REAL WAGE CHRONOLOGIES

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Abstract

We process information in a large number of wage contracts, signed over a period of several decades, to generate the long-run history of the real wage for each bargaining pair. We term these hitherto unexamined histories 'chronologies'. We are able to generate 1574 continuous real wage chronologies and we examine the evolution of the real wage in each case. We explore the influence of productivity growth, the industrial relations record of the pair, the influence of industry and region as well as the initial wage on the growth of the real wage rate over the decades in the sample. We conclude that these economically important forces can be statistically discerned in the wage chronologies.

JEL Code: E31, J41, J50.

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1 Introduction

For well over three decades now, economists have explored the unique and detailed information contained in wage contracts in order to take into account important institutional features of labour markets and in order to better understand how these important markets behave. The studies of Hamermesh (1970) and Sparks and Wilton (1971) pioneered the econometric exploration of US and Canadian collective bargaining agreements (respectively). Riddell (1979) is also in this tradition. With time, these explorations became broader and began to cover other provisions of wage contracts such as (i) the incidence and intensity of wage indexation issues, in *inter alia* Ehrenberg, Danziger and San (1983, 1984), Card (1983, 1986), and Hendricks and Kahn (1983) and (ii) the duration of wage contracts, in *inter alia* Christofides and Wilton (1983), Vroman (1989), Murphy (1992, 2000), and Rich and Tracy (2004). These are but a few examples of papers that deal with the major provisions of contracts, some addressing several features at the same time and, more recent ones, venturing into hitherto underappreciated aspects of collective bargaining - e.g. Hendricks and Kahn (1986), Cramton and Tracy (1992), Fortin (1996), Gu and Kuhn (1998), and Danziger and Neuman (2005).

Because the focus in these papers has been the information in collective bargaining agreements available in unbalanced panels over relatively short periods of time, these studies have overlooked a potentially informative aspect of the data which derives from the fact that the entire history of the collective bargaining agreements reached by a pair (a firm and a particular union) may be available over a very long period of time. It is, therefore, possible to see how important contract provisions *for a given pair* evolve over a matter of

decades.

To be sure, the concepts of unexpected and uncompensated inflation, in the sub-literature synthesized in Christofides (1987), for example, require that contracts be connected so that information from the previous contract can be allowed to influence the terms of the current agreement. However, this connection is between consecutive contracts only. Also, the examination in Christofides and Wilton (1985) of a possible wage 'explosion' in the aftermath of wage controls relied on linking contracts under controls with those signed by the same pair in the aftermath of controls. Finally, the papers on hold-out pay particular attention to issues of timing between contracts. However, the entire contractual history for each pair can be linked together, revealing how important contract provisions change through time. The length of this history is limited only by the available sample length and by possible breaks in the relationship between pairs. It is therefore possible to speak of the 'chronologies' of contract provisions. Important provisions in contracts such as the real wage, contract duration and the elasticity of indexation can be traced out at the pair level through these chronologies. A number of questions that do not emerge naturally when the focus is individual contracts can be posed and answered. For instance, a real wage chronology would show how the real wage agreed to by a pair has evolved through long periods of time, whether it has grown secularly to reflect productivity growth, whether it depends on the industrial relations history of the pair, whether it differs from those agreed to by 'comparable' pairs and, if so, whether it ultimately converges to them. Chronologies could examine *at the pair level* whether secular increases in contract duration, which might render the macroeconomy

less flexible, are pervasive - Christofides and Peng (2006) show that the average duration of contracts that became effective in each year has doubled between 1980 and 2000. A similar approach can deal with wage indexation issues and the apparent decline of indexation through time also noted in the above reference, a tendency that would work towards increasing real wage flexibility.

In this paper, we explore a particular long run feature of wage contracts, focussing on real wage chronologies. In section 2, the data used and the concept of a real wage chronology, as it derives from the contract data, are discussed; features of the derived chronologies are also examined. In section 3, the method used to examine these chronologies econometrically is presented and the results obtained are discussed in section 4. Conclusions appear in section 5.

2 Contract Data and the Wage Chronologies

The contract data used for this study is constructed from electronic records provided by Human Resources Development Canada (HRDC), as it was known when the data were released to us. This is the agency in charge of industrial relations in Canada. The data base contains information on 11885 contracts signed between 1976 and 2000 by firms which employ 500 or more employees. Each contract contains a unique identifier which allows us to string together all agreements signed by the same pair. In order to ensure the continuity needed in the chronologies, only contracts with an uninterrupted history are included in the analysis, leaving 8928 contracts

available for analysis - construction contracts are also excluded because they were not part of the data until 1984. The HRDC data contain information on a number of variables, including the settlement, effective and expiry dates of the contract, the number of employees that it covers, the industry and region that it is located in, and the nominal base wage (including 'fold-ins' generated by the cost of living allowance clause (COLA) if any) at the end of the previous contract *pexpwage*. Information in the current contract makes it possible to generate the annual nominal wage percentage change (including COLA generated increases) $\dot{w}$ and the duration of the contract measured as the difference between the expiry date and the effective date of the current contract, *Duration*, in months. The nominal wage level at the expiry date of the current contract may then be calculated as $expwage = pexpwage + (pexpwage \times (\dot{w}/100) \times (Duration/12)))$.

The nominal wage rates *pexpwage* and *expwage* are then converted into real terms using the values of the consumer price index at the expiry date of the previous contract (in most cases this is equal to the effective date of the current contract) and the expiry date of the current contract. Thus, the real wage level at the beginning and at the end of each contract are calculated in this way. Descriptive statistics on the variables used, by contract, are presented in Table 1. Duration is shown to have a mean of 25.41 months and a standard deviation of 11.62 months. The average nominal wage at the end of previous contracts is \$12.66 with a standard deviation of \$4.55; at the end of contracts, the average nominal wage is slightly higher at \$13.69 with a standard deviation of \$4.57. The average real wage at the expiry date of previous and current contracts is 15.13 and 15.24 respectively with standard

Table 1
Summary Statistics Based on the Number of Contracts (NOBS 8928)

Variable	Definition	Mean	St. Dev.
Pexpwage	Nominal Wage at Expiry of Previous Contract	12.66	4.55
Expwage	Nominal Wage at Expiry of Current Contract	13.69	4.57
Rpexpwage	Real Wage at Expiry of Previous Contract	15.13	3.99
Rexpwage	Real Wage at Expiry of Current Contract	15.24	4.00
Duration	Length of the Contract (Months)	25.41	11.62
W dot	Nominal Wage Adjustment (Annual %)	4.85	4.26
Nat. Res.	Natural Resouce Sector	0.03	0.17
Manufact.	Manufacturing Sector	0.20	0.40
Transport	Transportation Sector	0.09	0.28
Commun.	Communication Sector	0.04	0.19
Utilities	Utility Sector	0.03	0.17
Trade	Trade Sector	0.04	0.21
Education	Education Sector	0.27	0.44
Health	Health Sector	0.09	0.29
Service	Service Sector	0.03	0.18
Others	Other Sectors	0.18	0.38
Atlantic	Atlantic Region	0.07	0.25
Quebec	Quebec	0.16	0.36
Ontario	Ontario	0.35	0.48
Prairies	Prairie Region	0.17	0.38
BC	British Columbia	0.12	0.32
Territories	Territories	0.00	0.07
Multi Prov.	Muti-province Contract	0.13	0.34

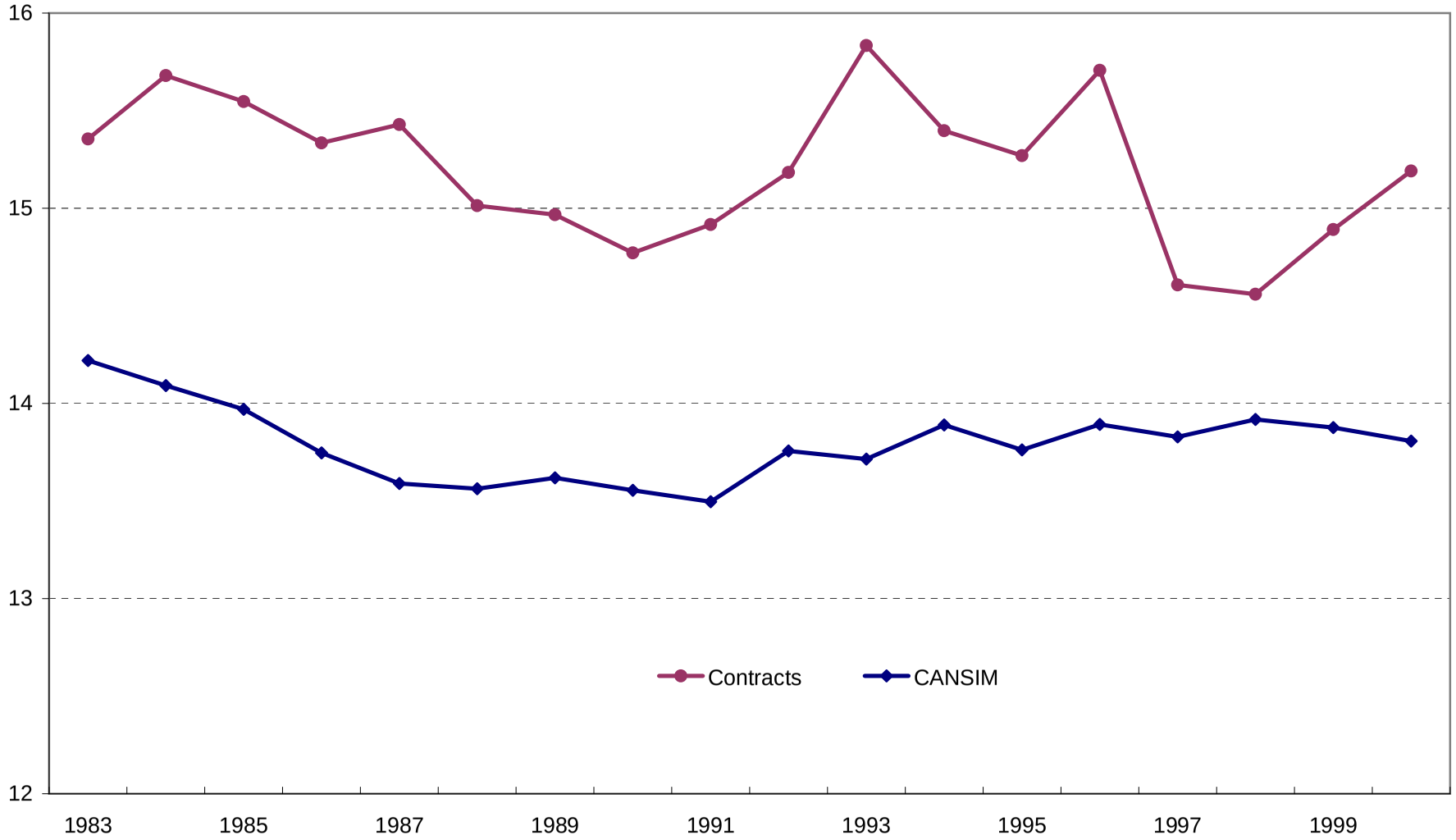
deviations of 3.99 and 4.00 respectively. The average annual increase in the overall (including COLA) nominal wage rate is 4.85% with a standard deviation of 4.26. Figure 1 shows the real hourly contract wage calculated over all contracts whose effective date falls in a particular year. For comparison purposes, Figure 1 also shows real hourly earnings[1] from 1983 to 2000 - the period over which the latter series is available. The contract real wage series is higher and more volatile, especially during the 1990s. The relative position of the two series is not surprising given that contract wages come from large firms in the unionized sector. The greater volatility of the contract series reflects the turbulent period of industrial relations in the public (provincial and federal) sector during the period 1991 -1996, a period during which active wage control policies were pursued. In addition, the contract series is more likely to reflect idiosyncratic forces which average out in the aggregate. Both series in Figure 1 show the remarkable stability in the unconditional real wage through time. Apparently, there has been no perceptible real wage growth over this period and, indeed, both series are below their starting values by the end of the period. One issue that is explored below is whether productivity gains have influenced wage growth during this period.

The HRDC data base includes a regional identification code and 3-digit SIC code which allow us to create seven regional dummy variables (Atlantic, Quebec, Ontario, Prairie, British Columbia, Territories and Multi-province[2]) and ten industrial dummy variables (Natural Resources, Manufacturing, Transportation, Communication, Utilities, Trade, Education, Health,

[1] Hourly earnings are the CANSIM montly series V255025. They have been converted into real terms using the CPI index (P100000) and have been averaged by year.

[2] Certain contracts cover more than one province and are thus multi-regional.

Figure 1
Hourly Real Wages From Contracts and Earnings From CANSIM



Services and Others) that categorize each contract. Table 1 shows that most contracts are in Education (27%), followed by Manufacturing (20%), and in Ontario (35%). Figures 2 and 3 show the hourly real contract wage calculated over all contracts, whose effective date falls in a particular year, by SIC (Figure 2) and by region (Figure 3). As in the case of Figure 1, a striking feature of Figures 2 and 3 is the remarkable flatness of the series for each industry and region. However, more features of interest are apparent at the industry and regional levels. In Figure 2, remarkably stable inter-industry wage differentials are apparent over this two-decade period. Services generally have the lowest real wage while contracts in Education, Natural Resources, Transportation and Manufacturing tend to have the highest real wages. This ranking is consistent with the one in data from the 1986 Labour Market Activity Survey of Canada established by Gera and Grenier (1994).[3] Figure 3 shows similar information to that in Figure 2 but on a regional basis. Contracts in the Atlantic provinces have the lowest real wages during most of

[3]There is a widespread view that industry effects, which are significant in individual wage functions, cannot be easily explained by classical competitive theories of wage determination (see Slichter (1950), Thurow (1976), Wachtel and Betsey (1972) and Cain (1976)). Studies of wage determination based on human capital and mobility frictions typically leave substantial unexplained inter-industry or inter-firm wage differentials - see Dickens and Katz (1987) and Krueger and Summers (1988). Helwege (1992) shows that those differentials are not highly positively correlated with subsequent employment growth, as one could expect if they resulted from mobility frictions. Gibbons and Katz (1992) investigate the possibility that differentials are explained by unmeasured ability differences but do not have encouraging results. The more recent study by Walsh (1999) shows that the efficiency wage model can only explain a small fraction of the wage differentials that prevail accross industries.

Figure 2
Annual Average Hourly Real Wage by Industry From Contracts

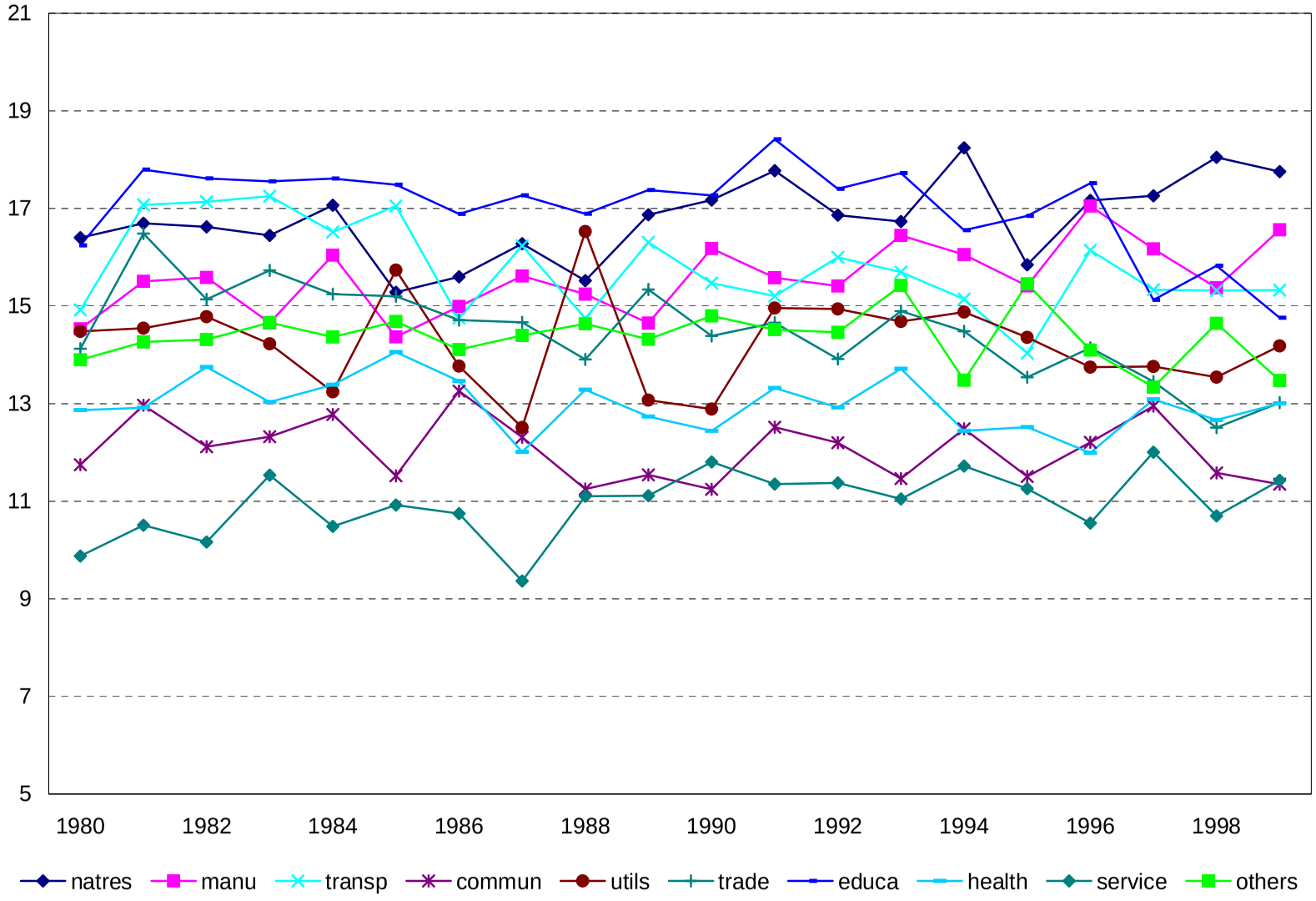
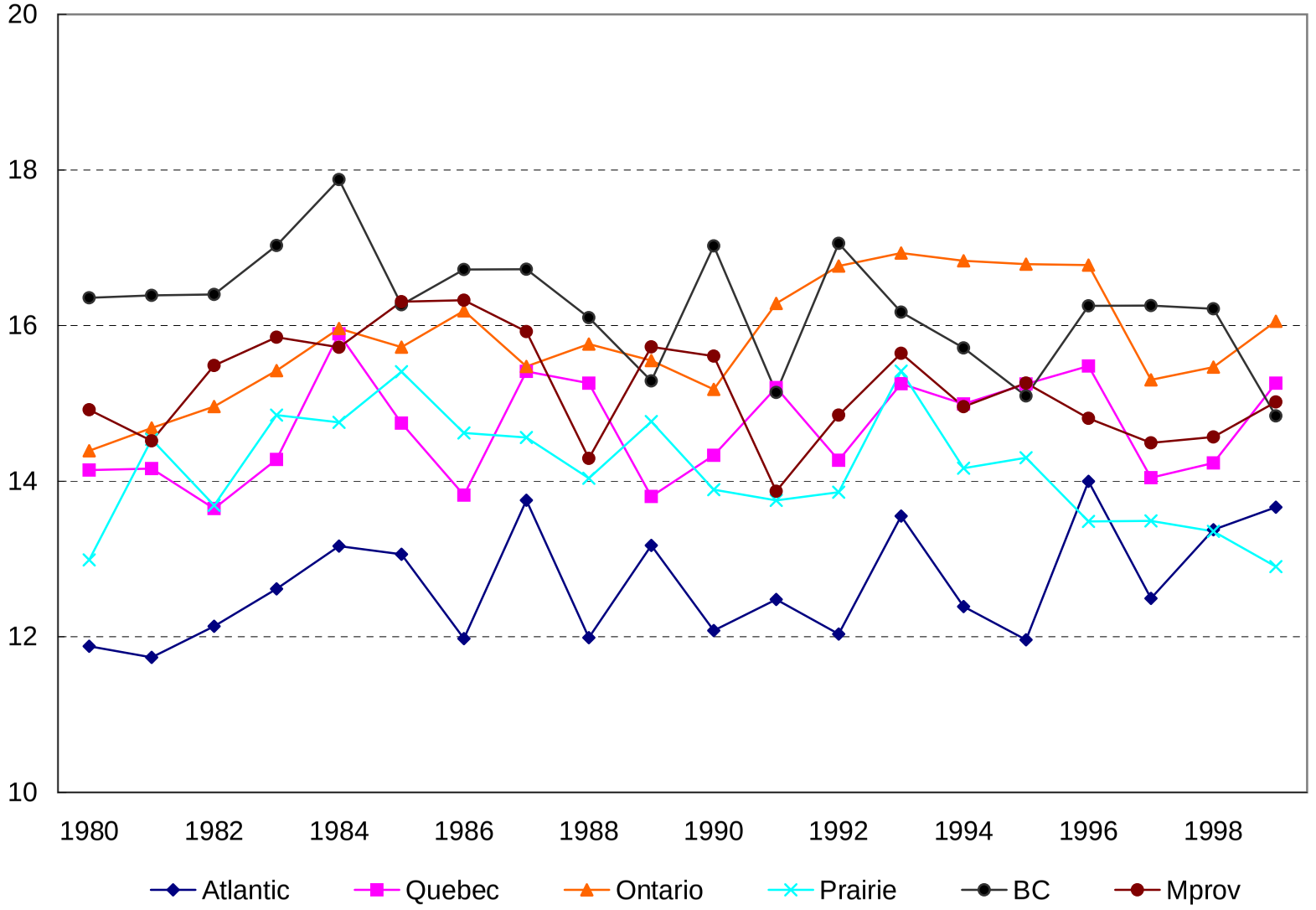


Figure 3
Annual Average Hourly Real Wage by Region From Contracts

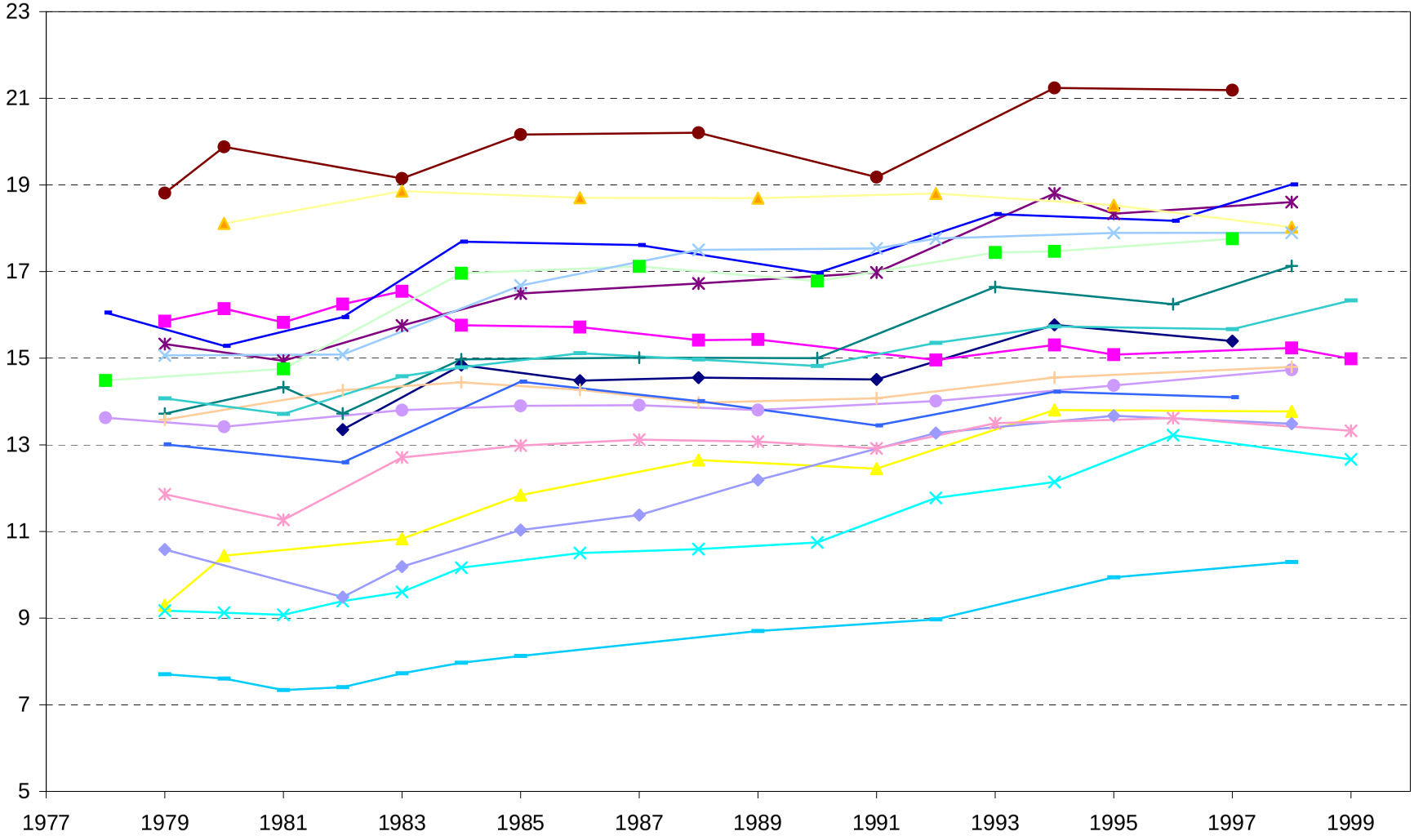


this period while contracts in British Columbia and Ontario have the highest real wages - note that a common price index has been used to deflate across regions. Again, this ranking is consistent with stylized facts about regional disparities in Canada over the period studied. In the empirical work below we take into account possible industry and region effects. There is slight visual evidence of some convergence in the series of Figure 3, a general issue to which we return below.

The key innovation in this paper is arranging the contract data into pair-based chronologies. This is achieved by sorting the contracts using the unique identifier for each pair. Overall, 1574 unique chronologies can be created. The longest chronology involves as many as 19 renewals and spans a horizon of 24 years. Figure 4 presents the 17 longest real wage chronologies in Manufacturing. Each line shows the real wage history embodied in the contracts signed by a particular pair. For instance, the top line joining the circles shows that this particular pair agreed to the highest sequence of real wages among all the chronologies shown. The first dot shows the beginning-of-contract (i.e. *pexpwage*) real wage for a one-year agreement that became effective in 1979 and the next dot its end-of-contract real wage (i.e. *expwage*); the latter is higher than the former, indicating that there was real wage growth during this contract. The end-of-contract real wage is also the (prior to the) beginning-of-contract wage for the next agreement which became effective in 1980 and lasted until 1983. This second contract entailed a reduction in the real wage rate. This may have occurred despite increases in the nominal wage rate if, as was likely, inflation was unexpectedly strong during this contract.[4]

[4]The incidence and extent of nominal and real wage decreases in this data is investigated

Figure 4
The Longest Contract Chronologies in the Manufacturing Sector



The third contract in the sequence begun in 1983; it was a two-year contract, and did entail real wage growth. The particular chronology discussed shows the changing pattern of contract duration for the pair involved and follows a slight upward trajectory. This is generally true of the other chronologies shown in Figure 4. There is considerable difference in the real wages paid by the top and bottom chronologies; in the case of Figure 4, this difference is more than ten real dollars per hour. This is noteworthy given that, in both cases, the real wage shown is the base wage for firms in manufacturing, albeit not necessarily firms of the same size and not necessarily paid to workers with similar skills who are represented by the same unions. It should be noted that this difference remains even if we confine Figure 4 to Ontario, thereby reducing (but not necessarily eliminating) an important part of regional disparities. A final feature of Figure 4 is that not all chronologies begin or end at the same time.

For some purposes, it is useful to have common starting and ending points for these chronologies. For instance, any discussion of the influence of the initial wage and convergence would be facilitated if this condition were satisfied. With this in mind, we selected a fixed window of 22 years, from 1980 to 2001, and discarded the modest amount of information outside this window. When a chronology is incomplete, either at the start or at the end of the window, we use information in the extant chronology to complete it. More precisely, we calculate the average annual growth rate 'Grate' $Grate_i = (ln\ w_{Ti} - ln\ w_{0i}) \ / \ T$ over the entire extant chronology of length T and use this to compute the starting (1980) level of the real wage; w_{Ti} indicates the

in Christofides and Stengos (2003).

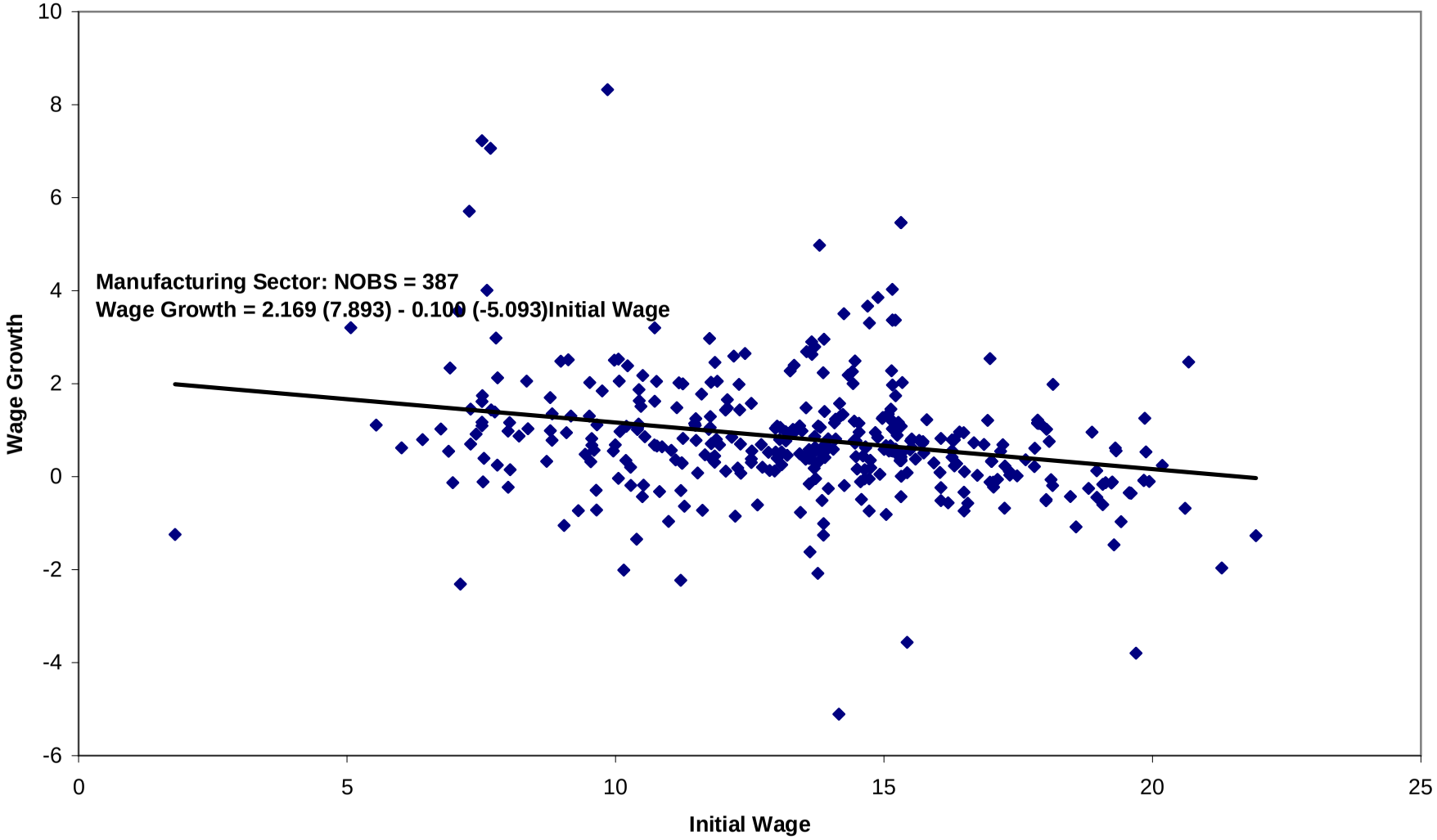
expiry wage *expwage* at the end of the last contract and w_{0i} the initial wage *pexpwage* at the beginning of the first contract in the chronology. The resulting information is used in Figure 5 to illustrate how the values of Grate in the 387 chronologies in Manufacturing relate to the logarithm of the initial wage in the respective chronology. A negative relationship, statistically significant at the 1% level, is suggested - figures in brackets are t-statistics. We return to this issue in the empirical section below.

Table 2 shows descriptive statistics on important variables based on the set of 1574 chronologies. The average value of Grate is 0.0032, suggesting that the very flat profile of the illustrative chronologies in Figure 4 is more broadly representative. The standard deviation of Grate is 0.0136. The average value of the real wage rate *at the start* of the historical chronologies is 14.43 real dollars[5] with a standard deviation of 3.94. When the historical chronologies are completed back to 1980 (where this is necessary), the average value of the real wage in 1980 is 14.62 with a standard deviation of 4.7.[6] The closeness of the figures in rows 2 and 3 of Table 2 suggests that the historical and completed chronologies are not very different. This, despite the fact that the completed average length of the chronologies over this window is 12.01 years. The number of renewals in the historical chronologies is, on average,

[5]Note that this number is lower than the figure of 15.13 real dollars reported, in the contract-based Table 1, as the average real wage at the expiry of the previous contract because it is calculated at an earlier point in time.

[6]The fact that the 1980 average real wage of the completed chronologies exceeds the average real wage at the start of chronologies (row, 3 versus row 2 in Table 2) suggests that the real wage chronologies that have had to be projected back to 1980 entailed higher than average real wages.

Figure 5
Scatter Plot of Chronology Wage Growth on Initial Wage (Manufacturing Sector)



5.67 with a standard deviation of 3.93. Regarding industries and regions, 25 percent of all chronologies are from the manufacturing sector and 33 percent of them are from Ontario.

A variable that has an important long-run role in the wage determination process is productivity growth. The variable 'Prod' is is defined as the annual growth rate of an index of labour productivity over the length of each historical chronology. It was generated from Statistics Canada Table 383-0005 and was attached to the HRDC database using the three-digit SIC code and the effective date of the contract. Prod has a mean of 0.0171 and a standard deviation of 0.0183 over the chronologies in the sample - Table 2. While this average annual growth rate is modest, it would, over the two decades studied, justify a noticeable increase in the real wage rate. We examine whether what is apparently not evident in the averages plotted in Figures 2 and 3 can be a significant statistical force at the individual chronology level.

Another variable that may condition real wage outcomes in the long run is the professionalism and effectiveness of the industrial relations practices followed by the bargaining pair. These practices are not exercised in a vacuum but, rather, reflect the economic environment that the pair operates within. A variable that may capture both aspects is the duration of negotiations between the pair *Durneg* leading up to the agreed upon contracts that make up the chronologies. In the HRDC data, this variable is measured as the length of time between the official notice to bargain and the settlement date for the contract. It has a mean of 8.18 months and a standard deviation of 4.37 months - Table 2. Cramton and Tracy (1992, 1994) suggest that holdout, which is intimately related to *Durneg*, entails loss of productive efficiency

Table 2
Summary Statistics Based on Real Wage Chronologies (NOBS 1574)

Variable	Definition	Mean	St. Dev.
Grate	Real Wage Growth Rate (Annual, Fraction)	0.0032	0.0136
W_0	Real Wage at the Start of Chronologies	14.43	3.94
$W_{0\text{ - Projected}}$	Real Wage Projected to 1980	14.62	4.70
$W_{0\text{ - Instrument}}$	Real Wage Projected to 1980 - instrument	14.62	3.29
Length	Length of Chronology (Years)	12.01	7.20
Count	Number of Contract Renewals	5.67	3.93
Durneg	Duration of Negotiations	8.18	4.37
Pdurneg	Duration of Negotiations of Previous Contract	7.74	4.05
Nat. Res.	Natural Resouce Sector	0.04	0.19
Manufact.	Manufacturing Sector	0.25	0.43
Transport	Transportation Sector	0.11	0.31
Commun.	Communication Sector	0.04	0.20
Utilities	Utility Sector	0.02	0.16
Trade	Trade Sector	0.06	0.24
Education	Education Sector	0.19	0.39
Health	Health Sector	0.10	0.31
Service	Service Sector	0.04	0.21
Others	Other Sectors	0.14	0.34
Atlantic	Atlantic Region	0.06	0.24
Quebec	Quebec	0.19	0.39
Ontario	Ontario	0.33	0.47
Prairies	Prairie Region	0.14	0.35
BC	British Columbia	0.12	0.32
Territories	Territories	0.00	0.07
Multi Prov.	Muti-province Contract	0.15	0.35
Prod	Labour Productivity Growth	0.0171	0.0183

which may then be reflected in wage growth. In a number of games, the pie gets smaller with delays in reaching agreement. We, therefore, take account of this variable in the empirical work below.

We also report, in rows 2 and 4 of Table 3, an alternative initial real wage and the average value of the duration of negotiations in the previous contract *Pdurneg*. These variables are used to deal with possible endogeneities in the regression analysis that follows - see the next section. For the moment, we note that, though they are independent of current-contract notions, they are close (in terms of descriptive statistics) to the variables that they will instrument.

3 Methodology

Having introduced the concept of the wage chronology and having traced out 1574 such chronologies in various industries and regions, we turn to an econometric analysis of the determinants of the annual rate of real wage growth, *Grate*, implied in each chronology. As already noted, this rate is established for each chronology over its life, a life that may be shorter than the 22-year window between 1980-2001. We control for industry and region effects but also explore the influence of the other variables mentioned above, namely the average (over the chronology) annual rate of productivity growth *Prod* and the average (over the chronology) duration of negotiations embarked on by the pair *Durneg*. When the influence of the initial real wage is also taken into account, this wage is normalized at its 1980 value. In the case of incomplete chronologies, *Grate* is used to project the earliest available real

wage backwards to 1980 and, in light of this, *Grate* remains the appropriate regressand.

The forces of wage arbitrage and convergence would imply a negative relation between *Grate* and the initial real wage lnW_0. However, measurement of this process could be complicated by unobservables. If, for example, the forces of managerial dynamism that make for sustained growth over time (such that *Grate* defined over the entire chronology is high) also imply conservative wage setting preferences on the part of the firm, the initial wage might also be unusually low. Thus, the initial wage when it is included as a regressor may be negatively correlated with the equation error term; if so, the estimator of the coefficient on lnW_0 will be biased. In order to avoid this possibility, we instrument (using Two Stage Least Squares) the initial 1980 wage for each chronology using a relevant average of starting wages which *excludes the own wage* for each particular chronology. This average is calculated at the detailed three-digit industry level (rather than the more aggregate level used in the regressions) and for the province (rather than the more aggregate region used in the regressions) within which each particular chronology is located - see row 4, Table 2. Its natural logarithm is used to instrument the natural logarithm of the initial real wage lnW_0.

A similar complication may arise with respect to *Durneg*. If, for instance, large settlements that are due to unobservables take longer to negotiate, then the error term may be positively related to *Durneg*, leading to bias in the estimation of its coefficient. The potential problem here may not be severe: An unobservable that makes for a high wage settlement may not always involve long negotiations if it is acknowledged by both sides of

the bargain. In addition, in the regressions that follow, $Durneg$ is defined as an average over all the contracts signed by the pair in each chronology, thereby weakening the endogeneity mechanism. Nevertheless, we explore two robustness procedures: First, we proxy the industrial relations context within which the bargaining pair works with the previous-contract duration of negotiations ($Pdurneg$), see row 8, Table 2 for descriptive statistics. In an alternative approach, we treat $Pdurneg$ as an instrument, in which case the predicted values for $Durneg$ and lnW_0 in Two-Stage-Least Squares are constructed from all exogenous variables as well as the two instruments. These specifications are explored in the appendix Table A1. All estimation is carried out with SAS.

In all cases, the average number of employees in each chronology is used to weight the data for each chronology.

4 Empirical Results

Table 3 contains the estimates obtained. Results I-III refer to weighted OLS regressions where the possible endogeneity of lnW_0 is not taken into account. Result I reports the regression of $Grate$ on an intercept, $Prod$ and $Durneg$ only. $Prod$ has the expected positive coefficient and it is significantly different from zero at the 1% level. $Durneg$ has a negative coefficient which is significantly different from zero at the 1% level. When the logarithm of the initial wage is added, in Result II, the estimates on the coefficients of $Prod$ and $Durneg$ are not substantially altered and the initial wage has a negative coefficient which is significantly different from zero at the 1% level. The

negative coefficient suggests some degree of convergence in that chronologies with large values of their initial 1980 real wage tend to be associated with low values of *Grate*. Industry effects (Manufacturing is the omitted class) and region effects (Multi-province contracts are the omitted class) are added in Result III. The coefficients for these effects are generally significantly different from zero at the 1% level. The estimated industry effects are consistent with the location of the profiles in Figure 2 and the results in Gera and Grenier (1994). This suggests that the stylized facts on inter-industry differentials apply to base wage rates as well and, indeed (given that the regressand is wage growth), the stylised facts may become stronger through time. The estimated region effects are consistent with generally held views on regional income differences and growth patters during this period; for instance, realizing that comparisons are made indirectly through the omitted class of multi-province chronologies, Ontario chronologies have relatively high growth and those in the Atlantic provinces, Quebec and the Prairies relatively low growth, suggesting that regional differences in base wage rates may increase.

The instrumental variable estimates appear in Results IV and V. Result IV, which excludes the industry and region effects, is quite similar to Result II, the main difference being the reduced t value for the coefficient on the instrumented initial wage, which nevertheless continues (at -10.56) to indicate that the logarithm of the initial wage has a coefficient which is significantly different from zero at the 1% level. Result V is analogous to Result III and generally similar except that chronologies in the Atlantic, Quebec and Prairie regions do not now have significantly lower growth than chronologies

Table 3
Weighted Regression of Long Run Chronology Real Wage Growth

Result	I		II		III		IV		V	
Variable	coeff	t stat	coeff	t stat	coeff	t stat	coeff	t stat	coeff	t stat
Intercept	0.0037	5.64	0.0492	24.11	0.0624	26.00	0.0442	11.4	0.0544	8.62
Prod	0.0626	3.53	0.0867	5.65	0.0530	3.21	0.0840	5.43	0.0506	3.04
Durneg	-0.0004	-8.06	-0.0003	-5.97	-0.0002	-3.74	-0.0003	-6.15	-0.0002	-3.97
Ln W_0			-0.0178	-23.21	-0.0212	-25.23	-0.0158	-10.56	-0.0182	-7.62
Nat. Res.					0.0036	2.08			0.0033	1.87
Transport.					-0.0012	-1.13			-0.0013	-1.17
Commun.					-0.0057	-4.91			-0.0055	-4.74
Utilities					-0.0037	-2.33			-0.0038	-2.41
Trade					-0.0052	-4.78			-0.0053	-4.82
Education					-0.0034	-3.86			-0.0042	-3.93
Health					-0.0045	-5.26			-0.0045	-5.26
Services					-0.0076	-4.81			-0.0063	-3.44
Others					-0.0083	-9.82			-0.0079	-8.86
Atlantic					-0.0031	-2.50			-0.0023	-1.70
Quebec					-0.0019	-2.37			-0.0016	-1.83
Ontario					0.0033	4.13			0.0034	4.20
Prairies					-0.0020	-2.29			-0.0016	-1.61
BC					0.0005	0.54			0.0000	0.04
Territories					0.0091	1.99			0.0093	2.03
Adj. R Sq.	0.0503		0.2924		0.3926		0.1239		0.2166	

involving multi-region contracts. A Hausman (1978) specification test accepts equality between the OLS and IV estimates and, indeed, the coefficient estimates in Results III and V are very close.

Using the estimates in Result V, it is worth considering the quantitative importance of the estimates for the explanatory variables *Prod*, *Durneg* and lnW_0. An increase in *Prod* by one standard deviation (0.0183 in Table 2) would have the effect of increasing *Grate* by 0.000926 (0.0506×0.0183). This is approximately 29% of the mean value of *Grate* (0.0032) in Table 2. While this is not an enormous effect, it is not negligible either. Thus, the average annual productivity growth experienced over a chronology does have a measurable effect on the average annual growth rate of real wages over a chronology. An increase in *Durneg* by one standard deviation (4.37 in Table 2) would decrease *Grate* by 0.000874 (-0.0002×4.37), an effect comparable to that of an increase in *Prod* by one standard deviation. Thus, the ability of the pair to work effectively at the bargaining table does appear to have an impact on the real wage fortunes of the pair. Finally, an increase in lnW_0 by one standard deviation (0.25 in Table 2) would decrease *Grate* by 0.00455 (-0.0182×0.25). This suggests, relative to the productivity effects, substantial effects through the convergence processes. The effects of the convergence calculations are about five times as large as those for productivity.

While the economic case for the endogeneity of Durneg is not overwhelming, it is important to examine whether the conclusions reached above are robust to the procedures outlined in the previous section. In general, these robustness checks are favourable and we, therefore, confine their detailed presentation to an appendix. Note that a Hausman (1978) specification test

accepts the equality of the OLS and IV estimates. Table A1 reports details of these checks. In the first regression, the variable *Durneg* is replaced by *Pdurneg*. The estimated coefficient (-0.0004) is equal to that reported as Result I in Table 3. When the instrumented version of lnW_0 is added to the *Prod* and *Pdurneg*, the estimated coefficient (t value) is, at -0.0157 (-10.21) very similar to Result IV in Table 3. This is also true when industry and region effects are included (columns 5 and 6, Table A1). In the alternative robustness check, *Pdurneg* is used as an instrument for *Durneg* (columns 7 to 12, Table A1), while lnW_0 continues to be instrumented as described above. In column 7, Table A1, the estimate for the coefficient on *Durneg* is higher and that for *Prod* lower than in column 1, Table A1. However, this difference disappears in the more complete specifications: In the most complete specification (columns 11 and 12, Table A1) *Durneg* entails a coefficient (-0.0002) which is identical to that in column 9, Table 3, albeit with a t value which, at -1.97, indicates significance at the 5% but not the 1% level. The coefficients on Prod and lnW_0 continue to have the expected signs and be significant at the 5% level but they are somewhat lower in absolute values relative to those in column 9, Table 3. Thus, the calculations for their quantitative significance discussed above may present maximal impacts. Industry effects in these regressions are not much affected, though the regional effects display two noteworthy changes, namely the now (relative to Result V, in Table 3) significantly lower growth in real wages in Quebec and British Columbia relative to multi-province chronologies.

Table A1
Weighted Regression of Long Run Chronology Real Wage Growth (Endogenous Durneg)

Result	Pdurneg and Instrumented Wage						Instrumented Durneg and Wage					
Variable	coeff	t stat	coeff	t stat	coeff	t stat	coeff	t stat	coeff	t stat	coeff	t stat
Intercept	0.0025	3.98	0.0442	10.73	0.0473	8.77	0.0052	5.23	0.0447	11.48	0.0471	9.21
Prod	0.0809	4.55	0.0748	4.84	0.0347	2.02	0.0565	3.13	0.0748	4.90	0.0347	2.03
Durneg	-0.0004	-6.17	-0.0004	-7.04	-0.0003	-5.01	-0.0006	-6.20	-0.0003	-3.77	-0.0002	-1.97
Ln W_0			-0.0157	-10.21	-0.0149	-7.65			-0.0159	-10.55	-0.0150	-7.81
Nat. Res.					0.0030	1.61					0.0030	1.62
Transport.					-0.0014	-1.25					-0.0014	-1.26
Commun.					-0.0058	-4.70					-0.0058	-4.73
Utilities					-0.0033	-1.96					-0.0033	-1.97
Trade					-0.0059	-5.20					-0.0059	-5.24
Education					-0.0070	-7.49					-0.0070	-7.54
Health					-0.0056	-6.68					-0.0056	-6.72
Services					-0.0035	-2.06					-0.0035	-2.07
Others					-0.0058	-6.71					-0.0058	-6.75
Atlantic					-0.0021	-1.51					-0.0021	-1.52
Quebec					-0.0024	-2.73					-0.0024	-2.74
Ontario					0.0019	2.21					0.0019	2.23
Prairies					-0.0016	-1.62					-0.0016	-1.63
BC					-0.0030	-3.43					-0.0030	-3.45
Territories					0.0075	1.58					0.0075	1.59
Adj. R Sq.	0.03431		0.10171		0.1962		0.0347		0.0104		0.1981	

5 Conclusion

In this paper, we take a fresh look at the information contained in the repeated wage agreements struck by bargaining pairs over more than two decades with the view to examining, not the collective bargaining outcomes at a point in time that have been studied so far, but the long run outcomes implied in these bargains. This focus on the outcomes of individual bargains complements studies at more aggregative levels. While a number of outcomes such as contract duration and indexation can in principle be considered, we focus on real wage chronologies that trace out the long run pattern of real wages for each pair in the sample. This is an approach that has not been followed so far and one that, hopefully, casts light on the long run behaviour of the all-important notion of the real wage.

We generate the average annual growth rate in the real wage for each chronology and study the influence of productivity growth, the speed with which the bargaining pair can reach agreements and the initial wage on this growth rate. We do so controlling for and estimating industry and region effects that are consistent with intensification of the stylized facts on inter-industry and regional wage patterns. We find that productivity growth and the bargaining skills of the pair influence the long-run growth in the real wage. Convergence in real wages, controlling for the other variables mentioned above, appears to be at work and it appers to be quantitatively strong.

The results in this paper pertain to the unionised sector, of course. While long run analysis of this kind is only possible because of the nature of the information in this sample, the results obtained may illuminate behaviour in the broader economy. Christofides and Stengos (2003, footnote 8) report

that the employees covered by this data represent 11% of the Canadian labour force. To the extent that similar results hold for contracts involving small numbers of employees (these are not represented in the data sources that we tap), our findings would be more broadly applicable. It is worth recalling that, in contrast to the US, union membership in Canada as a proportion of non-agricultural employment is relatively high (32% in 1999). As longer panels on individuals become available, it would be interesting to focus on the long run labour market experience of individuals, appropriately averaged over wide-enough groups to remove idiosyncratic effects. To our knowledge, these individual-based chronologies have not been studied and it is hoped that this paper may help stimulate interest in that direction.

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