combler les écarts entre le salaire observé et le salaire d'équilibre.

1. INTRODUCTION

Most Keynesian macro models embody some form of the Phillips curve which, in its most general form, is a positive relationship between changes in inflation and excess demand. This is usually presented in the context of a standard "markup" model of wage-price dynamics, in which wages respond to a real disequilibrium in the goods or labour market as well as to expected price inflation, and prices are set as a markup over productivity-adjusted wages (or unit labour costs). The standard model thus assumes that wages and prices are causally related, with causality flowing in both directions.

In a recent paper, Gordon (1988) finds that, contrary to the prediction of a standard cost-markup model, wages do not Granger-cause prices in the United States. Somewhat anomalously, he also finds no causality in the other direction. However, when the implications of cointegration are accounted for, Mehra (1989) finds that causality runs unidirectionally from prices to wages in the United States -- rejecting the standard model. This last result is consistent with earlier work by Barth and Bennett (1975), which also found unidirectional causality running from prices to wages in the U.S. data.

This paper tests the predictions of the standard model using Canadian data. The predictions regarding the directions of Granger-causality are tested. It is shown that testing the standard model implies testing whether movements in the share of labour have implications for prices or for wages. This is equivalent to testing in an error-correction framework whether prices and unit costs are cointegrated. An alternative model of wage and price adjustment is also provided, in which prices respond directly to the output gaps (excess demand/supply), the rate of change of aggregate nominal spending relative to potential output, and supply shocks, while wages adjust gradually to past movements in prices and productivity, as well as to clear the gap between the levels of actual and equilibrium wages. Based on the statistical evidence in this paper, we reject the standard cost-markup model. Causality runs unidirectionally from prices to wage costs. The alternative model, in which prices respond directly to excess demand, is supported by the data.

The text is structured as follows. Section 2 presents a standard model of the inflation process, discusses its implications for wage-price causality and interprets the results of simple Granger-causality tests. Section 3 shows how cointegration techniques can be used to test the standard model by taking account of level conditions. Section 4 presents an error-correction model of demand-pull inflation, with the Phillips curve viewed as a price-adjustment equation. Section 5 presents an error-correction model of wage adjustment, with wages driven by the gap between actual and equilibrium wage levels. Concluding remarks are in Section 6. Appendix A presents the results of simple Granger-causality tests using wage settlements.

2. THE STANDARD MODEL OF WAGE-PRICE DYNAMICS

The cost-markup view of wage-price dynamics is embodied in many large-scale macroeconomic models and is a popular basic model of the Phillips curve (e.g., Gordon 1985, Stockton and Glassman 1987). Following Mehra (1989), one way of representing the dynamics implied by the model is:

$$\Delta P = a_1(L)\Delta P_{-1} + a_2(L)(\Delta W - \Delta Q)_{-1} + a_3(Y - Y^*)_{-1} + a_4 S \qquad (1)$$

$$\Delta W - \Delta Q = b_1(L)(\Delta W - \Delta Q)_{-1} + b_2(L)\Delta P_{-1} + b_3(Y - Y^*)_{-1} + b_4 S, \qquad (2)$$

where all variables are in natural logarithms, Δ is the first-difference operator, P is the price level, W is the nominal wage, Q is labour productivity, W-Q is unit labour cost, Y-Y^* is an excess demand variable such as the output gap, and S represents supply shocks. The coefficients $a_1(L)$, $a_2(L)$, $b_1(L)$, and $b_2(L)$ are polynomials in the lag operator L.

Equation (1) captures the idea that prices are set based on a markup over costs, but are also influenced by excess demand and supply shocks. The predictions about the signs are: $a_1(1) \geq 0$, $a_2(1) > 0$, $a_3 \geq 0$, and $a_4 \geq 0$.[1] By allowing excess demand to influence prices directly, we are testing a weak form of the standard model. The strong form would not permit goods market conditions to influence prices (i.e., $a_3 = 0$): excess demand conditions would influence prices only insofar as they first influenced wage costs. Equation (2), the Phillips curve, says that productivity-adjusted wages react to past prices, as well as to excess demand and supply shocks. The predictions about the signs of the price and cost coefficients are: $b_1(1) \geq 0$, $b_2(1) > 0$, $b_3 > 0$ (i.e., excess demand should have a positive effect on wage

1. The supply shocks are transformed so that they have a positive effect on inflation.

growth), and $b_4 \geq 0$. The accelerationist version of the model would imply that $b_1(1) + b_2(1) = 1$. Equation (2) can be thought of as derived from:

$$\Delta W - \Delta Q = b_1(L)(\Delta W - \Delta Q)_{-1} + d\Delta P^e + b_3(Y - Y^*)_{-1} + b_4 S, \qquad (3)$$

where ΔP^e is the expected inflation rate. Assuming autoregressive expectations, $\Delta P^e = \lambda(L)\Delta P_{-1}$, and substituting this into equation (3) gives us our equation (2), with $b_2(L) = d\lambda(L)$.

The causal implications of the system consisting of equations (1) and (2) are clear: there ought to be bi-directional causality between wages and prices. Wages should Granger-cause prices because prices are set as a markup over labour costs. Prices should Granger-cause wages through inflation expectations or catch-up in the Phillips curve.

The empirical work in this paper is based on the broadest measures available of prices and costs for the Canadian economy. In particular, the price used is a producer price index (a factor-cost GDP deflator), while the cost measure is unit labour cost calculated as aggregate labour income per unit of GDP. Figure 1 graphs year-over-year growth rates of the measures of producer prices and unit labour costs in Canada. The output gap is measured by the deviation of output from potential output from the Bank of Canada's RDXF model (see Figure 2). Two measures of supply shocks are used: the growth rate of a real oil price index and the growth rate of a real non-oil commodity price index. Appendix B provides the data as well as the details on how the series were defined.

Table 1 presents the results of estimating versions of the Granger-causal system, equations (1) and (2). Note that the rate of change of unit labour costs, $\Delta(W\text{-}Q)$, is denoted by ΔC in Table 1 and in subsequent tables. Based on the F-tests, equations (1) and (2) of Table 1 show univariate causality from the rate of change of prices to the rate of change of unit labour costs. The sum of coefficients on price inflation in the unit labour cost regression is 0.838 and significant at the 5 per cent level, while that on the rate of

Figure 1

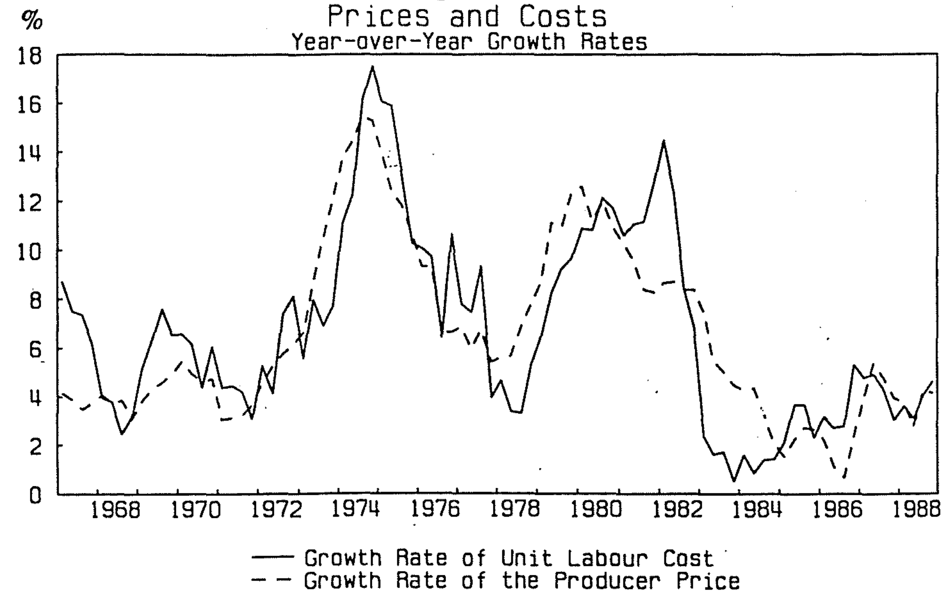

Figure 2

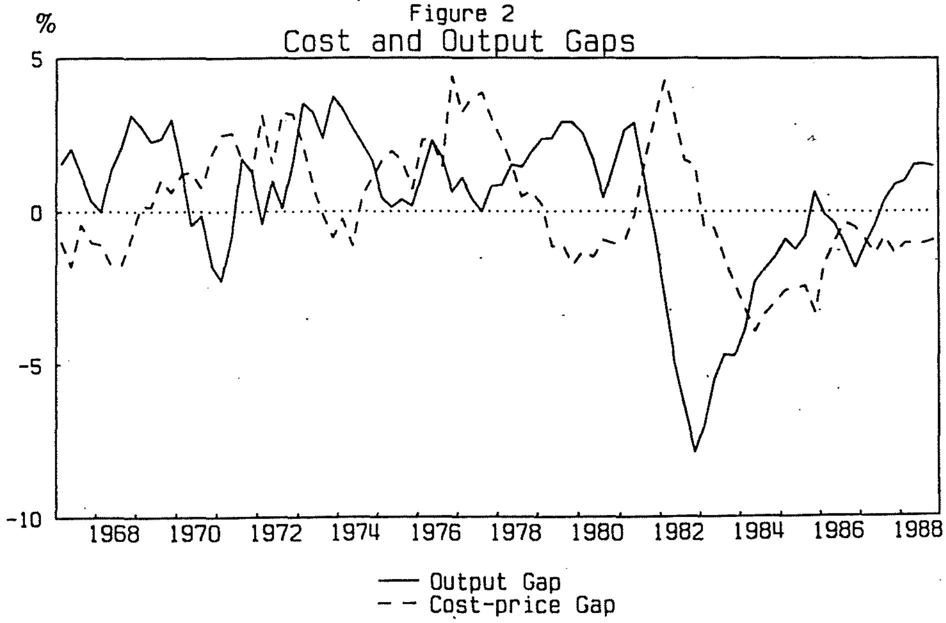

Table 1
Cost-Price Causality

1967Q2 to 1988Q4

Independent Variables	Dependent Variable (1) ΔP	(2) ΔC	(3) ΔP	(4) ΔC
Constant	0.002 (0.72)	0.003 (0.99)	0.003 (1.63)	0.002 (1.01)
ΔP{1 to 4}	0.778 (3.92)*	0.838 (3.01)*	0.873 (5.50)*	0.807 (3.46)*
ΔC{1 to 4}	0.088 (0.56)	-0.082 (-0.36)	-0.037 (-0.25)	0.044 (0.21)
$(Y - Y^*)\{1\}$	0.079 (2.31)*	0.208 (4.32)*		
ΔPCOM{0 to 4}	0.175 (2.03)*	0.167 (1.38)		
ΔPOIL{0 to 4}	-0.008 (-0.42)	-0.022 (-0.80)		
F(*ΔP*)	4.99*	3.09*	8.44*	3.21*
F(ΔC)	0.60	2.68*	0.80	2.96*
$\bar{R}^2$	0.60	0.50	0.50	0.35
SEEx100	0.63	0.89	0.69	1.01
Q(sl)	24.4(.61)	21.1(.78)	22.3(.72)	19.2(.86)
DW	2.1	2.2	2.0	2.1

Note: *ΔP* and *ΔC* are changes in the log of the producer price and unit labour costs respectively. $Y - Y^*$ is the log of the ratio of output to potential output from RDXF. *ΔPCOM* is the change in the log of a real non-oil commodity price index. *ΔPOIL* is the change in the log of a real oil price index. Figures in parentheses below coefficients are t statistics for the sum of the coefficients. F is the F statistic. Q(sl) is the Box-Ljung Q-statistic with 27 degrees of freedom with the marginal significance level in parentheses. An asterisk denotes significance at the 5% level. $\bar{R}^2$ is the adjusted R-squared statistic. DW is the Durbin-Watson statistic. SEE is the standard error of the residuals.

change of unit labour cost in the price regression is only 0.088 and statistically insignificant. Among the other explanatory variables, the output gap lagged once has a significant positive impact on both prices and unit labour costs. Neither the current output gap nor lagged values other than the first contributed significantly to the equations.[2] The commodity price variable is significant in the price equation but not in the unit labour cost equation, while the oil price variable is negative and insignificant in both equations. In fact, the oil price variable is always of negligible importance in the regressions reported in this paper. Equations (3) and (4) in Table 1 present results for the two-equation system without the excess demand and supply shock variables, as a check on whether the inclusion of these variables somehow biases the results. The conclusions as to Granger causality are even stronger.

Thus, contrary to the standard model, causality runs from price inflation to (productivity-adjusted) wage inflation and not vice versa. Moreover, the strong form of the standard model is also rejected because the output gap has a significant, positive effect directly on price inflation. The simple causality tests were repeated using wages instead of unit labour costs and the results as to the direction of causality were unchanged.[3]

An interesting feature of the results in Table 1 is that lagged rates of growth of unit labour costs do not contribute significantly to either current price or cost growth and that past price inflation is sufficient to capture the trends in both price and cost inflation. This means that, over the sample period, deviations from trend in the rate of growth of unit labour costs have tended to be high frequency noise and have not systematically fed into the price process.

Interestingly enough, despite the fact that wages do do not Granger-cause either prices or wages, wage settlements in unionized contracts, which are

2. Consistently throughout the empirical work, it was only the first lag of the output gap which entered significantly. Since other lagged values were not significant, it is only the specifications with the once-lagged gap that are reported here.

3. An interesting result, however, was that the consumer price index had no additional predictive content for wages, once the producer price was included. This is worthy of further study.

a forward-looking measure of wage inflation, do have information for future wages and prices. See Appendix A for the results with this variable and an interpretation.

3. AN APPLICATION OF COINTEGRATION

In the last section, evidence was reported that, for Canada over the 1967 to 1988 period, prices Granger-caused wages and not vice versa, contrary to the predictions of the standard model of wage and price dynamics. In a sense, though, we have been somewhat unfair to the standard model, since it can be viewed as making predictions not only about the relationship between the rates of change of wages and prices, but also about the way that gaps between the *levels* of prices and productivity-adjusted wages are resolved. To see this, consider a standard Cobb-Douglas production technology (in logarithms):

$$Y = Z + \theta L + (1 - \theta) K, \tag{4}$$

where Y is output, Z is the level of technology, L is the labour input, K is the capital input, all measured as logarithms, and θ is the share of labour. Profit maximization implies that, in equilibrium, labour is paid its marginal product. A transformation of this equilibrium condition gives:

$$C - P = W + L - Y - \log\theta - P = 0, \tag{5}$$

where C, adjusted unit labour cost, is defined as

$$C = W - Q - \log\theta, \tag{6}$$

where labour productivity Q is equal to Y - L. Thus C is unit labour cost adjusted for the constant share of labour, or unit cost.[4] The equilibrium

4. In this paper, the cost variable is often referred to as unit labour cost. It is important to note, however, that given the Cobb-Douglas technology assumed, a more appropriate term is unit cost. That is, the adjusted unit labour cost defined in equation (6) really includes capital costs.

condition (5) means that the producer price and unit cost are equated in the long run, in levels.

In the short run, gaps between price and unit cost may arise because of so-called *off the production function* behaviour. A popular example of this arises through costly adjustment of labour (which leads to labour hoarding). The level condition linking price to unit cost in equilibrium means that our two-equation system, (1) and (2), which involves growth-rate equations, is missing an important aspect of the wage-price adjustment process. When proper account is taken of the level condition, the standard model implies that, in cases of deviations between C and P, it is P which adjusts to attain equilibrium. In particular, if the level of unit cost temporarily exceeds the output price, then price inflation should increase until the levels of price and unit cost are equal. The result, that gaps between costs and prices require price adjustment, can be viewed in another way. Consider that θ is the mean or equilibrium share of labour. However, cyclical deviations between the real wage and the marginal product of labour will mean that the measured actual share of labour, $\hat{\theta}$, will vary over time. The log of the measured share of labour is given by:

$$\log\hat{\theta} = W + L - Y - P, \tag{7}$$

and thus the deviation of the actual from the mean share is:

$$\log\hat{\theta} - \log\theta = W + L - Y - P - \log\theta = C - P. \tag{8}$$

Thus deviations of unit cost and price are equivalent to deviations of labour's share from its mean. An implication of the standard model is that increases in the share of labour will result in higher price inflation.

It is appropriate to add the unit cost gap, *C-P,* to equations (1) and (2), thereby forming a standard error-correction system:

$$\Delta P = a_1 (L) \Delta P_{-1} + a_2 (L) \Delta C_{-1} + a_3 (C - P)_{-1} + a_4 (Y - Y^*)_{-1} + a_5 S \quad (9)$$

$$\Delta C = b_1 (L) \Delta P_{-1} + b_2 (L) \Delta C_{-1} + b_3 (C - P)_{-1} + b_4 (Y - Y^*)_{-1} + b_5 S. \quad (10)$$

In this case, the predictions about the signs of the price and cost coefficients are: $a_1(1) \geq 0, a_2(1) > 0, a_3 > 0, b_1(1) \geq 0, b_2(1) > 0, b_3 \leq 0$.

The error-correction model consisting of equations (9) and (10) can also be justified through cointegration theory. As Granger (1986) shows, if long-run components in two time series can be modelled as having stochastic trends, and if they move together in levels, then these two time series should be cointegrated. Following Engle and Granger (1987), if *P* and *C* are integrated processes of order 1, that is I(1), and their levels are cointegrated, then it is correct to estimate an error-correction system like (9) and (10) above. Moreover, there are then two concepts of causality: causality in growth rates and causality in levels. The test proposed by Engle and Granger has two steps. First, determine the order of integration of the variables. If they are I(1), containing a single unit root, then the second step is to check whether stochastic trends in the variables are related, by estimating a cointegrating regression and checking that there is no unit root in the residuals from that regression.

In accordance with standard practice in the identification of time-series models, and specifically following the advice of Granger and Newbold (1986), we first use the sample correlogram to help determine the order of integration of the variables. Table 2 presents sample autocorrelations for a number of variables. The autocorrelations for both *P* and *C* are close to unity at lag one and die off slowly, consistent with *P* and *C* being at least I(1) processes. The first differences of these variables show considerably less

Table 2
Autocorrelations

1966Q3 to 1988Q4
Sample Autocorrelations

Series	r_1	r_2	r_3	r_4	r_5	r_6	r_7	r_8
P	0.98	0.95	0.92	0.90	0.87	0.84	0.81	0.78
C	0.97	0.95	0.92	0.89	0.86	0.83	0.81	0.77
W	0.97	0.94	0.91	0.88	0.85	0.82	0.79	0.76
Q	0.96	0.92	0.89	0.85	0.81	0.77	0.73	0.70
ΔP	0.65	0.64	0.54	0.57	0.45	0.36	0.27	0.23
ΔC	0.30	0.46	0.40	0.17	0.26	0.11	0.09	0.15
ΔW	0.26	0.41	0.33	0.24	0.21	0.26	0.19	-0.01
ΔQ	-0.09	-0.09	0.10	-0.05	0.05	0.19	0.06	-0.16
C-P	0.87	0.75	0.62	0.46	0.36	0.25	0.14	0.06
Y-Y^*	0.91	0.76	0.63	0.49	0.37	0.28	0.20	0.13
U-U^*	0.96	0.90	0.82	0.74	0.67	0.62	0.57	0.52

Note: Δ is the first-difference operator; P is the log of the producer price; C is the log of unit cost; W is the log of the nominal wage; Q is the log of the average product of labour; C-P is the logarithmic gap between unit cost and the producer price; Y-Y^* is the logarithmic gap between output and RDXF's potential output; U-U^* is the gap between the unemployment rate and the natural rate from RDXF. r_i is the ith order autocorrelation coefficient. The large sample standard error under the null hypothesis of no autocorrelation is T. Given our sample size, T=90, the standard error is approximately 0.11.

autocorrelation, suggesting that I(2) processes are not likely, although augmented Dickey-Fuller tests reported in Table 3 suggest that, at the 5 per cent significance level, one cannot reject a unit root in the first differences of P and C. Note, however, that in the first-difference case, the point estimate of the root is 0.75 for ΔP and 0.62 for ΔC, both quite far from unity. This reflects the low power of the Dickey-Fuller test in small samples. We cannot reject a root of 1, but we also cannot reject the null hypothesis that the root is as low as 0.5 in the case of ΔP or 0.3 in the case of ΔC. There is thus considerable ambiguity as to the presence of a unit root in these data. For the purposes of the Granger cointegration scheme we shall assume that both P and C can be treated as I(1).

Step 2 is to test for cointegration between the levels of price and unit cost. Since the cointegrating vector is known, (1, -1), this means determining whether C-P is I(0). Table 2 reveals that the autocorrelation coefficient of C-P is high at lag 1, 0.87, but falls to zero after 8 quarters. Moreover, the augmented Dickey-Fuller test reported in Table 3 rejects a unit root in the level of C-P. Given the low power of this test, it would seem that a rejection of a unit root in the level of this variable is convincing evidence of stationarity.[5] To the extent that our error-correction system is consistent with cointegration ideas, we shall be proceeding under the assumption that both C and P are I(1), but C-P is I(0). The cost-price gap is graphed in Figure 2.

Equations 1 to 4 in Table 4 present the results of estimating the error-correction regressions. Once again, there is evidence of Granger-causality going from ΔP to ΔC and no evidence of causation in the other direction. Somewhat anomalously, however, the cost gap, C-P, has no significant effect on either ΔP or ΔC. This is difficult to explain, especially given the evidence of cointegration between P and C. If the profit maximization theory is right, we ought to be able to detect an effect of this variable. However, as we shall see later, it turns out that the unit cost gap is significant in a wage adjustment equation when we impose restrictions on the way that the cost

5. Stationarity of the gap between prices and unit costs is equivalent to saying that producer real wages and productivity are cointegrated. This is essentially the conclusion of Cozier (November 1989).

Table 3
Augmented Dickey-Fuller Tests

The augmented Dickey-Fuller equation is:

$$\Delta X = a + bT + cX_{-1} + \sum_{i=1}^{k} d_i \Delta X_{-i} + \varepsilon$$

X	k	c	t value (c=0)	Q(sl)
P	6	-0.03	-1.73	21.6(.60)
C	6	-0.03	-1.37	19.4(.73)
W	4	-0.02	-0.97	35.2(.13)
ΔP	6	-0.25	-2.36	22.2(.57)
ΔC	6	-0.38	-2.43	22.3(.52)
ΔW	4	-0.46	-2.79	37.1(.09)
$C - P$	6	-0.30	-3.67*	19.4(.73)

Note: An asterisk denotes significance at the 5% level. The 5% critical value for t (c=0) is 3.45 (Fuller 1976, Table 8.5.2). For other definitions, see the notes to Tables 1 and 2.

Table 4
Error-Correction Regressions

1967Q2 to 1988Q4

Independent Variables	(1) ΔP	(2) ΔC	(3) ΔP	(4) ΔC	(5) ΔP-ΔC
			Dependent Variable		
Constant	0.003	0.002	0.003	0.002	0.000
	(1.26)	(0.65)	(2.01)	(0.70)	(0.25)
ΔP{1 to 4}	0.821	0.811	0.946	0.735	0.009
	(4.13)*	(2.88)*	(5.79)*	(3.03)*	(0.04)
ΔC{1 to 4}	-0.051	0.003	-0.159	0.164	-0.053
	(-0.28)	(0.01)	(-0.98)	(0.68)	(-0.22)
(C-P){1}	0.067	-0.041	0.072	-0.070	0.107
	(1.52)	(-0.65)	(1.63)	(-1.08)	(1.86)
$(Y\text{-}Y^*)\{1\}$	0.082	0.206			-0.123
	(2.42)*	(4.25)*			(-2.75)*
ΔPCOM{0 to 4}	0.148	0.184			-0.035
	(1.69)	(1.48)			(-0.31)
ΔPOIL{0 to 4}	-0.002	-0.025			0.023
	(-0.12)	(-0.91)			(0.89)
F(Δ*P*)	5.43*	2.85*	9.27*	2.55*	0.33
F(ΔC)	0.51	2.57*	1.08	2.93*	2.42
$\bar{R}^2$	0.59	0.49	0.51	0.35	0.18
SEEx100	0.63	0.89	0.68	1.00	0.83
Q(sl)	24.7(.59)	21.0(.79)	33.3(.19)	17.7(.91)	41.0(0.04)
DW	2.1	2.2	2.0	2.1	1.9

Note: Figures in parentheses below coefficients are t statistics. F is the F statistic. Q(sl) is the Box-Ljung Q-statistic with 27 degrees of freedom with the marginal significance level in parentheses. An asterisk denotes significance at the 5% level. $\bar{R}^2$ is the adjusted R-squared statistic. DW is the Durbin-Watson statistic. SEE is the standard error of the residuals.

gap and lagged inflation influence wage inflation. As before, the lagged output gap enters significantly and positively in the price and wage equations.

An interesting aspect of the results in equations 1 and 2 in Table 4 is that past growth in unit labour costs has no significant effect on itself or on growth in prices, while past growth in prices affects both price and cost growth significantly, and with about the same coefficient. This suggests that, as noted before, the persistence that exists in both prices and costs over the sample period has been due primarily to persistence in the price process itself, and also that the profit share has been independent of inflation (since the coefficient on lagged price inflation is about the same in both regressions). Note also that growth in unit labour costs is more responsive to the output gap than is price growth, suggesting that the rate of change of the profit share is negatively related to the output gap.[6] Equation 5 in Table 4 has the rate of change of the price-cost gap or the profit share, ΔP-ΔC, as the dependent variable. Consistent with the findings from equations 1 and 2, it is found that the rate of change of the profit share is independent of past inflation (in either prices or costs) and is related negatively and significantly to the output gap. The coefficient of the level of the cost-price gap is positive and close to significance at the 5 per cent significance level, and is therefore probably consistent with the Dickey-Fuller test and the sample autocorrelations, both of which indicate that the profit share is mean reverting.

6. This result that the rate of change of the profit share is inversely related to past output gaps may at first seem odd, since the profit share is usually held to be procyclical, but it is in fact quite consistent with that notion. Since output gaps are stationary and thus tend to close, a state of excess demand (supply) will usually be followed by a decrease (increase) in output growth below trend and associated lower (higher) profit growth and a decline (rise) in the rate of change of the profit share.

4. PRICE ADJUSTMENT

The evidence presented in the preceding sections suggests that the Canadian data do not support the standard view of wage and price dynamics over the sample studied. Wage costs tend to be Granger-caused by prices, and not vice versa. Moreover, excess demand influences prices directly rather than indirectly through wage costs. These results accord with recent evidence from the United States, which also rejects the traditional view.

The lack of any Granger-causal influence of wages on prices, and the evidence of a direct influence of output disequilibrium on prices, suggest an alternative *excess demand* explanation of price and wage dynamics in Canada. Such a model would have the following features: (a) prices move to clear excess demand for goods and services; (b) given past prices, wages adjust to clear disequilibria in the labour market.

An example of a price-adjustment equation based upon output disequilibrium is provided in Cozier (1989), which uses Rotemberg's (1982) model of costly price adjustment to derive an aggregate price Phillips curve. The following model is a simplified version of Cozier's model, modified to allow for non-stationarity in prices. Consider an economy in which output of a single good is produced by a large number of monopolistically competitive firms. Firms take nominal demand as given and face random aggregate and firm-specific demand and supply shocks. There are quadratic costs of changing prices around the steady-state inflation rate. Assuming identical adjustment costs, technology and demand functions (required for aggregation), the problem can be written as if there were a single, intertemporally optimizing firm which maximizes:

$$E_0 \sum_{i=0}^{\infty} \beta^i \left[\Pi(P^*) - (P-P^*)^2 - k(P-P_{-1}-\Delta P^*)^2 \right], \qquad (11)$$

where P is the logarithm of the price level with an equilibrium value of P^* (to be defined later), β is the discount factor ($0 < \beta < 1$), and $k \geq 0$. Equation

(11) says that firms will try to minimize deviations of prices from equilibrium, given that there are costs of moving prices faster or slower than the equilibrium rate of inflation in the economy. This formulation is a convenient way of capturing the slow adjustment of prices to equilibrium, where the costs of adjustment can be seen as arising from a number of sources. After rearrangement, the Euler equation for the maximization problem can be written:

$$\Delta P = \beta \Delta P^e_{+1} + (1-\beta)\,\Delta P^* + \left(\frac{1}{k}\right)(P^* - P), \tag{12}$$

where ΔP^e_{+1} denotes expected inflation. Equation (12) is error-correction in form, relating the rate of inflation to the gap between the equilibrium and actual price levels, as well as to a weighted average of the expected and equilibrium inflation rates.

In order for this to be a useful theory of inflation, the equilibrium price level needs to be defined. One possibility is the cost-markup route, which would mean setting $P^* = C$. The evidence presented earlier does not support this approach, however, supporting instead a definition based on demand and supply conditions in the goods market. A convenient way to implement the latter approach is to assume that the overall level of nominal spending is given to the system.[7] Given exogenous nominal spending, X, equilibrium output, Y^*, and a random output (supply) shock, ε, the equilibrium price level P^* is given by:

$$P^* = X - Y^* - \varepsilon. \tag{13}$$

7. The assumption of exogenous nominal spending means that the aggregate demand curve is treated as a rectangular hyperbola which is shifted around by movements in nominal demand. The price adjustment equation then determines the split between real output and prices.

Equation (13) has the equilibrium price level determined by the nominal anchor through demand and supply conditions in the goods market. This is in sharp contrast to the standard model, in which, in a truly causal sense, the equilibrium price level is driven off the level of unit costs.

Note that, since by definition $P = X - Y$, the price gap, $P^* - P$, is directly related to the output gap as follows:

$$P^* - P = (Y - Y^*) - \varepsilon. \tag{14}$$

Except for the supply shock, the price disequilibria are identical to the output disequilibria.[8] Assuming regressive expectations and substituting (14) into (12) yields:

$$\Delta P = \beta \Delta P_{-1} + (1 - \beta)\, \Delta P^* + \alpha (Y - Y^*) + S. \tag{15}$$

where $\alpha = 1/k$, and $S = -(1/k)\varepsilon$ represents the influence of supply shocks on prices. Equation (15) is an excess-demand model of inflation in the sense that inflation depends on the level of output disequilibrium (the output gap) and lagged inflation, as well as the equilibrium inflation rate.

In estimating equation (15), there is the issue of how to measure the equilibrium inflation rate. An obvious way, appealing to equation (13), is to use the excess of nominal spending growth over potential output growth. Another possibility is to use a weighted average of past inflation rates. Table 5 presents the results of estimating equation (15) with both approaches. Once again, it is the once-lagged and not the current output gap that enters significantly, and this is the formulation reported. Equation 1 in Table 5

8. Using instrumental variables estimation, Duguay (1979) finds support for the implicit restriction in equation (14) that the price elasticity of aggregate demand is -1.

presents the case where, implicitly, ΔP^* is modelled by past inflation, so that the rate of inflation is simply a function of past inflation, the output gap and supply shocks. The sum of the coefficients on lagged inflation rates is 0.858 and is not significantly different from unity. The output gap coefficient is 0.085 (about the same as in the previous equations) and is significant at the 5 per cent level. Equation 2 in Table 5 estimates equation (15) using the rate of change of nominal spending per unit of potential GDP to define the equilibrium inflation rate. The coefficient on equilibrium inflation is 0.250 and significant. Moreover, the coefficient on the output gap stays the same. Finally, equation 3 of Table 5 imposes the restriction that the sum of the coefficients on the adaptive expectation of inflation and the equilibrium inflation rate sum to unity. The F statistic testing this restriction is 0.16 with a marginal significance level of 0.69, thus indicating that the restriction is easily accepted.

It should be noted that our inflation equation, (15), is not the first to have a role for both the level of the output gap and the rate of change of nominal spending relative to potential output. Rose and Selody (1985) employed similar mechanisms in the macro model SAM and the inclusion of these variables was advocated by Gordon (1980). Moreover, an early monetarist model of the Federal Reserve Bank of St. Louis (Andersen and Carlson, 1970) embodies similar ideas. Our approach, though, is able to justify such a formulation from an underlying costly price adjustment story.

Assuming that ΔP^* is given by $\Delta X - \Delta Y^*$ (from equation (13)), and using the identity $\Delta X = \Delta Y + \Delta P$, equation (15) can also be transformed into an equation in which both the level and the change in the output gap matter:

$$\Delta P = \Delta P_{-1} + \left(\frac{1-\beta}{\beta}\right)\Delta(Y-Y^*) + \frac{\alpha}{\beta}(Y-Y^*) + \frac{1}{\beta}S. \qquad (16)$$

Cozier and Wilkinson (1990) estimate Phillips curve relations for Canada and find that both the level and the change in the output gap matter for inflation, a result which is consistent with equation (16).[9] Cozier and Wilkinson are interested in testing for full hysteresis, according to which

9. As Duguay (1979) points out, β estimated from equation (15) will always be smaller than β estimated from equation (16), when OLS is used. At least one of the two estimates will be biased.

Table 5
Price Adjustment Regressions

1967Q2 to 1988Q4

Independent Variables	Dependent Variable (1) ΔP	(2) ΔP	(3) ΔP
Constant	0.002	0.001	-0.000
	(0.83)	(0.25)	(-0.43)
$\Delta P\{1\ to\ 4\}$	0.858	0.670	0.744
	(6.49)*	(5.36)*	(10.8)*
ΔP^*		0.250	0.256
		(3.53)*	(3.71)*
$(Y\text{-}Y^*)\{1\}$	0.085	0.085	0.086
	(2.67)*	(2.88)*	(2.93)*
$\Delta PCOM\{0\ to\ 4\}$	0.156	0.104	0.115
	(1.98)	(1.40)	(1.66)
$\Delta POIL\{0\ to\ 4\}$	-0.011	-0.015	-0.0215
	(-0.57)	(-0.89)	(-1.81)
$\bar{R}^2$	0.59	0.65	0.65
Q(sl)	22.1(.73)	25.1(.57)	25.2(.56)
SEEx100	0.63	0.58	0.58
DW	2.1	2.0	2.0

Note: Note: ΔP^* is the logarithmic rate of change of the equilibrium price level, which is itself measured as nominal GDP per unit of potential GDP. Figures in parentheses below coefficients are t statistics. Q(sl) is the Box-Ljung Q-statistic with 27 degrees of freedom with the marginal significance level in parentheses. An asterisk denotes significance at the 5% level. $\bar{R}^2$ is the adjusted R-squared statistic. DW is the Durbin-Watson statistic. For other definitions, see the notes to Tables 1 and 2. SEE is the standard error of the residuals.

only the change in the gap should matter for inflation. Their empirical findings suggest that *both* the level and change in the gap are important, and is evidence against full hysteresis and in favour of partial hysteresis or a modified version of the NAIRU hypothesis.

5. WAGE ADJUSTMENT

Given the apparent success of the costly adjustment or error-correction model for prices (based on the output gap), it is important to verify that wage adjustment can be modelled similarly. In particular, since we have rejected a role for prices in the resolution of disequilibria between wages and productivity, we must verify that wages do in fact adjust to clear such disequilibria. An error-correction model of nominal wage adjustment, comparable to that for price adjustment (equation (15)) is:

$$\Delta W = \lambda \Delta W_{-1} + (1-\lambda)\Delta W^{*} + \delta (W^{*} - W), \tag{17}$$

where W^{*} is the equilibrium nominal wage. Given P^{*} as defined in equation (13), and equilibrium productivity Q^{*} (assumed exogenous), W^{*} is given by:

$$W^{*} = P^{*} + Q^{*} + \log\theta. \tag{18}$$

Using equation (13) to substitute out P^{*} means that the wage gap, $W^{*} - W$, is given by:

$$W^{*} - W = -(C-P) + (L-L^{*}) + \varepsilon, \tag{19}$$

where L^{*} is the equilibrium labour input. The labour input gap can be written as the negative of an unemployment gap, giving:

$$W^{*} - W = -(C-P) - (U-U^{*}) + \varepsilon. \tag{20}$$

Thus the wage disequilibrium can be decomposed into the sum of two separate disequilibrium terms: a unit cost gap that, at the given level of employment, measures the extent to which the actual wage differs from the wage firms would like to pay (i.e., the extent to which firms are off the labour demand curve); and the gap between the wage that firms would like to pay and the competitive equilibrium wage (equivalent to the unemployment gap).[10] Substituting equation (20) into equation (17) yields:

$$\Delta W = \lambda \Delta W_{-1} + (1-\lambda)\Delta W^{*} - \delta(C-P) - \delta(U-U^{*}) + S, \tag{21}$$

where S is a positive function of the supply shock, ε. In practice, we measure the rate of growth of the equilibrium nominal wage by a distributed lag of the rate of change of prices and the rate of change of the average product of labour. Thus:

$$\Delta W^{*} = \psi_1(L)\Delta P + \psi_2(L)\Delta Q, \tag{22}$$

where

$$\psi_1(1) = \psi_2(1) = 1.$$

The summation constraint on the coefficients means that nominal wage growth is constrained to equal growth in the marginal value product of labour in the long run. The estimated wage adjustment equation is therefore:

10. This precise decomposition of wage disequilibrium is a result of the unit elasticity of labour demand with respect to the real wage, which is a property of the constant returns to scale Cobb-Douglas production function used here.

$$\Delta W = \lambda_1 (L) \Delta W_{-1} + \lambda_2 (L) \Delta P + \lambda_3 (L) \Delta Q + \lambda_4 (C-P)$$

$$+ \lambda_5 (U - U^*) + S \quad (23)$$

where the theoretical restrictions are:

$$\lambda_2 (1) = \lambda_3 (1) \quad (24)$$

$$\lambda_1 (1) + \lambda_2 (1) = 1 \quad (25)$$

$$\lambda_4 < 0 \quad (26)$$

$$\lambda_5 = \lambda_4. \quad (27)$$

Equation 1 in Table 6 is an unrestricted estimate of equation (23). All variables have the correct signs, but only the price inflation and the unemployment gap are significantly different from zero. Equation 2 in Table 6 imposes restrictions (24) and (25), that the rate of change of the equilibrium nominal wage has a one-to-one effect on the actual nominal wage in the long run. The F statistic for this restriction is 0.33 with a marginal significance level of 0.72. Thus the restriction is easily accepted. The short-run impact weight on equilibrium wage inflation (equivalent to 1- $\lambda_1 (1)$ in equation (23)) is 0.831 and significant. This result implies that the extra short-run dynamics coming from the lagged wage terms are not very important. The coefficient on the cost gap now becomes significant. Its coefficient is -0.134, not far from that on the unemployment gap, -0.192.[11]

11. It is interesting to note that the cost gap is significant in the estimated wage equation (equations 2 and 3 of Table 6), yet is found to be insignificant both in equation 1 of this table and in the cost equation of the cointegration system in Table 4. This result is probably related to the fact that the summation restriction on equilibrium wage inflation is imposed in equations 2 and 3, but not in the cointegration test or, for that matter, in equation 1 in Table 6.

Table 6
Wage Adjustment Regressions

1967Q2 to 1988Q4

Independent Variables	Dependent Variable (1) ΔW	(2) ΔW	(3) ΔW
Constant	0.002	0.000	0.000
	(0.48)	(0.05)	(0.03)
ΔW{1 to 4}	0.121	0.169	0.275
	(0.43)	(0.71)	(1.38)
ΔP{0 to 4}	0.829	0.831	0.725
	(3.02)*	(3.51)*	(3.64)*
ΔQ{0 to 4}	0.630	0.831	0.725
	(1.76)	(3.51)*	(3.64)*
(C-P){1}	-0.112	-0.134	-0.153
	(-1.72)	(-2.78)*	(-3.60)*
$(U\text{-}U^*)\{0\}$	-0.207	-0.192	-0.153
	(-2.87)*	(-2.98)*	(-3.60)*
ΔPCOM{0 to 4}	0.029	0.023	0.047
	(0.24)	(0.21)	(0.44)
ΔPOIL{0 to 4}	-0.025	-0.023	-0.016
	(-1.00)	(-1.33)	(-1.06)
$\bar{R}^2$	0.61	0.66	0.63
Q(sl)	34.7(.15)	29.6(.33)	32.1(.23)
SEEx100	0.79	0.74	0.76
DW	1.9	1.9	1.8

Note: Note: Figures in parentheses below coefficients are t statistics. Q(sl) is the Box-Ljung Q-statistic with 27 degrees of freedom with the marginal significance level in parentheses. An asterisk denotes significance at the 5% level. $\bar{R}^2$ is the adjusted R-squared statistic. DW is the Durbin-Watson statistic. For other definitions, see the notes to Tables 1 and 2. SEE is the standard error of the residuals.

Finally, equation 3 in this table adds restriction (27), that the coefficients on the unemployment gap and the cost gap be the same. The F statistic for this restriction is 0.60, with a marginal significance level of 0.44, and thus the restriction is not rejected. The joint coefficient on the two gaps is -0.153 and significant. The final coefficient on the equilibrium wage inflation rate remains quite high, at 0.725.

The empirical results support the hypothesis that wages adjust to clear disequilibria between wages and productivity and also to clear the gap between unemployment and its natural rate. Note also that, except for the *C-P* variable, the wage adjustment equation, (23), looks a lot like the traditional wage Phillips curve. The difference here is that, because of the significance of the *C-P* term, and because of our findings on the wage-price nexus, the wage Phillips curve is actually a real wage adjustment equation. Given prices, it describes how wages adjust to clear disequilibria in the labour market.[12]

12. The wage adjustment equation estimated in this paper is similar to those in the Bank of Canada's SAM (see Rose and Selody, 1985), and RDX2 (see Helliwell, Shapiro, Sparks, Stewart, Gorbet and Stephenson, 1971) which also performed the same economic function (i.e., the real wage adjusts to the marginal product of labour) as the one estimated here.

6. CONCLUSIONS

This paper examines wage and price dynamics in Canada over the 1967 to 1988 period with a view towards testing the implications of a standard model, according to which prices are set as a markup over costs. This model is compared to an alternative model in which excess demand conditions influence prices directly, rather than indirectly through a wage Phillips curve. The major findings and conclusions are:

- Contrary to the standard model, Granger-causality runs from the rate of change of prices to the rate of change of (productivity-adjusted) wages, and not vice versa.
- Excess demand influences prices directly, rather than only indirectly through wages, as the strong form of the standard model would predict.
- There is evidence that prices and unit costs are cointegrated, as theory would predict, though we could find no clear evidence of causality from the level of the gap between these two variables and their corresponding rates of change as the formal cointegration framework would predict. When certain restrictions are imposed, however, there is evidence of causation from the cost-price gap to wage costs.
- While the empirical results imply that the average market wage holds no significant information for future prices, wage settlements appear to contain information on future market wages and prices. This is not necessarily inconsistent with our other results, since wage settlements are the average increase over the future life of the contracts, and therefore by definition contain information on future wages. Moreover, to the extent that they are based on an expectation of future inflation, it is natural that they are correlated with actual future inflation.

Price adjustment seems well described by an aggregate supply curve in price-output space, that is, a price Phillips curve. Wage adjustment can be described by an error-correction model in which wages adjust to clear disequilibria between the levels of the actual and equilibrium wage.

APPENDIX A

The Information in Wage Settlements

The basic finding of this paper is that market wages are not a leading indicator of inflation. It is interesting to note, however, that wage settlements appear to have leading indicator information. Wage settlements are the average increase in base wage rates over the life of contracts of unionized workers. We use the non-COLA wage settlements because they are unaffected by cost-of-living adjustments. Simple bivariate tests reported in Table 7 indicate that wage settlements Granger-cause both consumer prices (though curiously not producer prices) and wages. The *leading indicator* role of wage settlements for market wages very likely reflects the information they contain about actual future wages for a subset of the total workforce. The apparent leading indicator role for consumer prices probably reflects the fact that wage settlements are based on an implicit or explicit forecast of inflation (usually consumer price inflation). Within the Granger-causal framework, as long as the inflation expectations used in wage negotiations is based on information other than lagged inflation rates, there will be a tendency to find Granger causality. These results suggest that, while actual market wages are, on average, a lagging indicator of inflation, wage settlements contain information on the future path of wage inflation as well as price inflation expectations which turns out to be reasonable ex post.

Table 7

Wage Settlements as a Leading Indicator

1979Q1 to 1988Q4

Dependent Variable	Independent Variables	Sum of Coefficients	t	F(4,31)	Q(sl)
ΔP	$\Delta P\{1\ to\ 4\}$	0.608	2.41*	1.72	7.9(.98)
	$\Delta WS\{1\ to\ 4\}$	0.172	0.74	1.22	
ΔWS	$DWS\{1\ to\ 4\}$	0.778	12.10*	48.83*	23.5(.17)
	$\Delta P\{1\ to\ 4\}$	0.193	2.74*	2.56	
ΔPC	$\Delta PC\{1\ to\ 4\}$	0.552	1.54	0.86	17.1(.52)
	$\Delta WS\{1\ to\ 4\}$	0.267	0.93	7.65*	
ΔWS	$\Delta WS\{1\ to\ 4\}$	0.508	2.44*	7.18*	17.9(.46)
	$\Delta PC\{1\ to\ 4\}$	0.516	1.99	1.59	
ΔW	$\Delta W\{1\ to\ 4\}$	-0.622	-1.79	1.00	17.8(.47)
	$\Delta WS\{1\ to\ 4\}$	1.163	3.85*	9.76*	
ΔWS	$\Delta WS\{1\ to\ 4\}$	0.855	8.19*	21.40*	13.3(.77)
	$\Delta W\{1\ to\ 4\}$	0.107	0.89	1.45	

Inference

ΔWS –/–> ΔP	ΔP –/–> ΔWS
ΔWS –––> ΔPC	ΔPC –/–> ΔWS
ΔWS –––> ΔW	ΔW –/–> ΔWS

Note: Δ is the first-difference operator; P is the log of the producer price; ΔWS is the quarterly growth rate of non-COLA wage settlements, calculated simply as the published annual growth rate divided by 400; PC is the log of the consumer price; W is the log of the nominal wage. F(4,31) is the F statistic for the null hypothesis that the group of coefficients is zero. Details on all other definitions are provided in the notes to Tables 1 and 2. –––> indicates causality at the 5% level. –/–> indicates the absence of causality at the 5% level.

APPENDIX B

The Data

The *producer price* is measured as nominal GDP at factor cost divided by real GDP (CANSIM D20463). It is therefore a measure of the GDP deflator at factor cost. Nominal GDP at factor costs is computed by subtracting indirect taxes net of subsidies (CANSIM D20008) from nominal GDP at market prices (CANSIM D20011). *Unit labour cost* is labour income (CANSIM D20088-D20091) per unit of real GDP (CANSIM D20463). The *output gap* is measured as the logarithmic deviation of real GDP from the Bank of Canada's RDXF measure of potential GDP. The *money wage* is measured by labour income divided by man-hours. Man-hours is measured by 52 times total employment (CANSIM D76708) times average weekly hours. Average weekly hours is based on Statistics Canada data (Labour Force Catalogue # 71-001), adjusted at the Bank of Canada for holiday effects (series HAWT). The *average product of labour* is measured by real GDP per man-hour. The *cost gap* is measured by the logarithmic gap between *unit labour cost* and the *producer price,* adjusted for the mean share of labour. The mean share of labour is the average value of the ratio of labour income to total income. The *unemployment gap* is measured by the gap between the unemployment rate (CANSIM D767609/D767606) and the natural rate of unemployment as estimated in the Bank of Canada's RDXF model. The *consumer price* is measured by the consumer price index (CANSIM P484549). *Wage settlements* is the annualized percentage growth rate of non-COLA wage settlements (CANSIM D747018), divided by 400 to obtain an approximate quarterly rate of change. The *real non-oil commodity price* is a price index computed by the Bank of Canada. The *real oil price* is a real crude oil price index computed by the Bank of Canada. The *equilibrium price* is measured by nominal income per unit of potential output. CANSIM is a Statistics Canada database. The Labour Force Catalogue is published by Statistics Canada.

The Data

Date	Producer Price	Unit Labour Cost	Money Wage	Average Product of Labour	Output Gap	Unemployment Gap
66:1	0.2960	0.1707	2.0491	12.0063	0.0490	-0.0223
66:2	0.3004	0.1733	2.1024	12.1334	0.0477	-0.0252
66:3	0.3031	0.1768	2.1386	12.0961	0.0356	-0.0219
66:4	0.3067	0.1803	2.1901	12.1488	0.0326	-0.0224
67:1	0.3082	0.1855	2.2385	12.0648	0.0156	-0.0182
67:2	0.3120	0.1863	2.2829	12.2570	0.0203	-0.0180
67:3	0.3136	0.1898	2.3152	12.1993	0.0120	-0.0186
67:4	0.3181	0.1914	2.3593	12.3242	0.0037	-0.0140
68:1	0.3207	0.1929	2.4255	12.5763	0.0000	-0.0099
68:2	0.3236	0.1933	2.4714	12.7861	0.0133	-0.0090
68:3	0.3256	0.1944	2.5245	12.9852	0.0205	-0.0116
68:4	0.3278	0.1975	2.5752	13.0391	0.0312	-0.0172
69:1	0.3330	0.2027	2.6206	12.9265	0.0276	-0.0194
69:2	0.3375	0.2054	2.6454	12.8795	0.0225	-0.0185
69:3	0.3405	0.2091	2.7631	13.2135	0.0236	-0.0188
69:4	0.3440	0.2104	2.8424	13.5125	0.0299	-0.0164
70:1	0.3511	0.2160	2.9199	13.5171	0.0143	-0.0125
70:2	0.3541	0.2180	2.9225	13.4054	-0.0046	-0.0035
70:3	0.3563	0.2182	2.9722	13.6194	-0.0015	0.0005
70:4	0.3602	0.2231	3.0226	13.5507	-0.0177	0.0001
71:1	0.3618	0.2254	3.0709	13.6226	-0.0227	-0.0020
71:2	0.3652	0.2277	3.1971	14.0412	-0.0080	-0.0017
71:3	0.3678	0.2274	3.2383	14.2421	0.0171	-0.0210
71:4	0.3735	0.2299	3.2845	14.2838	0.0127	-0.0205
72:1	0.3783	0.2373	3.3509	14.1233	-0.0041	-0.0220
72:2	0.3843	0.2371	3.4312	14.4724	0.0098	-0.0211
72:3	0.3888	0.2441	3.5229	14.4311	0.0010	-0.0180
72:4	0.3963	0.2486	3.6695	14.7625	0.0162	-0.0172
73:1	0.4033	0.2504	3.7152	14.8348	0.0352	-0.0234
73:2	0.4176	0.2559	3.7567	14.6799	0.0323	-0.0281
73:3	0.4297	0.2609	3.8606	14.7968	0.0237	-0.0278
73:4	0.4441	0.2677	4.0230	15.0306	0.0373	-0.0267
74:1	0.4590	0.2783	4.1622	14.9573	0.0334	-0.0293
74:2	0.4779	0.2872	4.3087	15.0011	0.0273	-0.0302
74:3	0.4961	0.3030	4.5395	14.9810	0.0217	-0.0294
74:4	0.5120	0.3145	4.7070	14.9672	0.0164	-0.0254
75:1	0.5226	0.3230	4.8943	15.1537	0.0044	-0.0148
75:2	0.5370	0.3328	5.0395	15.1415	0.0013	-0.0136
75:3	0.5546	0.3427	5.2574	15.3403	0.0039	-0.0119
75:4	0.5664	0.3468	5.3461	15.4163	0.0017	-0.0105
76:1	0.5713	0.3554	5.5559	15.6337	0.0125	-0.0132

Date	Producer Price	Unit Labour Cost	Money Wage	Average Product of Labour	Output Gap	Unemployment Gap
76:2	0.5871	0.3652	5.8656	16.0630	0.0229	-0.0121
76:3	0.5912	0.3646	5.8760	16.1159	0.0174	-0.0099
76:4	0.6040	0.3836	6.2092	16.1853	0.0063	-0.0075
77:1	0.6102	0.3829	6.3040	16.4621	0.0109	-0.0029
77:2	0.6220	0.3922	6.4330	16.4011	0.0042	-0.0029
77:3	0.6309	0.3985	6.5278	16.3798	-0.0002	0.0004
77:4	0.6366	0.3988	6.6645	16.7117	0.0082	0.0017
78:1	0.6441	0.4007	6.6670	16.6391	0.0086	0.0020
78:2	0.6571	0.4054	6.7295	16.5976	0.0151	0.0024
78:3	0.6740	0.4117	6.8283	16.5868	0.0143	0.0025
78:4	0.6860	0.4197	6.9545	16.5694	0.0193	-0.0010
79:1	0.7000	0.4265	7.0561	16.5452	0.0235	-0.0035
79:2	0.7300	0.4386	7.3034	16.6513	0.0238	-0.0065
79:3	0.7475	0.4495	7.4566	16.5883	0.0292	-0.0110
79:4	0.7707	0.4603	7.5682	16.4427	0.0290	-0.0099
80:1	0.7881	0.4728	7.8059	16.5084	0.0255	-0.0069
80:2	0.8117	0.4860	8.0234	16.5088	0.0169	-0.0047
80:3	0.8371	0.5040	8.2774	16.4224	0.0043	-0.0077
80:4	0.8549	0.5141	8.4969	16.5282	0.0150	-0.0100
81:1	0.8688	0.5230	8.6649	16.5677	0.0263	-0.0095
81:2	0.8891	0.5397	9.0640	16.7940	0.0289	-0.0107
81:3	0.9071	0.5603	9.3120	16.6190	0.0100	-0.0071
81:4	0.9255	0.5795	9.7367	16.8029	-0.0070	0.0016
82:1	0.9439	0.5987	10.0507	16.7872	-0.0284	0.0064
82:2	0.9664	0.6064	10.2569	16.9144	-0.0499	0.0221
82:3	0.9831	0.6075	10.3936	17.1083	-0.0648	0.0382
82:4	1.0028	0.6187	10.6198	17.1646	-0.0790	0.0446
83:1	1.0139	0.6128	10.6049	17.3071	-0.0697	0.0436
83:2	1.0192	0.6161	10.6956	17.3593	-0.0550	0.0402
83:3	1.0325	0.6178	10.7859	17.4571	-0.0470	0.0330
83:4	1.0476	0.6219	10.9441	17.5976	-0.0473	0.0289
84:1	1.0571	0.6224	11.0608	17.7713	-0.0389	0.0308
84:2	1.0634	0.6213	11.2640	18.1290	-0.0234	0.0321
84:3	1.0658	0.6264	11.3352	18.0968	-0.0188	0.0299
84:4	1.0691	0.6307	11.4594	18.1703	-0.0148	0.0289
85:1	1.0731	0.6356	11.6690	18.3603	-0.0090	0.0282
85:2	1.0868	0.6440	11.7109	18.1842	-0.0125	0.0238
85:3	1.0948	0.6493	11.8967	18.3213	-0.0081	0.0197
85:4	1.0974	0.6452	11.9237	18.4801	0.0063	0.0190
86:1	1.0968	0.6557	11.9938	18.2919	-0.0010	0.0144
86:2	1.0986	0.6614	12.1914	18.4332	-0.0040	0.0136
86:3	1.1020	0.6674	12.3382	18.4874	-0.0110	0.0135
86:4	1.1235	0.6793	12.4948	18.3939	-0.0187	0.0120

Date	Producer Price	Unit Labour Cost	Money Wage	Average Product of Labour	Output Gap	Unemployment Gap
87:1	1.1403	0.6869	12.6838	18.4642	-0.0110	0.0131
87:2	1.1574	0.6938	12.8320	18.4954	-0.0045	0.0085
87:3	1.1542	0.6958	12.9796	18.6539	0.0034	0.0047
87:4	1.1676	0.6998	13.0660	18.6704	0.0087	-0.0004
88:1	1.1830	0.7116	13.2971	18.6863	0.0100	-0.0037
88:2	1.1891	0.7152	13.4383	18.7906	0.0152	-0.0054
88:3	1.2034	0.7238	13.6936	18.9195	0.0153	-0.0035
88:4	1.2157	0.7320	13.9315	19.0332	0.0146	-0.0045

Date	Cost Gap	Equil. Price	Real Commodity Price	Real Oil Price	Consumer Price	Wage Settlements
66:1	-0.0527	0.3109	0.8706	0.2012	0.3480	N.A.
66:2	-0.0523	0.3151	0.8731	0.2002	0.3513	N.A.
66:3	-0.0410	0.3140	0.8715	0.1992	0.3538	N.A.
66:4	-0.0334	0.3168	0.8631	0.1991	0.3568	N.A.
67:1	-0.0097	0.3131	0.8598	0.2030	0.3587	N.A.
67:2	-0.0180	0.3184	0.8546	0.2051	0.3630	N.A.
67:3	-0.0043	0.3174	0.8528	0.2041	0.3680	N.A.
67:4	-0.0100	0.3193	0.8541	0.2005	0.3705	N.A.
68:1	-0.0108	0.3207	0.8579	0.1926	0.3750	N.A.
68:2	-0.0175	0.3280	0.8541	0.1898	0.3776	N.A.
68:3	-0.0178	0.3323	0.8520	0.1885	0.3811	N.A.
68:4	-0.0089	0.3382	0.8613	0.1889	0.3862	N.A.
69:1	0.0017	0.3423	0.8758	0.1942	0.3894	N.A.
69:2	0.0013	0.3452	0.8697	0.1950	0.3957	N.A.
69:3	0.0104	0.3486	0.8626	0.1933	0.3996	N.A.
69:4	0.0062	0.3544	0.8663	0.1897	0.4036	N.A.
70:1	0.0121	0.3562	0.8658	0.1822	0.4078	N.A.
70:2	0.0128	0.3525	0.8653	0.1790	0.4104	N.A.
70:3	0.0077	0.3557	0.8646	0.1783	0.4113	N.A.
70:4	0.0186	0.3539	0.8564	0.1786	0.4123	N.A.
71:1	0.0247	0.3537	0.9296	0.1792	0.4140	N.A.
71:2	0.0254	0.3623	0.9358	0.1783	0.4197	N.A.
71:3	0.0170	0.3741	0.9487	0.1785	0.4247	N.A.
71:4	0.0129	0.3783	0.9489	0.1784	0.4293	N.A.
72:1	0.0313	0.3768	0.9500	0.1748	0.4343	N.A.

Date	Cost Gap	Equil. Price	Real Commodity Price	Real Oil Price	Consumer Price	Wage Settlements
72:2	0.0148	0.3881	0.9566	0.1759	0.4377	N.A.
72:3	0.0324	0.3892	0.9661	0.1801	0.4457	N.A.
72:4	0.0315	0.4027	0.9832	0.1880	0.4510	N.A.
73:1	0.0214	0.4178	1.0051	0.1779	0.4597	N.A.
73:2	0.0082	0.4313	1.0369	0.1799	0.4700	N.A.
73:3	-0.0010	0.4400	1.0553	0.1824	0.4817	N.A.
73:4	-0.0085	0.4610	1.1162	0.2905	0.4920	N.A.
74:1	-0.0025	0.4746	1.1624	0.5658	0.5047	N.A.
74:2	-0.0113	0.4911	1.1846	0.6181	0.5207	N.A.
74:3	0.0050	0.5069	1.1859	0.5848	0.5350	N.A.
74:4	0.0105	0.5205	1.1599	0.5670	0.5510	N.A.
75:1	0.0166	0.5250	1.1276	0.5721	0.5637	N.A.
75:2	0.0194	0.5377	1.1120	0.5863	0.5750	N.A.
75:3	0.0165	0.5568	1.0886	0.5968	0.5930	N.A.
75:4	0.0072	0.5674	1.0856	0.6164	0.6063	N.A.
76:1	0.0233	0.5784	1.0925	0.5511	0.6160	N.A.
76:2	0.0230	0.6007	1.0980	0.5497	0.6247	N.A.
76:3	0.0145	0.6016	1.1013	0.5435	0.6317	N.A.
76:4	0.0440	0.6078	1.0756	0.5358	0.6423	N.A.
77:1	0.0320	0.6169	1.0567	0.5558	0.6573	N.A.
77:2	0.0368	0.6246	1.0448	0.5533	0.6720	N.A.
77:3	0.0386	0.6308	1.0305	0.5453	0.6850	N.A.
77:4	0.0302	0.6419	1.0181	0.5372	0.7017	N.A.
78:1	0.0232	0.6497	1.0281	0.5295	0.7153	1.7250
78:2	0.0151	0.6671	1.0351	0.5127	0.7313	1.5500
78:3	0.0048	0.6838	1.0368	0.5036	0.7490	1.8250
78:4	0.0066	0.6994	1.0487	0.5026	0.7617	2.0500
79:1	0.0023	0.7167	1.0567	0.5297	0.7800	2.0250
79:2	-0.0115	0.7475	1.0667	0.6243	0.7993	2.1000
79:3	-0.0107	0.7696	1.0705	0.7671	0.8147	2.2750
79:4	-0.0176	0.7934	1.0704	0.8442	0.8340	2.4250
80:1	-0.0130	0.8085	1.0519	0.9862	0.8533	2.3750
80:2	-0.0150	0.8255	1.0170	1.0218	0.8760	2.8000
80:3	-0.0094	0.8407	1.0288	1.0096	0.9003	2.9000
80:4	-0.0107	0.8678	1.0363	0.9998	0.9270	2.9000
81:1	-0.0097	0.8920	1.0175	1.0745	0.9577	3.4500
81:2	-0.0013	0.9151	1.0042	1.0309	0.9863	3.1500
81:3	0.0161	0.9162	0.9966	0.9598	1.0147	3.4500
81:4	0.0297	0.9190	0.9786	0.9395	1.0410	3.5000
82:1	0.0426	0.9175	0.9712	0.9038	1.0677	3.2500
82:2	0.0318	0.9194	0.9649	0.8444	1.0977	3.1250
82:3	0.0165	0.9215	0.9447	0.8330	1.1210	2.5500
82:4	0.0150	0.9265	0.9342	0.8238	1.1410	1.8250

Date	Cost Gap	Equil. Price	Real Commodity Price	Real Oil Price	Consumer Price	Wage Settlements
83:1	-0.0057	0.9457	0.9476	0.7465	1.1493	1.6750
83:2	-0.0055	0.9647	0.9571	0.7007	1.1630	1.4500
83:3	-0.0156	0.9851	0.9651	0.7117	1.1813	1.4250
83:4	-0.0236	0.9992	0.9720	0.7055	1.1927	1.0250
84:1	-0.0318	1.0167	0.9716	0.6873	1.2083	0.9750
84:2	-0.0395	1.0388	0.9703	0.6892	1.2163	0.7250
84:3	-0.0337	1.0460	0.9662	0.6760	1.2273	0.7500
84:4	-0.0299	1.0534	0.9656	0.6629	1.2373	1.1250
85:1	-0.0259	1.0635	0.9571	0.6289	1.2533	0.9500
85:2	-0.0254	1.0733	0.9476	0.6295	1.2647	0.9000
85:3	-0.0245	1.0861	0.9415	0.6050	1.2763	0.9250
85:4	-0.0332	1.1043	0.9381	0.6031	1.2890	0.9500
86:1	-0.0166	1.0957	0.9345	0.4303	1.3057	0.9250
86:2	-0.0096	1.0942	0.9462	0.2878	1.3140	0.9000
86:3	-0.0036	1.0899	0.9468	0.2626	1.3300	0.7750
86:4	-0.0052	1.1026	0.9408	0.2965	1.3450	0.8250
87:1	-0.0089	1.1278	0.9321	0.3691	1.3587	0.9250
87:2	-0.0139	1.1522	0.9418	0.3955	1.3747	1.0000
87:3	-0.0082	1.1581	0.9468	0.4094	1.3910	0.9500
87:4	-0.0140	1.1778	0.9738	0.3837	1.4020	0.9750
88:1	-0.0104	1.1948	1.0007	0.3297	1.4147	1.0000
88:2	-0.0106	1.2074	1.0220	0.3307	1.4297	1.1500
88:3	-0.0105	1.2219	1.0533	0.2985	1.4463	1.0750
88:4	-0.0095	1.2335	1.0616	0.2716	1.4593	1.1500

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