MAJOR PROVISIONS OF LABOUR CONTRACTS AND THEIR THEORETICAL COHERENCE

LOUIS N. CHRISTOFIDES
AMY CHEN PENG

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Abstract

Theoretical work on indexation and contract duration suggests no role for the expected rate of inflation in equations explaining these variables. Yet, stand-alone or two-equation studies of indexation and contract duration often report that this variable is statistically significant. We study a wider econometric system which includes, in addition, non-contingent wage adjustment. This third, jointly dependent, variable and its nominal anchor (the expected rate of inflation) play a role in the duration and indexation decisions and offer a context within which earlier findings can be understood. In this three-equation system, the wage equation accommodates complex mechanisms through which price inflation feeds into wage adjustment both within and across contracts. The elasticity of indexation is modelled as a latent variable, supporting consideration of both the incidence and the intensity of indexation and linking consistently with the wage equation. In our results, the expected rate of inflation has no role in the duration equation and only a minor one in the elasticity of indexation equation. These findings are more consistent with received theory but they also suggest that more complex models involving all three variables and the sequence of contracts signed by a bargaining pair are needed.

JEL Code: E31, J41, J50.

Keywords: contracts, duration, indexation, wage adjustment, simultaneity.

Louis N. Christofides
Department of Economics
University of Cyprus
Kallipoleos 75
P.O. Box 20537
1678 Nicosia
Cyprus
louis.christofides@ucy.ac.cy

Amy Chen Peng
Ryerson University
Department of Economics
Toronto, Ontario
Canada
apeng@ryerson.ca

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1 Introduction

Provisions of labour contracts such as their duration and the contingent and non-contingent wage adjustments that they entail are important economic outcomes in themselves and have significant macroeconomic implications. Long term contracts freeze the terms on which agents interact and make it possible for the authorities to affect macroeconomic performance through unanticipated actions. Complete compensation against inflation perpetuates the real wage rate structure and may lead to inefficiencies and costly quantity adjustments. Compensation against inflation can be achieved through indexation but, the data suggest, it is more likely to happen through non-contingent wage increases. Non-contingent increases reflect current expectations of future inflation but they also embody uncompensated inflation from the earlier contract, thus providing a propagation mechanism that stretches out the economy's response to shocks. The length of this propagation mechanism may itself be increased by inflation uncertainty. While much can be gleaned from the very complete data that describe formal and legally binding union contracts, the provisions of these agreements may also shed light on behaviour in the rest of the economy.

Our current understanding of what shapes the provisions of union contracts dates back to theoretical and empirical work carried out during the high-inflation period of the 1970s and the 1980s.[1] This literature suggests

[1] For theoretical contributions see Blinder (1977), Azariadis (1978), Card (1983, 1986), Dye (1985), Danziger (1988), Ehrenberg, Danziger and San (1983, 1984), Gray (1976, 1978), and Shavell (1976). Concern with contingent wage adjustment produced empirical studies that deal with the measurement, intensity but, typically, incidence of indexation clauses (Wilton (1980), Estenson (1981), Card (1983, 1986), Cousineau, Lacroix and Bilodeau (1983), and Ehrenberg, Danziger and San (1983, 1984)). Another literature considers how to integrate Cost of Living Allowance (COLA) clauses into wage-change

that contractual provisions such as duration and indexation are interconnected, that non-contingent wage adjustment is an important dimension of labour contracts and that the inflation environment (expected inflation and inflation uncertainty), the state of the product and labour markets (real uncertainty, productivity shocks and unemployment), contractual costs, and bargaining pair-specific variables (attitudes to risk and how firm and other incomes move with inflation) all influence these provisions.

Two important, outstanding, issues concern (i) the theoretically surprising role[2] found in many empirical studies[3] for the expected rate of inflation

equations (Mitchell (1980), Kaufman and Woglom (1984), Vroman (1984), Hendricks and Kahn (1983, 1985, 1986), Christofides (1987), and Prescott and Wilton (1992)). The literature dealing with contract duration includes (Christofides and Wilton (1983), Vroman (1989), Wallace and Blanco (1991), Murphy (1992, 2000), Davis and Kanago (1997), Kanago (1998), Barcena-Ruiz and Campo (2000), Wallace (2001), and Rich and Tracy (2004)). Attempts to explore the simultaneities involved have been partial, studying contract duration, indexation, and wage adjustment in various pairs (Prescott and Wilton (1992), Bils (1990), and Christofides and Peng (forthcoming)) and typically looking at the incidence, rather than the intensity, of indexation. Two studies that have addressed all three issues are Christofides (1990) and Murphy (2000). Based on a smaller sample, the former concludes in favour of a causal structure, where contract duration and indexation are determined first, feeding into non-contingent wage adjustment at a later stage. Murphy (2000) studies a simultaneous context where the study of indexation is confined to incidence and the wage equation is linear.

[2] Ehrenberg, Danziger and San (1984, Table 1, row 7) and Gray (1978, note 3, 3) note that the expected rate of inflation plays no role in the canonical models.

[3] Cousineau, Lacroix and Bilodeau (1983), examining contract duration and COLA incidence, report a significantly negative coefficient for expected inflation in the duration equation and a significantly positive coefficient in the COLA incidence equation. Using various proxies, Rich and Tracy (2004, Table 5) report significant coefficients for most of their expected inflation proxies which are negative in the duration equation and positive in the COLA incidence equation. The same pattern is also found in Christofides and Peng

in contract duration and indexation equations and (ii) the related, we argue, fact that all studies stop short of a fully simultaneous treatment of contract duration, the elasticity of indexation, and non-contingent wage adjustment. Since duration and indexation are negotiated at the same time as non-contingent wage adjustment, it is possible that the role assumed by expected inflation in empirical studies reflects the fact that non-contingent wage adjustment has not typically been taken into account.[4] To fully explore a possible role for the expected rate of inflation in shaping the duration and indexation decisions it is necessary to spell out and simultaneously estimate the missing wage equation.

With these challenges in mind, we examine a long (1976-2000) history of Canadian collective bargaining agreements in an econometric context where (i) full simultaneity involving duration, indexation and non-contingent wage adjustment is possible, (ii) indexation is modeled as a censored variable (allowing examination of both the incidence and the intensity of indexation), (iii) the wage equation nests Phillips and Wage Curve behaviour, is consistent with the possibility that current and/or past contracts may be indexed, and accounts for the history of expected future and uncompensated past inflation, and (iv) contingent, non-contingent, and total wage adjustment are modelled endogenously, in the context of a unified framework.

The database used derives largely from electronic records maintained by the ministry (Human Resources Development Canada or HRDC) responsi-

(forthcoming). A number of other authors also control for the expected inflation rate in duration and indexation equations.

[4] For instance, contingent and non-contingent wage adjustments are natural substitutes and the expected real non-contingent wage adjustment should enter a structural indexation equation with a negative sign - implying, as in footnote 3, a positive sign for expected inflation.

ble for these legally binding agreements, thereby ensuring continuity and accuracy. Continuity is essential to devising an appropriate framework for modelling how price inflation feeds into wage inflation. In a world where the distribution of anticipated inflation is not degenerate at the expected rate, uncertainty about future inflation can be dealt with ex post by taking uncompensated inflation into account in a subsequent contract. This notion differentiates intra-contract non-contingent compensation and contingent compensation through a COLA clause from inter-contract non-contingent wage adjustment for uncompensated past inflation. However, uncertainty about future inflation also affects contract duration and indexation. Theory suggests that greater inflation uncertainty should shrink the length of contracts and intensify indexation. It may also stretch out compensation against inflation by strengthening the ex post mechanism described above, a possibility that we examine.

Future inflation is modelled using recursive GARCH procedures, ensuring that both expected inflation and inflation uncertainty are generated in an internally consistent manner. The same procedures can be used to generate real uncertainty, a variable whose influence on contract duration has been stressed by Danziger (1988).

The model is used to analyse total (including COLA-generated) wage change as well as contract duration and indexation. An assumed disinflation, of the type experienced during the recessions of the early 1990s, produces changes in contractual provisions which are very similar to the actual ones. However, the transmission mechanism is through the impact of expected inflation on non-contingent wage adjustment and thence to contract duration and indexation. A general-to-particular modeling strategy suggests that expected inflation per se is no longer needed in the contract duration equation, while its influence in the indexation equation is muted.

While our results are more consistent with received theory, they also serve an inductive role in that they call for more complete theoretical models of how major provisions of labour contracts are shaped. Since the evidence, here and elsewhere, that uncompensated inflation from the previous contract affects non-contingent wage adjustment is very strong, theoretical efforts should take into account the long-term relationships that exist in the labour market.[5]

Section 2 deals with specification and econometric issues. Section 3 discusses the contract data as well as information that has been appended from other sources. Section 4 presents the empirical results and section 5 provides a summary of our findings.

2 Econometric Specification

2.1 Uncertain Inflation, Intra and Inter-Contract Compensation

In general, actual inflation will differ from what is anticipated. In a context where consecutive bargaining between pairs occurs, it is natural for uncompensated inflation to appear as an issue in subsequent negotiations, leading to inter-contract compensation against inflation. Since this uncompensated inflation mechanism serves a purpose similar to that of a COLA clause, it is necessary to take both into account when specifying a general wage adjust-

[5] In the sample we examine, a large number of continuous contract histories exist and the maximum number of consecutive contracts signed by the same bargaining pair is 18.

ment equation.[6] Consider the equation

$$WNC_t = c + \alpha(1-\varepsilon_t)\pi_t + \beta[(P_{t-1} - \alpha\pi_{t-1})L_{t-1}/L_t] - \delta[\varepsilon_{t-1}(P_{t-1} - \alpha\pi_{t-1})L_{t-1}/L_t] + \cdots \quad (1)$$

where the subscript t indicates the current and $t-1$ the previous contract. WNC_t is the non-contingent wage adjustment over the current contract at annual rates, ε_t is the elasticity of indexation[7], P_t and π_t are actual and expected inflation respectively at annual rates, L indicates the length of a contract, and c, α, β and δ are constant parameters. Discussion of other relevant variables is postponed. On the right hand side (RHS) of equation (1), non-contingent wage adjustment is composed of three parts: (i) A portion $(1-\varepsilon_t)\pi_t$ of expected inflation π_t is not captured by the elasticity of indexation in the current COLA clause, unless indexation is complete ($\varepsilon_t = 1$) in which case this term drops out. The amount α ($0 \leq \alpha \leq 1$) times $(1-\varepsilon_t)\pi_t$ is built into non-contingent wage adjustment. If no COLA clause exists in the current contract ($\varepsilon_t = 0$), this term becomes the standard expectational one $\alpha\pi_t$. This term captures intra-contract non-contingent wage adjustment. (ii) The expression $(P_{t-1} - \alpha\pi_{t-1})$ represents uncompensated inflation from the previous contract, or inter-contract non-contingent wage adjustment. In

[6] Other authors have included various functions of the actual and expected inflation rate in wage equations - see Turnovsky (1972), Auld et al (1979), Riddell (1979), Kaufman and Woglom (1984), Vroman (1984), Hendicks and Kahn (1985, 1986), and Christofides (1987). The uncompensated inflation mechanism allows the bargaining pair to avoid potentially costly arguments and implementation mistakes over inflation pass-through, given that past wrongs can be put right at future negotiations. This mechanism may be particularly useful at times of more uncertain inflation. We return to this point below.

[7] This is defined as the percentage change in the nominal wage rate divided by the percentage change in the consumer price index, both appropriately annualised - see the data section.

the event that the duration of the contract changes, the term L_{t-1}/L_t appropriately annualizes this uncompensated inflation, otherwise it drops out. The amount β $(0 \leq \beta \leq 1)$ times the first term in square brackets may be built into the current contract as 'catch-up' for uncompensated past-contract inflation. If $\alpha = 1$, as is assumed in the standard version of the expectations-augmented Phillips Curve, then uncompensated inflation over the previous contract $(P_{t-1} - \alpha\pi_{t-1})$ is equal to unexpected inflation $(P_{t-1} - \pi_{t-1})$. (iii) In the event that the previous contract included a COLA clause $(\varepsilon_{t-1} > 0)$, a portion ε_{t-1} times uncompensated inflation would have been captured by the indexation provisions in the previous contract. Thus, term (ii) above overcompensates and an amount δ $(0 \leq \delta \leq 1)$ times the second square bracket must be subtracted. If $\varepsilon_{t-1} = 0$, this term drops out. Equation (1) can be further simplified to

$$WNC_t = c + \alpha(1 - \varepsilon_t)\pi_t + \beta\{(1 - \varepsilon_{t-1})[(P_{t-1} - \alpha\pi_{t-1})L_{t-1}/L_t]\}... \quad (2)$$

if $\beta = \delta$. Prior testing suggested that this constraint can be accepted and further estimation is based on equation (2). If $\varepsilon_t = \varepsilon_{t-1} = 1$, all response to inflation occurs through the indexation clause and WNC_t equals c. If $\varepsilon_t = \varepsilon_{t-1} = 0$, equation (2) collapses to c plus intra $(\alpha\pi_t)$ and inter $(\beta(P_{t-1} - \alpha\pi_{t-1})L_{t-1}/L_t)$ contract non-contingent adjustment.

Equation (2) can deal with any pattern of indexation provisions in the current and past contracts and there is no need to analyze indexed and non-indexed contracts separately, as was done in some earlier studies. In particular, there is no need to single out for special treatment wage agreements whose indexation status or contract duration changes between contracts.

2.2 Contract Duration and Indexation

Equation (2) can be estimated using non-linear ordinary least squares, provided ε_t and L_t are exogenous. However, since contract duration, indexation and non-contingent wage adjustment are all determined during the negotiation process, exogeneity cannot be assumed and a simultaneous structure must be allowed for.

Here, duration is measured as the continuous variable L_t and indexation arrangements are captured by the elasticity of indexation ε_t. Thus a three-variable system is considered consisting of equation (2) and:

$$L_t = \gamma_1.\varepsilon_t^* + \zeta_1 WNC_t + X'_{1t}\theta_1 + u_1 \tag{3}$$

$$\varepsilon_t^* = \gamma_2.L_t + \zeta_2 WNC_t + X'_{2t}\theta_2 + u_2 \tag{4}$$

where the actual value of the elasticity of indexation is related to its latent value ε_t^* by

$$\varepsilon_t = \begin{cases} \varepsilon_t^* & \text{if} \quad \varepsilon_t^* > 0 \\ 0 & \text{otherwise} \end{cases} \tag{5}$$

Since one of the endogenous variables, ε_t^*, is a latent variable and equation (2) is non-linear, the system cannot be readily estimated in a single step. However, the Tobit model in equations (4) and (5) can be linearized and the Full Information Maximum Likelihood (FIML) method can be applied to the three-equation system. The linearized form of equations (4) and (5) is given (Maddala 1983, 222) by

$$\varepsilon_t = \gamma_2 \Phi_t L_t + \zeta_2 \Phi_t WNC_t + \Phi_t X'_{2t}\theta_2 + \sigma_2 \phi_t + u_3, \tag{6}$$

where ϕ_t and Φ_t are the standard normal density and distribution functions, respectively, and these expressions are evaluated at the values of the variables for the individual observations t. Equations (2), (3), and (6) could be estimated by Maximum Likelihood if ϕ_t and Φ_t were known. Estimates of $\widehat{\phi_t}$ and $\widehat{\Phi_t}$ can be obtained from a Probit equation, and ϕ_t, Φ_t can be replaced with $\widehat{\phi_t}$, $\widehat{\Phi_t}$ as explanatory variables in a modified version of equation (6)

$$\varepsilon_t = \gamma_2(\widehat{\Phi_t} L_t) + \zeta_2(\widehat{\Phi_t} WNC_t) + (\widehat{\Phi_t} X'_{2t})\theta_2 + \sigma_2 \widehat{\phi_t} + u_4. \tag{7}$$

The variables in the Probit equation are as in equation (4), the coefficients being normalized by the standard deviation of u_2, which cannot be separately identified. The system consisting of equations (2), (3) and (7) can be estimated by FIML, iterating until parameter estimates, including parameter estimates in the initial Probit equation, converge. The latent nature of the elasticity variable, simultaneity, as well as the non-linear wage structure are all taken into account. While the X_1 and X_2 variables are discussed below, it is important to note that both equations condition on the expected rate of inflation and the nominal anchor that it provides. Without this anchor, the level of inflation and hence WNC would have implications for the elasticity of indexation and contract duration. More discussion of this issue appears in section 3.2.

2.3 Further Aspects of Wage Adjustment

Extant macroeconometric and microeconometric evidence shows a negative relationship between nominal wage adjustment and the unemployment rate, the Phillips Curve. However, many theoretical models and some empirical evidence support a Wage Curve, describing a negative relationship between the level of the real wage and the rate of unemployment.[8] A nesting equation

[8]See Blanchflower and Oswald (1994, 2005).

includes the real wage from the previous contract and current productivity on the RHS of equation (2).[9]

Another aspect of our wage adjustment model is the distinction between the non-contingent wage change described in equation (2), the contingent wage change $WC_t = \varepsilon_t P_t$ which is determined endogenously given ε_t in equation (7), and the total wage change WT_t which is the sum of the two. The model is capable of addressing all three concepts.

The discussion so far has focussed on the specification of the main variables and their interdependence, abstracting from other important forces that operate on wage adjustment, contract duration and the elasticity of indexation. These are discussed below.

3 Data and Sources

3.1 The HRDC Data Base

The contract data used for this study is constructed from electronic records provided by HRDC. The database contains information on 11885 contracts agreed upon between 1976 and 2000. In order to take into account lagged effects, only observations where at least one prior agreement has been negotiated are considered, leaving 9646 observations covering the period 1977-2000. For these, any variable available for the current contract is also available for the previous contract and is denoted by a p prefix.

The HRDC data contains information on a number of variables, including

[9] This is spelled out in Blanchard and Katz (1999) in a time series context. Their equation (6) can be re-written in the form just suggested by dropping the implied coefficient constraints. A Phillips Curve would not involve the lagged real wage in the nominal wage adjustment equation while a Wage Curve would. See also Farès (2002).

the three main variables under study. Descriptive statistics are presented in Table 1. On average, total wage adjustment is about 4.8% with a standard deviation of 4.2 percentage points. Non-contingent wage adjustment counts for over 90% of total wage change with a mean of 4.45% and a standard deviation of 4.06 percentage points. Duration is defined as the difference between the effective and expiry dates of the contract[10], and is shown to have a mean of 25.63 months with a standard deviation of 11.5 months. The COLA provisions in contracts are diverse and complex but they generally describe how the base wage rate changes as some price index evolves. The variable Elasticity, ε_t, is defined as the percentage change in the base wage rate due to the COLA clause divided by the percentage change in the CPI, both over the life of the contract.[11] When the agreement does not contain a COLA

[10] An important literature deals with 'holdout', i.e. the gap that exists between the previous contract's expiry date and the current contract's settlement date. Crampton and Tracy (1992, 1994) and Gu and Kuhn (1998) consider the information-gathering significance (this relates to the ability of the firm to pay and to details of the settlements reached by other bargaining pairs) of this period for the bargaining process. Danziger and Newman (2005) examine optimal holdout in the context of a macroeconomic perspective. The definition of contract duration used here is the same as that of the Bureau of Labor Statistics. The negotiating process for all but 756 of the 9646 contracts in our sample began before the expiry date. Where holdout exists (8078 contracts), the effective date specified in the new contract was equal to the previous expiry date in 6962 out of the 8078 contracts, thereby maintaining an uninterrupted sequence of agreements. As Rich and Tracy (2004) note, timing issues may arise if additional information (e.g. the expected inflation rate) that we assign according to the effective date does not conform with what agents had in mind at the time of settlement. Agents may have considered values at the start of negotiations, values on settlement, or something in-between such as the effective date used here. We do not have information that would reliably discriminate among these possibilities. This issue is less likely to be important in the context of the quarterly data used here.

[11] An ex ante elasticity of indexation is not available in this data. Note that the term

clause, $\varepsilon_t = 0$. As Table 1 shows, the unconditional mean value of Elasticity is 0.075 with a standard deviation of 0.257. Conditional on Elasticity>0, this value for the 1256 contracts involved is 0.579 with a standard deviation of 0.462. A related variable Cola equals unity when the contract contains a formal COLA clause, even when it was not activated,[12] and is equal to zero otherwise. Its mean value is 0.192, indicating that less than 20% of the contracts contain a COLA clause.

Figure 1 shows average values of Duration, Elasticity and WNC_t over the contracts that became effective in each of the years in the sample. WNC_t was as high as 13% in 1981, and it decreased to less than 3% in the 1990s. Duration, on the right scale of Figure 1, more than doubled from 18 months in 1978 to 38 months in 1998. Elasticity was quite volatile; it increased dramatically during 1990-1991, decreased continually till 1998 and increased substantially in 1999. The substantial variance in these variables makes their study of interest but it also ensures that, where they appear as explanatory variables, they have sufficient variation to make them statistically useful.

3.2 Other variables in the Three Equations

A number of variables were attached to the HRDC database and appear in some, or all three, equations. Exclusion restrictions are suggested by the underlying theory, they have been checked statistically, and they are discussed below. An important variable is the regional unemployment rate,

contingent wage change refers to COLA-induced wage adjustments because the only contingency built into contracts is with respect to inflation.

[12]There are 1854 contracts for which Cola=1 and, for these contracts, the mean value of Elasticity is 0.393 with a standard deviation of 0.467. The mean for this group is lower than that in the 1256 contracts since the latter includes only contracts for which the indexation trigger was exceeded and the COLA clause generated a positive wage adjustment.

Rurate, prevailing at the time the contract became effective. This rate varies cross-sectionally and over time. For instance, in 1988, the unemployment rate was 5.0% in Ontario and 12.4% in the Atlantic region; the variation over time is exemplified by the increase in Ontario's unemployment rate to 10.9% in 1992. Figure 2 shows WT_t, Rurate, and actual and expected inflation, averaged over the contracts of each year, in the period 1977-2000. The unemployment rate fluctuates around a mean of 9.36 over the whole period, with cyclical changes which are contrary to the changes in price inflation and wage adjustment. This variable appears in all three equations as it signals bargaining strength and is central to both Phillips and Wage Curve ideas. The price inflation variables are discussed below.

A variable in the HRDC data base is the nominal base wage rate profile in effect over the contract. Given this and price information that was appended, it is possible to construct the average nominal and real wage rates prevailing over a contract. In this paper, the previous real wage, which is exogenous to the current contract, is used in the nesting wage equation referred to earlier - in the sensitivity analysis below, we test whether the real wage rate should also enter the duration and indexation equations. As Table 1 shows, the Pnomwage is, on average, $13.308 with a standard deviation of $5.469 over the 9646 contracts. The previous real wage, Prealwage, has a higher mean as it is deflated by a CPI which has a base of 100 rather late in the sample (in 1992). Another variable in the nesting wage equation that has an important role in the wage determination process is a measure of productivity shocks. The variable Prodshock, defined as the the deviation of the natural logarithm of real GDP from its trend, is also attached to the database using the previous contract value to avoid possible endogeneity. General productivity shocks have not been an explicit concern of the literature on indexation and contract duration; we exclude Prodshock from these equations but test for this exclusion in our sensitivity analysis.

In addition, a number of other variables, particularly changes in public policies, have been suggested as determinants of nominal wage change. Until the second quarter of 1978, the Anti Inflation Board (AIB) controlled wages in the both the private and public sectors. Auld et al (1979) found that, ceteris paribus, this program reduced wage inflation. Beginning in 1982, a number of provinces attempted in a variety of ways to control wage growth in their own public sector. During the 1990s, more determined efforts were made to do likewise in both the provincial and federal public sectors. Three dummy variables, 7control, 8provcontr and 9pubcontr are used to flag these programs respectively.[13]

The duration and indexation equations also include the logarithm of the number of employees in the previous contract (Plemployee): large and probably more sophisticated bargaining units are more likely to seek long and indexed contracts and firms may be more willing to spread out the cost of indexation over a larger number of employees and a longer time period. There is no direct theoretical influence on wage behaviour, other than possible bargaining power effects, but we test for this exclusion in our sensitivity analysis.

All three equations include region (Atlantic, Quebec, Ontario which is

[13] The detailed information on the 1990s programs, required to set up 9pubcontr, was obtained from Swimmer (2000). We attempt to capture the influence of provincial controls programs by setting 8provcontr=1 for provincial settlements that became effective in 1982. The AIB remained in effect until the second quarter of 1978 (inclusive) and all settlements up to the end of that quarter would have been subject to its scrutiny. In our sensitivity analysis, we test whether the controls programs are important in the contract duration and indexation equations.

the omitted category, Prairie, British Columbia and Territories) and industry (Construction, Transportation, Communications, Utilities, Trade, Education, Health, Services, Other and Manufacturing as the omitted category) effects - see Table 1. These variables control for demand and supply elasticities which figure prominently in theoretical discussions. They also account for unobservables that may influence bargaining outcomes, thereby allowing the variables that we are particularly interested in to have a clearer statistical role. Information on industry and region is available in the HRDC records.

Each of the duration and indexation equations, includes as regressors the remaining two jointly determined variables (e.g. WNC_t and ε_t in the case of duration) and conditions on the expected rate of inflation. Doing so provides a nominal anchor in all equations of the system and allows us to consider whether duration and indexation are sensitive to the nominal or the expected real values of non-contingent wage change. Following the general-to-particular route, we can check what role, if any, must be accorded to the expected rate of inflation per se, as distinct from the expected real values that it defines.

The equations also include the previous-contract own value of duration or the elasticity of indexation. These values capture slow adjustment and pair-specific factors that may influence the two decisions but on which no information is available. The duration and indexation equations include nominal and real uncertainty, variables stressed by the theoretical discussions mentioned above and the construction of which merits special attention; we test for the exclusion of these variables from the wage equation.

3.3 Future Inflation, Nominal and Real Uncertainty

Many previous researchers used survey data or sliding-regression techniques to generate proxies for expected inflation and inflation uncertainty. Survey measures are widely used in US studies, e.g. Vroman (1989), Kanago (1998), and Rich and Tracy (2004). However, good quality survey data are not available in Canada[14] and sliding regression techniques have been superceded by modern time series methods. A recursive AR(6) regression model[15] with a GARCH(1,1) error process provided the best fit. $x_t = \gamma_0 + \gamma_1 x_{t-1} + \gamma_2 x_{t-2} + \gamma_3 x_{t-3} + \gamma_4 x_{t-4} + \gamma_5 x_{t-5} + \gamma_6 x_{t-6} + \varepsilon_t$, where $\varepsilon_t | \Psi_{t-1} \sim N(0, h_t)$ and $h_t = \omega + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1}$, was used to describe x={the inflation rate, rate of growth of real GDP}, where the inflation rate is given by $100 \ln(CPI_t / CPI_{t-4})$[16] and the rate of growth of real GDP[17] is defined analogously. As a by-product of GARCH estimation, a proxy of expected inflation is constructed from the forecast values of x_t one quarter ahead. Expected inflation, Expinf, is assigned to each contract according to its effective date. The implied error

[14] GARCH-based proxies were preferable to Conference Board in Canada survey data on conceptual and statistical grounds.

[15] That is, new quarterly observations are added to the sample one at a time as history unfolds and the model is re-estimated. This assumes that agents have the latest (but no future) information set at hand and that they use it to estimate the most recent GARCH structure for their predictions.

[16] Quarterly data availalble over 1946Q1-2000Q3 (1992=100) were used for the inflation process. CPI is CANSIM I Series P10000 and CANSIM II Series v735739. In a benchmark study, Crawford and Kasumovish (1996) review different ARCH/GARCH models for the Canadian CPI inflation series; their results show that a relatively simple fixed parameter GARCH model, such as the one used here, can capture the characteristics of Canadian inflation well.

[17] Real GDP is Cansim series D15721. A linear filter is used on the natural logrithm of real GDP to construct the Productivity variable (the deviation of ln real GDP from trend) included in the wage equation.

variance h_t is time dependent and proxies nominal (Nomuncert) and real (Realuncert) uncertainty when based on the inflation and real GDP growth equations respectively. Note that the variables P_t and P_{t-1} in equation (2) are derived from the same CPI series using the dates of the relevant contract and are expressed at annual rates. In Figure 2, actual inflation P_t, expected inflation π_t, and total wage adjustment WT_t show exactly the same trend: All series decline from over 10% in the late 1970s and early 1980s to about 3% after 1990 and move against the regional unemployment rate.

In Figure 3, the variable Nomuncert has a general tendency to decline but one that is interrupted by the major recessions of the early 1980s and 1990s. During these periods but especially during the early 1990s, the dramatic stepdown of inflation generated substantial increases in nominal uncertainty. These breaks in the secular decline of nominal uncertainty may not be generally appreciated and have important implications for this study which are examined below. It should be noted that Expinf and Nomuncert are negatively correlated[18], suggesting that the former does not proxy the latter. In the case of Realuncert, this variable is stationary with substantial spikes during the early 1980s and 1990s, as well as smaller spikes in 1985 and 1987.

[18] A simple regression produces Nomuncert=0.428(159.6)-0.018(-35.5)Expinf with an R Squared of 0.12. Note that the terms nominal and inflation uncertainty are used interchangeably.

4 Empirical Results

4.1 General Findings From Single Equations

We begin by reporting single equation results. Since these are similar to but dominated by the FIML results[19], we confine them to the Appendix Tables A1 and A2 and discuss them only in this paragraph. In Table A1, estimates of equation (2) are based on non-linear least squares, those of the elasticity equations (4) and (5) on Tobit, and those of the duration equation (3) on Ordinary Least Squares (OLS). Appendix Table A2, presents the coefficients for the Tobit estimates in column 1, the marginal effects ($F(\bar{z}) \cdot coefficient$) in column 2, and the McDonald and Moffitt (1980) decomposition of the marginal effects. The latter are broken down into the impact of a change in the variable x_i on (i) the Elasticity above zero, $\partial Elasticity^*/\partial x_i$, weighted by the probability, $F(\bar{z})$, of being above zero (this is denoted as the Intensity Effect in column 3), and on (ii) the probability of being above the limit, $\partial F(\bar{z})/\partial x_i$ weighted by the expected value of the latent elasticity $E(Elasticity^*)$ (this is denoted as the Incidence Effect in column 4). The variable $\bar{z}$ is the standardized mean value of the argument. The figures in columns 3 and 4, Table A2, add up to the complete marginal effect in column 2, Table A2. Columns 5 and 6, Table A2, give $\partial Elasticity^*/\partial x_i$ (the Elasticity* Effect) and $\partial F(\bar{z})/\partial x_i$ (the Probability Effect) respectively.[20] Table A2 shows that, relative to the coefficients, the marginal effects are muted. Also, while the Elasticity and Probability Effects are relatively close in size, their weights in

[19]In the case of the Tobit results, it is the marginal effects, in Appendix Table A2, column 2, that should be compared to those in Table 2 below, given that equation (7) contains variables that have been multiplied by the distribution function Φ_t.

[20]Note that $F(\bar{z}) = 0.0915$, $f(\bar{z}) = 0.1644$, $E(Elasticity) = 0.0294$ and $E(Elasticity*) = 0.321$.

the McDonald and Moffitt (1980) decomposition are not. Since the probability of indexation is considerably lower than the conditional expectation, i.e. $F(\bar{z}) < E(Elasticity*)$, the impact of changes in variables on the weighted probability of indexation (column 4, Table A2) is larger than their weighted impact on the degree of indexation (column 3, Table A2). For instance, Pelasticity, the variable with the largest marginal effect of 0.0933, has an Incidence Effect of 0.0779 and an Intensity Effect of 0.0153 - allowing for rounding. Leaving the difficulty of generating an elasticity variable aside, these results suggest that it is easier to model the incidence than the intensity of indexation.

Before proceeding to consider the FIML results, it is important to confirm that a fully simultaneous treatment of the three equations is appropriate. Various exclusion restrictions have been noted in the discussion above and are addressed further below. Based on theoretical considerations and earlier studies, ε_t and L_t are integral to equation (2). Attention is focused on equations (3) and (7). Whether WNC_t also belongs to these equations is considered by conducting modified Hausman tests (1978).[21] These suggest that full simultaneity cannot be rejected at the 1% level.

4.2 The Simultaneous System

Table 2 presents results on contract duration (columns 1 and 2), the elasticity of indexation (columns 3 and 4) and non-contingent wage adjustment (columns 5 and 6). We begin with the wage equation. WNC_t reflects strongly the current and previous-contract inflationary environment, captured by the coefficients α and β. The estimate of α is 0.931 and it is significantly different from both zero and unity. Compensation against inflation is, however,

[21] See also Maddala (1988, 434-441).

spread over two consecutive contracts and the estimate of β is 0.087, a coefficient which is significantly different form zero at the 1% level. Rurate has a coefficient that is significantly different from zero at the 1% level. While these results are fully consistent with a Phillips Curve, it should be noted that significant Wage Curve elements are also present. The previous real wage rate has the expected sign and is significantly different from zero at the 1% level. To the extent that the variable Prodshock is correlated with a productivity level variable such as output per capita, it, too, is consistent with the Wage Curve specified in Blanchard and Katz (1999).

The wage control variables for the two most rigorous control programs (the AIB and the provincial and federal programs of the 1990s) are negative and statistically significant at the 1% level. Most of the industry coefficients are negative except those on Natural Resources and Construction; the lowest wage adjustments are found in Utilities and Services. The Atlantic provinces have the highest and the Prairie provinces have the lowest wage adjustments.

The first four columns of Table 2 deal with contract duration and indexation. Previous-contract values of Duration and Elasticity are included in their respective equations. These variables help capture pair-specific fixed effects which are difficult or impossible to measure, e.g., risk aversion. Both have the expected signs and are significant at the 1% level. Plemployee was included in both equations in order to proxy worker sophistication but this is only significant in the indexation equation. It suggests that the elasticity of indexation is higher in large bargaining units. Region and industry fixed effects were included as proxies for labor demand and supply elasticities in local markets and are often significant. The longest and most highly indexed contracts are in Manufacturing (the omitted industry), particularly in Quebec. The regional unemployment rate suggests shorter and less indexed contracts when it is high. The positive interaction between duration and indexation suggested by Gray (1978) and Ehrenberg, Danziger and San (1983, 231) and others is very strongly present in the results of Table 2. This is particularly noteworthy, given that WNC_t contains the uncompensated inflation mechanism which acts as a substitute for indexation.

Inspired by the theoretical literature, earlier empirical studies of contract duration and indexation also focus on the role of nominal and real uncertainty. Nominal uncertainty is expected to shorten contracts and strengthen indexation provisions and these are the results found. Real uncertainty may also shorten contracts and weaken indexation. Its coefficient is negative and significant in both equations.

The presence of WNC_t in the duration equation renders Expinf insignificant. The secular doubling of contract duration, evident in Figure 1, remains tied to the inflationary environment. However, the influence of inflation in the duration equation is now mostly through its impact on WNC_t, not through Expinf directly (coefficients of -0.814 and -0.109 respectively, in Table 2, column 1). This is a feature of the simultaneous model - see the stand-alone equations in the Appendix Table A1, where WNC_t has a smaller absolute coefficient than Expinf (-0.337 and -0.550 respectively, Table A1, column 1). Thus, consideration of the duration equation in a simultaneous system strips Expinf of any direct role in that equation. The general decline in Nomuncert, except during the early 1990s, tends to increase contract duration.

As seen in Figure 1, the elasticity of indexation tends to decline through time but it does not have the strong and consistent secular trend that contract duration does. In view of the substitutability between real expected non-contingent wage adjustment and indexation, WNC_t should enter the indexation equation with a negative and Expinf with a positive coefficient.

This is in fact the case and, indeed, the coefficients are so close in absolute value that they suggest imposing the implied constraint. When this is done, the coefficient (coeff/se) on $(WNC_t - Expinf)$ is -0.018 (-72.99). However, this constraint cannot be accepted statistically and a small role for Expinf in the indexation equation remains.[22] The trend decline in nominal uncertainty influences the elasticity of indexation in the right direction but this force is interrupted by the inflation regime changes of the early 1990s which created substantial inflation uncertainty.

In summary, the model produces theoretically coherent results. On the outstanding empirical issue mentioned in the introduction, it suggests that the elasticity of indexation depends negatively on the real expected non-contingent wage adjustment, with a small role left over for expected inflation itself. The duration equation affords no role for expected inflation once non-contingent wage adjustment is taken into account.

4.3 Total Wage Adjustment

The results in Table 2 provide a complete analysis of wage adjustment in all contracts regardless of whether they contain indexation provisions and regardless of whether these provisions change between contracts. The capacity of the model to address all these aspects of wage adjustment is important. Since total wage adjustment consists of the sum of WNC_t and $WC_t = \varepsilon_t P_t$, the predicted total wage adjustment WT_t is obtained from the predicted values of WNC_t, ε_t, and π_t (in place of P_t). Details of the relationship between actual and predicted values for WC_t, WNC_t and WT_t are presented in Figure 4. The 9646 actual values and the predicted values are averaged by year and

[22] When Expinf is added to the indexation equation, along with $(WNC_t - Expinf)$, its coefficient (coeff/se) is 0.0069 (20.47). In these analyses, other coefficients are not affected.

plotted against time.[23] The bottom two series, in Figure 4, present actual and predicted WC_t. Since this is determined by the product $\widehat{\varepsilon_t}\pi_t$, the figure is largely shaped by expected inflation. The height of the graph reflects the small values of the elasticity of indexation. The predictions track the actual data well, capturing the secular decreasing trend. Figure 4 provides similar information for WNC_t. The time variation in this figure is largely influenced by Expinf in equation (2) which caries a near-unity coefficient. The graph is also influenced by the uncompensated inflation term, regional unemployment, productivity and the controls variables. The predicted values trace the actual series well. The combined predictions for WT_t appear in the top two lines of Figure 4. Clearly, non-contingent wage adjustment has the dominant impact on total wage adjustment.

The model provides a number of channels through which prices feed into wages, i.e. intra-contract contingent adjustment, intra-contract non-contingent adjustment which depends on the coefficient α and expected inflation, and inter-contract compensation for uncompensated past inflation which depends on the coefficient β. A fully anticipated, constant, rate of inflation would elicit a non-contingent wage adjustment equal to $\alpha + \beta - \alpha\beta = 0.937$. This, along with the average contingent adjustment (the average value from Table 1, of $\varepsilon = 0.075$) produces a full pass-through to wages.

It should be noted that this pass-through stretches over two contracts and may be modified in an uncertain environment. When the wage equation allows for Nomuncert to influence the estimated values of α and β, we find that α decreases and β increases with inflation uncertainty.[24] Thus, in a more

[23]The time variation in these figures is produced by all RHS variables, including the pattern of settlements by industry and region which may not be constant over time. The statements that follow presume an otherwise neutral pattern of industry and region effects.

[24]Writing out α and β as $\alpha_0 + \alpha_1 Nomuncert$ and $\beta_0 + \beta_1 Nomuncert$, we obtain

uncertain environment, not only will the elasticity of indexation increase but agents will tend to decrease intra-contract and increase inter-contract non-contingent wage adjustment. Thus, the ex ante non-contingent compensation against inflation will be reduced in favour of contingent payments which do not occur until inflation has materialised and ex post coverage of uncompensated inflation which does not occur until the next contract. The response to inflation shocks is, therefore, stretched out.

4.4 Simulating the Impact of Disinflation

To further study the interrelationships among the three key provisions of labor market contracts, we simulate how declining inflation affects duration, indexation, and non-contingent wage adjustment. Since inflation declined from an average of 9.14% during the high inflation period to an average of 1.64% during the low inflation period, the linear combination of the respective averages $9.14(1-t)+1.64t$, where $t = 0, 0.05, 0.1, ...0.9, 0.95, 1$ is used to describe the expected inflation path. Equations (2), (3) and (7) are used to solve for non-contingent wage adjustment, duration and indexation for each inflation value. Since, for present purposes, only time-dependent variables are important[25], Manufacturing and Ontario (the omitted classes) are considered. The starting values of the relevant RHS variables are taken from their means in the high inflation period. Then the three equations are solved simultaneously. The estimates of Duration, Elasticity and WNC_t are used to update Pdur, Pelasticity, and Prealwage. Inflation information is updated accordingly, and the system is solved again to derive a new set of Duration,

$\alpha_0 = 0.89(139.08)$, $\alpha_1 = -0.034(-14.5)$, $\beta_0 = 0.125(10.78)$, and $\beta_1 = 0.075(2.97)$. The remaining coefficients in the wage equation are not afffected.

[25] We set nominal and real uncertainties at their mean.

Elasticity, and WNC_t values.

The predictions of Duration, Elasticity and WNC_t are consistent with the raw data. As inflation decreases from its average in the high inflation period to its average in the low inflation period, predicted duration increases from 20.8 to 30.8 months. The actual averages in the two subsamples were 20.9 and 29.3 respectively. Predicted elasticity decreases by 0.02, which is close to the change of the subsample means. Similarly, predicted non-contingent wage adjustment changes from 9.77% to 2.55% while the subsample means changed from 10.51% in the high inflation period to 1.67% in the low inflation period. The linear form of the simulated inflation function carries through to L_t, ε_t and WNC_t but, since ε_t is a Tobit and WNC_t is nonlinear, their predictions contain non-linearities. A graph is available on request.

4.5 Sensitivity Analysis

We have checked a number of the exclusion restrictions in Table 2 in order to see if our main results are affected. First, we added the previous real wage in the duration and indexation equations on the grounds that, in the risk-sharing paradigm, this may proxy risk aversion and enter all equations. This variable was not significant in either case and our results were unchanged.

Controls have been thought to influence contract provisions other than the one toward which they were explicitly directed (i.e. wage adjustment). When all three control variables are included in all equations they are insignificant with two exceptions. The variables 9pubcontrol and 7control have a coefficient of -2.128 (-3.45) in the duration equation and 0.033 (3.01) in the indexation equation respectively. The remaining results are not affected.

The inclusion of Prodshock in the duration and indexation equations produced a small, significant, coefficient in the duration equation of -0.034

(-2.17) and an insignificant coefficient in the elasticity equation.

If the professionalism and sophistication that may come with a larger bargaining unit increases interest in indexation, as our results suggest, this may also influence the wage bargain. Including Plemployee in the wage equation as well produced an insignificant coefficient and left our results unchanged.

Adding the uncertainty variables in the wage equation resulted in coefficients which were not significantly different from zero in either equation.

The selective inclusion of variables in the few instances where significance was achieved was of no real consequence for the arguments presented here.

5 Conclusion

In this paper, we consider the determinants of key provisions of wage contracts such as their duration, their degree of indexation and hence contingent wage adjustment, and their non-contingent and total wage adjustment. We examine a period (1976-2000) long enough to encompass periods of high and low inflation and transitions between inflation regimes that are associated with heightened nominal and real uncertainty. A large number (9646) of contracts are investigated. A particular concern is the theoretically unexpected presence of expected inflation in the contract duration and indexation equations found in many earlier studies. Our more complete model has implications for this conundrum because it justifies the inclusion of non-contingent wage adjustment and the expected rate of inflation in the duration and indexation equations. Using general-to-particular methods, it is then possible to comment on the role of these variables.

The inflation variables, constructed in an internally consistent manner from recursive GARCH procedures, have a critical role to play in this model. Expected inflation continues to have a negative coefficient but it is not significant in the duration equation. The correctly predicted doubling of contract duration comes from the endogenously declining non-contingent wage adjustment. In the elasticity equation, real expected non-contingent wage change has a major role to play, though a small (relative to earlier studies) role remains for the expected rate of inflation. Inflation uncertainty affects contract duration negatively and indexation positively. Real uncertainty reduces both duration and indexation. Contract duration and indexation are substantially interrelated, with more heavily indexed contracts being long and long contracts more likely to be strongly indexed.

It would be surprising if, in light of earlier work based on both micro and aggregate data, unemployment did not influence non-contingent wage adjustment. Yet, elements found in Wage Curve specifications and in the Blanchard and Katz (1999) nesting equation are also present. In particular, the previous-contract real wage has a negative and statistically significant coefficient in the wage equation. The deviation of the natural logarithm of real GDP from a linear trend, which proxies productivity shocks, has a positive and significant coefficient in the wage equation. This equation describes non-contingent wage adjustment well, taking into account current and past indexation provisions, expected inflation, and uncompensated inflation left over from the previous contract. This latter finding provides a propagation mechanism for inflation shocks that entails long lags, given that the average contract duration is over two years. Some evidence was provided that greater inflation uncertainty would reduce the amount of expected inflation built into the current non-contingent adjustment, shifting inflation pass-through into the future through the uncompensated inflation mechanism. Thus, the propagation mechanism becomes longer during more uncertain inflation times.

Our results are more consistent with the theoretical ideas referred to in footnote 1 than those of earlier empirical studies, where all three variables and their interactions were not modelled as a system. While we build on received theory, our study offers some inductive messages to the deduction/induction cycle. To begin with, more complete mechanisms linking contingent and non-contingent wage adjustment, particularly as the latter may emanate from uncompensated past-contract experience, are needed. Hints that the elasticity of indexation may, under certain circumstances, depend on expected inflation appear in Ehrenberg, Danziger and San (1983, 224) and this possibility needs to be explored further. Finally, the fact that inflation appears to feed into wage adjustment in a complex manner, which is itself influenced by the inflation environment, should be of interest to macroeconomists and students of propagation mechanisms generally.

Of course, our inductive messages need to be checked in a number of ways. The recursive GARCH process generating the all-important inflation variables could, in the context of countries where such information is available, be replaced by good survey data. Data from other countries might also be useful if their inflation and contractual provisions differ.

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6 Data Appendix

The following variables were drawn from the HRDC database:

Duration: Difference between expiry and effective date (rounded to the nearest whole month).

Cola: A dummy variable which equals 1 if the contract contains any one of four COLA clause types.

Elasticity: The percentage change of COLA wage adjustment divided by the percentage change in the CPI, over the duration of the contract - at annual rates.

WNC_t: Non-COLA wage change as a percentage - at annual rates.

WC_t: COLA wage change as a percentage - at annual rates.

WT_t: Total wage change as a percentage - at annual rates.

Pelasticity: Elasticity for the previous contract.

Prealwage: The nominal wage rate divided by the CPI at the end of previous agreement.

Industry: Dummy variables generated using the Statistics Canada 1970 Standard Industrial Classification code - Manufacturing is the omitted class.

Region: Atlantic refers to Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick; Prairies refers to Manitoba, Saskatchewan and Alberta: Territories refers to Yukon and North West Territories. Ontario is the omitted class.

Plemployee: The natural logarithm of the number of employees in the previous contract.

The following variables are generated from the GARCH processes:

Expinf: Expected inflation generated, from a recursive GARCH (1,1) process describing the inflation rate. It is the average inflation rate forecast one quarter ahead and at the end of the current contract. It is assigned according to the effective date of the contract. Based on the All Items Consumer Price Index (Statistics Canada P100000 and CANSIM II Series v735739 with 1992=100).

Nomuncert: Inflation uncertainty generated as the one quarter ahead forecast of the conditional variance from a recursive GARCH (1,1) process describing the inflation rate. Assigned according to the effective date.

Realuncert: Real uncertainty generated as the one quarter ahead forecast of the conditional variance from a recursive GARCH (1,1) process describing the growth rate of real GDP (Statistics Canada D15721, with 1992=100). Assigned according to the effective date.

Additional variables that were appended

Rurate: The regional, quarterly, unemployment rate matched by province at settlement date - source Statistics Canada.

Prodshock: Productivity shock measured as the deviation of ln real GDP from a linear trend (Statistics Canada D15721).

7control: Dummy variables that equals unity if the effective date of the contract was in 1978 quarter 1 or 2 or earlier; otherwise equal to zero.

8provcontrol: Dummy variable that equals unity if a relevant provincial contract started during 1982; otherwise equal to zero.

9pubcontrol: Dummy variable that equals unity if a contract fell under federal or provincial controls during the early 1990s - see Swimmer (2000); otherwise equal to zero.

Table 1
Summary Statistics (NO. of Observations = 9646)

Variable	Description	Mean	Std Dev
WNC_t	Non-COLA wage change as a percentage	4.451	4.059
WC_t	COLA wage change as a percentage	0.346	1.277
$WNCWC_t$	Total wage change as a percentage	4.798	4.205
Duration	contract length in month	25.629	11.499
Cola	=1, if a contract contains COLA clause	0.192	0.394
Elasticity	the intensity of indextion	0.075	0.257
E| E>0	conditional elasticity	0.579	0.462
Pcola	=1, if previous contract contains COLA clause	0.206	0.404
Pelasticity	the intensity of indextion for previous contract	0.085	0.269
Pdur	contract duration for previous contract	23.892	9.906
Pnomwage	nominal wage in previous contract	13.308	5.470
Prealwage	real wage in previous contract	15.711	4.801
Plemployee	natural logarithm of employee in previous contract	7.064	0.959
Rurate	quarterly regional unemployment rate	9.361	2.762
Pgdp	detrended real GDP in previous contract	-4.420	18.468
Pdurneg	negotiation duration in previous contract	7.716	5.632
Expinf	expected inflation estimated from GARCH	4.446	3.053
Nomuncert	nominal uncertainty from recursive GARCH	0.350	0.158
Realuncert	real uncertainty from recursive GARCH	1.167	1.175
Natres	dummy variable for natural resource	0.027	0.163
Manuf	dummy variable for manufacture	0.195	0.396
Constr	dummy variable for construction	0.051	0.220
Transp	dummy variable for transportation	0.082	0.274
Commun	dummy variable for communication	0.036	0.186
Utils	dummy variable for untilty	0.028	0.165
Trade	dummy variable for trade	0.042	0.200
Educat	dummy variable for education	0.251	0.434
Health	dummy variable for health care	0.085	0.278
Services	dummy variable for service	0.032	0.176
Others	dummy variable for other sector	0.171	0.377
Mari	dummy variable for Maritime provinces	0.071	0.257
Que	dummy variable for Qubec	0.150	0.358
Ont	dummy variable for Ontario	0.365	0.481
Prarie	dummy variable for Prarie provinces	0.170	0.376
BC	dummy variabe for British Columbia	0.115	0.319
Terri	dummy variable for territories	0.005	0.069
Mprov	dummy variable for muti-provinces	0.124	0.330
7control	dummy variable for wage control in the 70s	0.003	0.005
8pubcontr	dummy variable for wage control in the 80s	0.004	0.065
9pubcontr	dummy variable for wage control in the 90s	0.030	0.175

Table 2
Estimation Results for Simultaneous Equations:
Duration, Elasticity and Non-Contingent Wage Adjustment

Variable	Duration	coeff/se	Elasticity	ceoff/se	WNC	coeff/se
Intercept	33.374	33.410	-0.086	-7.700	4.841	32.890
Duration			0.004	16.960		
Elasticity	1.724	2.610				
WNC	-0.814	-7.870	-0.015	-42.830		
α					0.931	143.090
β					0.087	9.100
Expinf	-0.109	-0.950	0.022	78.170		
Rurate	-0.992	-14.570	-0.005	-11.210	-0.334	-28.220
Pdur/Pelas.	0.328	29.370	0.241	239.480		
Prealwage					-0.054	-8.900
Natres	-0.528	-0.850	-0.006	-1.670	0.082	0.660
Constr	-2.128	-3.560	-0.073	-13.510	0.401	2.950
Transp	-1.297	-2.890	-0.047	-13.770	-0.328	-2.940
Commun	-2.470	-4.410	-0.047	-9.160	-0.273	-2.220
Utils	-3.815	-5.940	-0.050	-8.450	-0.586	-3.590
Trade	-0.552	-0.980	-0.088	-18.260	-0.358	-2.990
Educat	-6.828	-17.560	-0.059	-20.510	-0.416	-5.350
Health	-3.894	-8.540	-0.064	-18.770	-0.099	-1.100
Services	-2.048	-2.740	-0.080	-13.930	-0.687	-4.270
Others	-4.775	-11.380	-0.070	-20.380	-0.377	-4.230
Atlantic	9.221	17.390	-0.005	-1.170	1.427	12.440
Quebec	6.400	17.030	0.022	7.180	0.861	10.040
Prairie	0.121	0.360	-0.019	-7.160	-0.733	-10.960
BC	4.182	11.440	-0.023	-8.180	0.456	6.210
Terri	2.501	1.340	0.014	1.010	0.325	0.850
Mprov	2.025	4.700	-0.021	-6.510	0.181	1.840
Plemployee	-0.035	-0.310	0.007	9.520		
Nomuncert	-1.690	-2.440	0.010	1.970		
Realuncert	-0.331	-2.710	-0.007	-12.600		
Prodshock					0.026	19.960
7control					-2.134	-6.7
8provcontrol					0.766	1.97
9pubcontrol					-0.812	-4.46

Figure 1
Actual Duration (Right Scale), Elasticity and Non-Contigent Wage Adjustment (Left Scale)

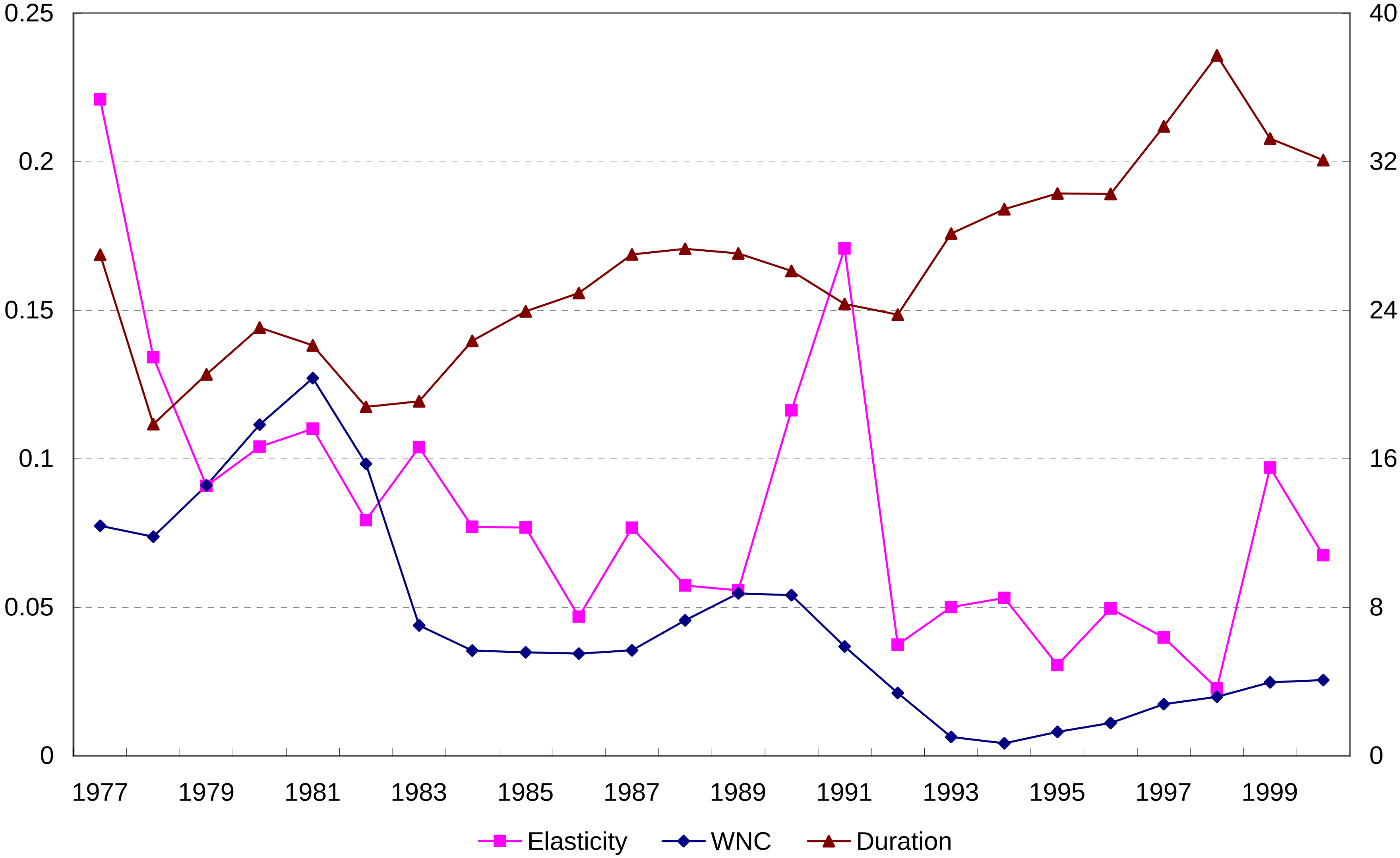


Figure 2
Unemployment Rate, Actual and Expected Inflation and Wage Adjustment

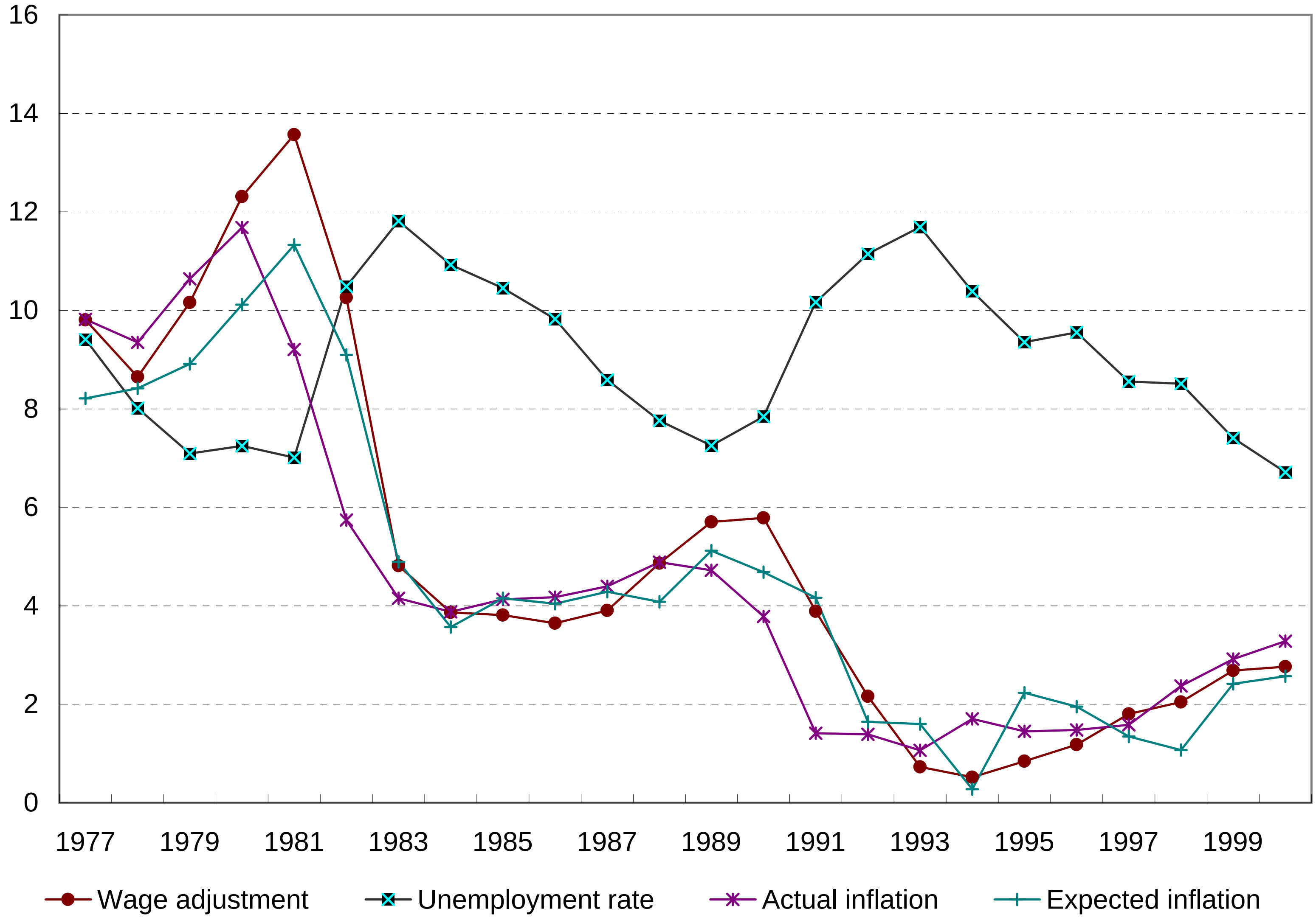


Figure 3
Resursive GARCH Estimation of Nominal and Real Uncertainty

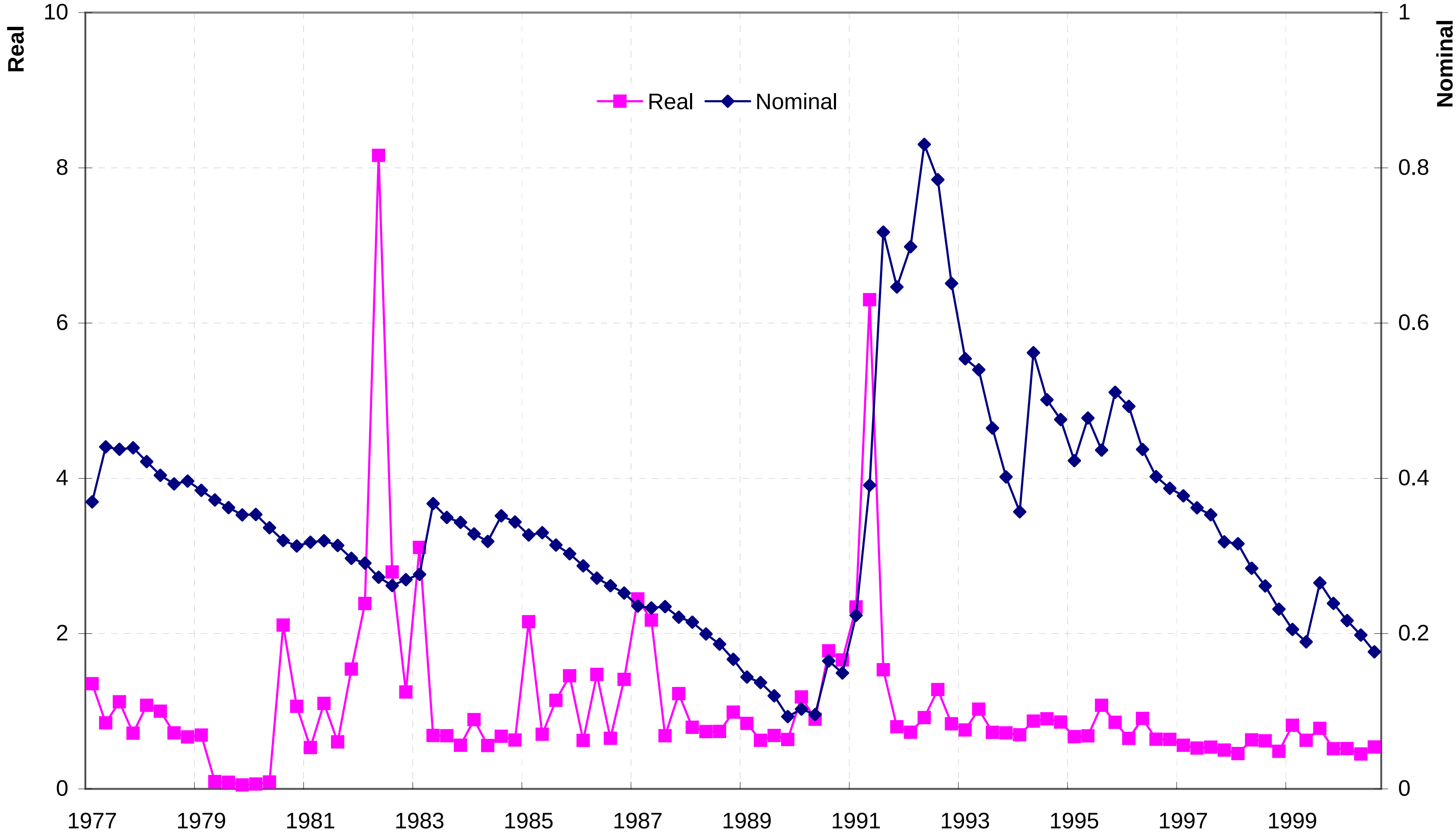
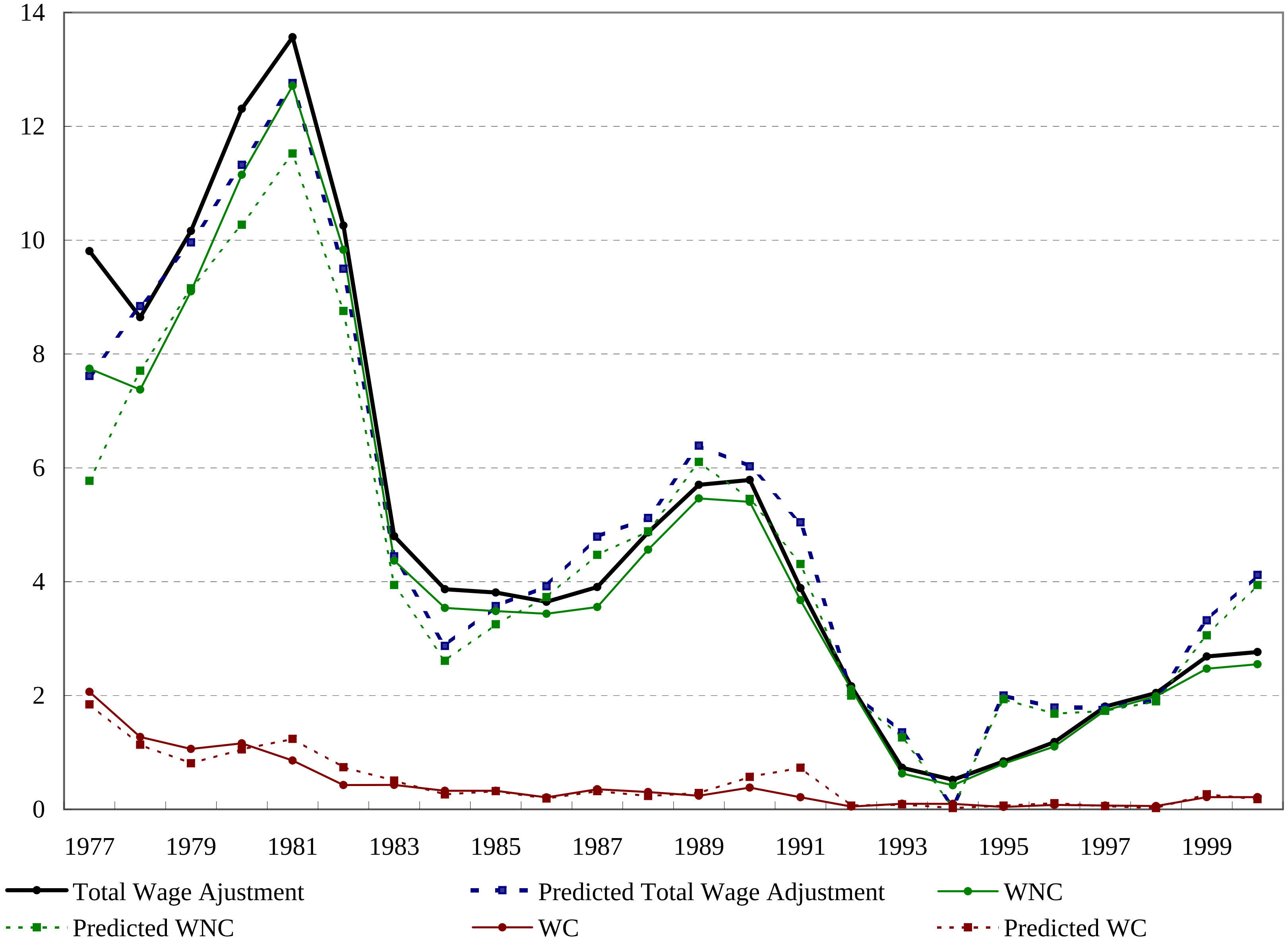


Figure 4
Actual and Predicted Value of Contingent, Non-Contingent and Total Wage Adjustment



Appendix Table A1
Single Equation Estimates for Duration, Indexation and Nominal Wage Adjustment

	Duration	(OLS)	Elasticity	(Tobit)	WNC (Nonlinear OLS)	
Variable	**coefficient**	**coeff/se**	**coefficient**	**coeff/se**	**coefficient**	**coeff/se**
Intercept	31.494	30.700	-1.376	-10.220	4.996	35.340
Duration			0.015	12.180		
Elasticity	2.666	6.280				
WNC	-0.337	-7.610	-0.100	-16.830		
α					0.899	150.250
β					0.127	14.110
Expinf	-0.550	-9.210	0.142	20.120		
Urate	-0.815	-13.900	-0.064	-7.580	-0.337	-29.220
Pdur/Pelas	0.325	28.950	1.019	28.620		
Prealwage					-0.057	-9.490
Natres	-0.421	-0.670	-0.027	-0.440	0.089	0.760
Constr	-2.068	-4.150	-0.342	-4.800	0.419	3.200
Transp	-1.144	-2.550	-0.139	-2.520	-0.320	-2.980
Commun	-2.451	-4.150	-0.178	-2.320	-0.267	-2.220
Utils	-3.585	-5.670	-0.215	-2.740	-0.574	-3.590
Trade	-0.487	-0.910	-0.504	-6.260	-0.335	-3.040
Educat	-6.643	-20.580	-0.333	-8.460	-0.390	-5.490
Health	-3.954	-9.360	-0.391	-6.840	-0.092	-1.120
Services	-1.904	-3.200	-0.540	-5.280	-0.678	-5.210
Other	-4.651	-13.120	-0.391	-8.400	-0.328	-3.930
Atlantic	8.373	15.910	0.108	1.430	1.445	12.990
Que	6.007	16.230	0.234	4.890	0.860	10.420
Prairie	0.426	1.450	-0.094	-2.280	-0.733	-11.090
BC	3.930	11.020	-0.110	-2.100	0.474	6.670
Terri	2.488	1.760	0.168	0.960	0.337	0.960
Mprov	1.918	4.970	-0.152	-2.650	0.195	2.050
Lpemploye	-0.016	-0.140	0.067	4.550		
Nomuncert	-1.936	-2.820	0.148	1.480		
Realuncert	-0.392	-4.350	-0.044	-4.140		
Prodshock					0.027	21.050
7control					-2.147	-6.610
8provcontr					0.689	1.830
9pubcontr					-0.946	-5.580

Appendix Table A2
Decomposition of Tobit Results for Elasticity

	Coefficient	Marginal Effect	Intensity Effect	Incidence Effect	Elasticity Effect	Probability Effect
Intercept	-1.3764	-0.126	-0.0207	-0.1053	-0.2263	-0.328
Duration	0.0154	0.0014	0.0002	0.0012	0.0025	0.0037
WNC	-0.0997	-0.0091	-0.0015	-0.0076	-0.0164	-0.0238
Expinf	0.1419	0.013	0.0021	0.0109	0.0233	0.0338
Rurate	-0.0644	-0.0059	-0.001	-0.0049	-0.0106	-0.0153
Pelasticity	1.0191	0.0933	0.0153	0.0779	0.1675	0.2428
Natres	-0.0272	-0.0025	-0.0004	-0.0021	-0.0045	-0.0065
Constr	-0.3417	-0.0313	-0.0051	-0.0261	-0.0562	-0.0814
Transp	-0.1392	-0.0127	-0.0021	-0.0106	-0.0229	-0.0332
Commun	-0.1781	-0.0163	-0.0027	-0.0136	-0.0293	-0.0424
Utils	-0.2153	-0.0197	-0.0032	-0.0165	-0.0354	-0.0513
Trade	-0.5035	-0.0461	-0.0076	-0.0385	-0.0828	-0.12
Educat	-0.3329	-0.0305	-0.005	-0.0255	-0.0547	-0.0793
Health	-0.3912	-0.0358	-0.0059	-0.0299	-0.0643	-0.0932
Services	-0.5397	-0.0494	-0.0081	-0.0413	-0.0887	-0.1286
Other	-0.3905	-0.0357	-0.0059	-0.0299	-0.0642	-0.093
Atlantic	0.1084	0.0099	0.0016	0.0083	0.0178	0.0258
Que	0.2343	0.0214	0.0035	0.0179	0.0385	0.0558
Prairie	-0.0935	-0.0086	-0.0014	-0.0072	-0.0154	-0.0223
BC	-0.1101	-0.0101	-0.0017	-0.0084	-0.0181	-0.0262
Terri	0.1681	0.0154	0.0025	0.0129	0.0276	0.0401
Mprov	-0.1524	-0.0139	-0.0023	-0.0117	-0.0251	-0.0363
Lpemploye	0.0665	0.0061	0.001	0.0051	0.0109	0.0158
Nomuncert	0.1483	0.0136	0.0022	0.0113	0.0244	0.0353
Realuncert	-0.0436	-0.004	-0.0007	-0.0033	-0.0072	-0.0104
$F(\bar{z})^a$	0.0915					
$f(\bar{z})^b$	0.1644					
E(Elasticity)[c]	0.0294					
E(Elasticity*)	0.321					

[a] F is the cumulative standard normal density function evaluated at $\bar{z} = \bar{x}\hat{\beta} / \hat{\sigma}$

[b] f is the standard normal probability density function.

[c] Mean of estimated unconditional elasticity; E(Elasticity*) is the mean of the conditional variable.

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