Testing for Downward Rigidity in Nominal Wage Rates

Allan Crawford and Alan Harrison*

Introduction

Wage flexibility has an important role in facilitating the allocation of labour to its most efficient uses following shocks to the economy. If there is a decrease in the demand for the output of some industry, a reduction in the real wage in that industry will induce some workers to move to other sectors. If inflation is high enough, such real wage decreases can be achieved with nominal wage rates rising less rapidly than prices.

Some argue that this adjustment process breaks down in a low-inflation regime because nominal wage rates are rigid downward. When inflation is low, downward nominal rigidity will slow the pace of real wage adjustments, adversely affecting the allocative efficiency in labour markets. Downward rigidity could also cause the average unemployment rate to rise when policymakers pursue a low rate of inflation. Proponents of this view suggest, therefore, that some moderate rate of inflation would facilitate labour-market adjustments and improve economic performance. Statements of this "inflation-as-lubricant" hypothesis include Schultze (1959); Tobin (1972); Akerlof, Dickens, and Perry (1996); and Fortin (1996, 1997).

The proposition that nominal wage rates are downwardly rigid is a critical issue in evaluating the empirical validity of the lubricant hypothesis.

* *We are grateful for the comments of Tom Crossley, David Green, David Longworth, Brian O'Reilly, and Tiff Macklem, and the assistance of Victor Collins, Umar Faruqui, André Léonard, Advin Pagtakhan, and Wasif Rasheed. Irene Ip provided valuable suggestions for considering alternative data sources.*

Our paper investigates this question, using Canadian data from various sources. In Section 1, we present some facts on the frequencies of freezes and rollbacks in wage settlements of large unionized bargaining units. These facts may be interpreted as unconditional tests for downward wage rigidity. Since some wages may be unchanged for reasons unrelated to downward rigidity, however, more sophisticated tests are needed to estimate the effect of rigidity on the observed distribution of wage changes. We present a more analytical test of rigidity in Section 2. In contrast to the unconditional tests in Section 1, this approach gives an upper-bound estimate of the effect of downward rigidity on the wage-change distribution around 0 per cent, conditional on other information that affects the position and shape of the distribution.

The ideal test for nominal wage rigidity would use a data set that is representative of movements in the overall wage costs throughout the economy. The wage settlements data set examined in Sections 1 and 2 measures only changes in the base wage rate, and it covers a relatively small share of the total employment in Canada. Given these limitations, it may not provide a representative measure of wage flexibility in the total economy. Most notably, these data exclude all non-unionized establishments and smaller firms (whether unionized or not), and they also fail to consider the effects of variable compensation. Section 3 reviews other data sources for evidence on whether these omissions may cause the wage settlements data set to be a biased indicator of rigidity in overall labour costs. Each individual data source provides only partial evidence. Nevertheless, the combined results give a clearer picture of wage rigidity in the total economy.

This paper analyses wage rigidity at the level of individual firms. The mobility of labour, although beyond the scope of the present paper, is also relevant when assessing the macro consequences of wage rigidity in certain sectors. If the labour market is composed of one sector with rigid wages, for example, and another sector with flexible wages, the adverse employment effects of rigidity could be alleviated if the unemployed moved into the flexible sector.[1]

1 Union Wage Settlements

The wage settlements data measure the percentage change in the base wage rate in union agreements for bargaining units with at least 500 employees.[2] The base wage is defined as the wage rate for the lowest-paid

1. Hogan (1997) discusses the implications of nominal wage rigidity for monetary policy.

2. Wage settlements data are reported in Human Resources Development Canada, *Major Wage Settlements*, various issues.

job category containing a significant number of employees. In recent years, the data cover approximately 55 per cent of unionized employees and 20 per cent of all paid non-agricultural employment in Canada. The coverage is even lower (about 10 per cent) for paid employees in the private, non-agricultural sector.

In this section we present several unconditional tests of wage rigidity using the wage settlements data. Specifically, we examine the frequency of freezes and rollbacks, since widespread nominal rigidity may result in relatively few nominal wage cuts and a large number of freezes. Moreover, the rigidity hypothesis suggests that wage freezes would be more frequent in periods with lower inflation and productivity growth because nominal wage floors are more likely to be a binding constraint in such periods.

1.1 Definitions of a wage freeze

There are three possible definitions of a wage freeze using the wage settlements data base. The first two definitions cover only new contracts signed during the reference year, whereas the third uses information from all contracts in effect at the end of a year.

1. *"Lifetime" definition*. Wage settlements are usually reported as the average annual percentage change in the base wage rate over the entire lifetime of a contract. With this measure, a wage freeze is defined as a contract with an average annual wage change of 0 per cent; a wage rollback is a contract with a negative average annual wage change.
2. *"First-year" definition*. Following Fortin (1996), a wage freeze could be defined as a contract with no wage change in the first year, even if there are wage changes in later years of the contract.
3. *"Year-over-year" definition*. In any year, there are some new contracts that were signed during that year and some multiyear contracts that were signed in previous years but that are still in effect. The year-over-year distribution of wage change is calculated using the 12-month percentage change in the wage rate for *all contracts in effect* at the end of a given year.[3] With this measure, a contract provides a wage freeze in a given year if it gives no change in the wage rate for that year.

The first-year definition will always give a higher frequency of wage freezes than the lifetime definition because some contracts that have no wage change in the first year have a non-zero average annual change. The relationship between these two measures and the year-over-year definition is

3. The 12-month changes are calculated using the level on 31 December of the current year and the level on 31 December of the previous year.

more complex. If wage freezes are more prevalent in the first year of a contract than in subsequent years (that is, freezes are front-loaded), the year-over-year definition will yield a lower numerical measure of wage freezes than will the first-year definition.

The preferred definition of a wage freeze depends on the issue being considered. One issue is whether wage freezes have a significant effect on overall wage growth in a given year. Since current wage growth depends on all contracts in effect in that year, the appropriate measure for this purpose would be the year-over-year definition, rather than the first-year or lifetime definitions, which cover only new contracts. The first-year definition will give misleading results if the incidence of freezes in the first year of the contracts is not representative of the frequency of freezes in later years of the contracts.

Another issue is whether a contract with a freeze in the first year necessarily indicates downward rigidity. If there are immediate pressures for a decrease in nominal wages, but a first-year freeze postpones the wage cut until later years, the first-year freeze would reflect a temporary downward rigidity. More persistent rigidity may exist if a first-year freeze is followed by freezes in later years of the same contract. However, if a freeze in the first year is followed by wage *increases* in later years of the same contract, it is unlikely that the unchanged wage rate in the first year indicates much downward wage rigidity, even in the short term.[4] This type of contract would not be counted as a freeze under the lifetime definition, which suggests that the lifetime definition is the best measure for studying wage rigidity.

The empirical limitations of the first-year definition are illustrated by an examination of the direction of wage changes in later years of private sector contracts signed during the low-inflation period of 1992-96. Only 1 per cent of the contracts with a first-year freeze had a wage cut in later years, and in these cases the measured "wage freeze" was retroactive—that is, the settlement date was at least one year (or very close to a year) after the expiry date of the previous contract. Approximately 46 per cent of the contracts with a first-year freeze had an unchanged nominal wage over the entire lifetime of the contract. Conversely, 53 per cent of the contracts with a first-year freeze provided wage *increases* in subsequent years of the same contract; as noted above, it is unlikely that the first-year freezes in many of these contracts indicated downward rigidity. These unconditional tests

4. That is, firms willing to grant wage increases after the first year are unlikely to be facing much (if any) pressure for a wage cut in the first year. Alternatively, both the *timing* of wage increases (and, therefore, the timing of periods of unchanged wage rates) and the average annual increase may be viewed as outcomes of the bargaining process.

suggest that at least half of the contracts that were counted as wage freezes under the first-year definition do not reflect downward rigidity.

In summary, depending on the issue, either the lifetime or the year-over-year definition would be the most appropriate measure of wage freezes.

1.2 Wage freezes and rollbacks

Figures 1 and 2 show the percentage of contracts with a wage freeze over the 1978-96 period according to the three definitions. Separate figures are provided for the private and public sectors. The frequency of wage freezes tends to be greatest during the low-inflation period of the 1990s, although freezes were also relatively common in the mid-1980s when inflation was in the 4 to 5 per cent range. The frequency of wage freezes in the 1990s is much higher in the public sector than in the private sector under all three definitions, owing to the large number of wage restraint programs in the public sector.

In the private sector, the percentage of contracts with wage freezes using the year-over-year definition tends to lie between the percentages for the other two measures (Figure 1), indicating that wage freezes are more common in the first year of contracts. During the low-inflation period of 1992-96, the incidence of freezes in private sector contracts averaged about 13 per cent under the lifetime definition and 19 per cent under the year-over-year definition (Table 1). Over the same period, the first-year definition gave considerably higher frequencies, of almost 33 per cent for the private sector and 60 per cent for the public sector.

It should be noted that the public sector is overrepresented in the wage settlements data base relative to its share in the total economy. Over the 1992-96 period, the public sector accounted for approximately 60 per cent of all wage settlements, while representing about 15 per cent of total employment. Since wage freezes have been more frequent in the public sector than in the private sector, the data on aggregate wage settlements are

Table 1

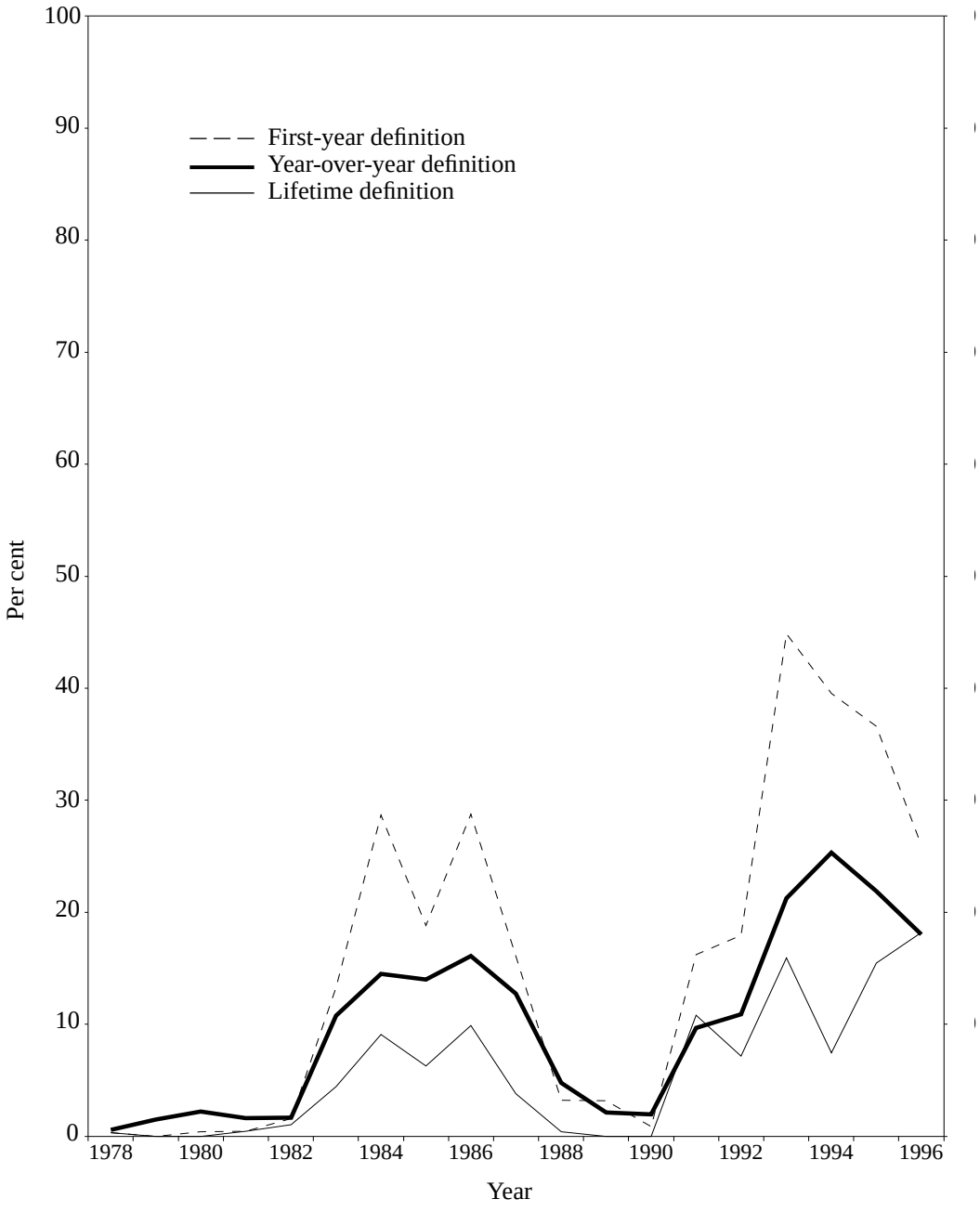
Percentage of Union Contracts with Wage Freezes (1992-96)

	Definition of wage freeze		
	Lifetime	**Year-over-year**	**First-year**
		per cent	
Private sector	12.9	19.4	32.6
Public sector	45.2	56.5	59.7
Both sectors	32.6	39.3	49.2

Source: Human Resources Development Canada. The year-over-year calculation is made by the authors.

Figure 1

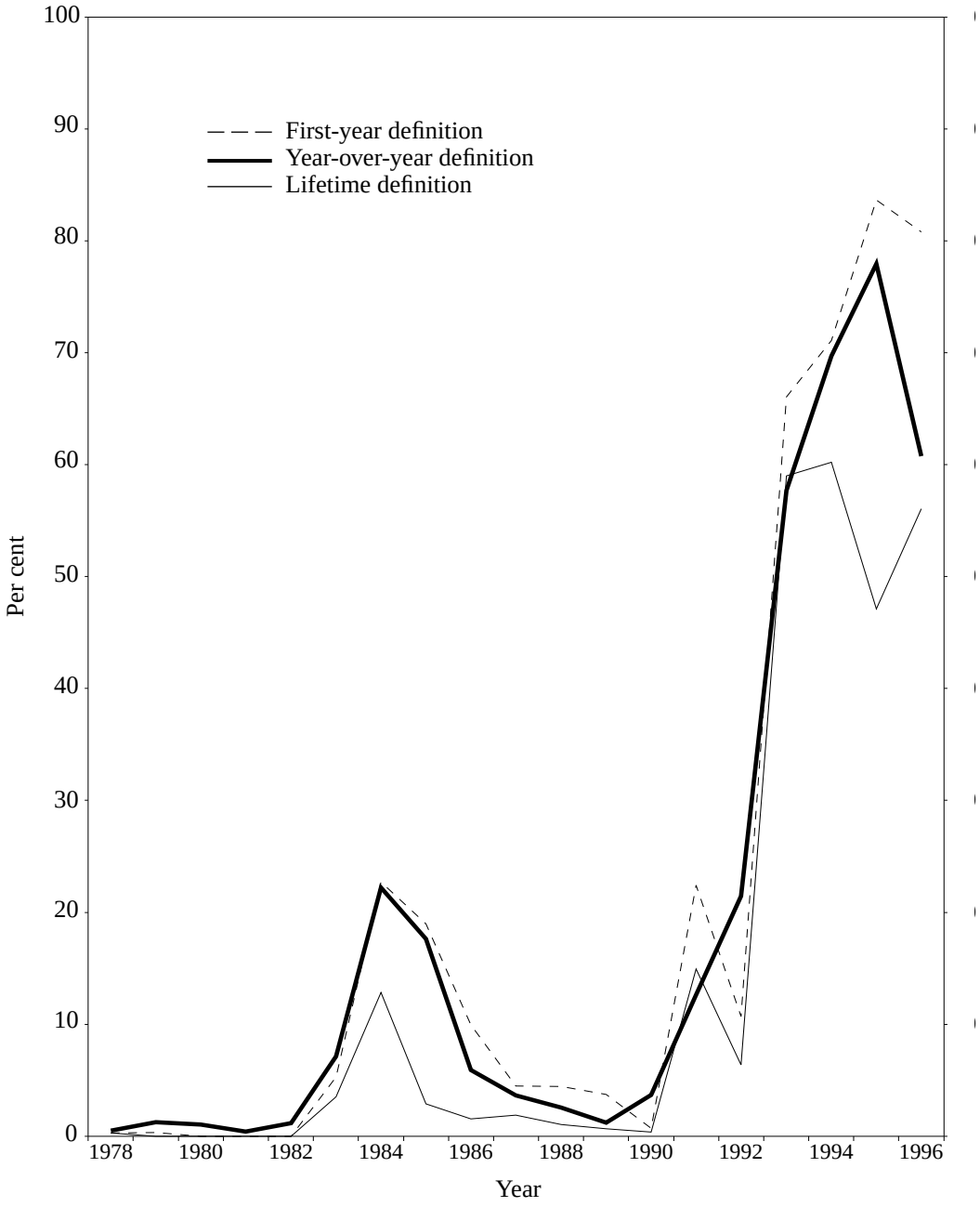
Percentage of Contracts with Wages Freezes, Private Sector



Source: Human Resources Development Canada. The year-over-year definition was calculated by the authors.

Figure 2

Percentage of Contracts with Wage Freezes, Public Sector



Source: Human Resources Development Canada. The year-over-year definition was calculated by the authors.

likely to overstate the frequency of wage freezes in the total economy in recent years. When we use these data as unconditional indicators of potential rigidity, we should at the very least reweight them according to the relative shares of the private and public sectors in the total economy. Preferably we should examine the effects of wage rigidity separately in the two sectors because the wage determination process as well as the implications for employment are likely to be quite different in the two sectors. The remainder of this paper focusses on the private sector.

We obtain further information by examining the entire frequency distribution of wage changes. Figures 3 to 5 show the histograms of wage changes in the private sector for each definition of wage change. Each bar in the histograms shows the percentage of contracts with wage changes within 1 per cent intervals, with the exception of wage freezes, which are shown as wage changes of exactly 0 per cent (denoted by the vertical dashed line in the figures). The endpoints of the intervals are exclusive on the lower bound and inclusive on the upper bound. The data are presented for three subperiods corresponding to years of high, medium, and low inflation as measured by the consumer price index (CPI) excluding the effect of indirect taxes. The subperiods are: 1978-82 (with average inflation of 10.8 per cent); 1983-91 (with average inflation of 4.0 per cent); and 1992-96 (with average inflation of 1.6 per cent).

The histograms illustrate the relative infrequency of nominal wage cuts even in the low-inflation years.[5] Under the lifetime definition, wage rollbacks occurred in 2.8 per cent of private sector contracts over the 1992-96 period.[6] Since wage freezes have been more common in recent years, the spikes at zero in the wage-change distributions become more pronounced with movement to the lower-inflation periods. The histograms also show a decrease over time in the standard deviation of the wage-change distribution. Some of this decrease may simply reflect the increased frequency of wage freezes, but it may also indicate that the dispersion of wage changes is positively related to the level of inflation.[7]

---

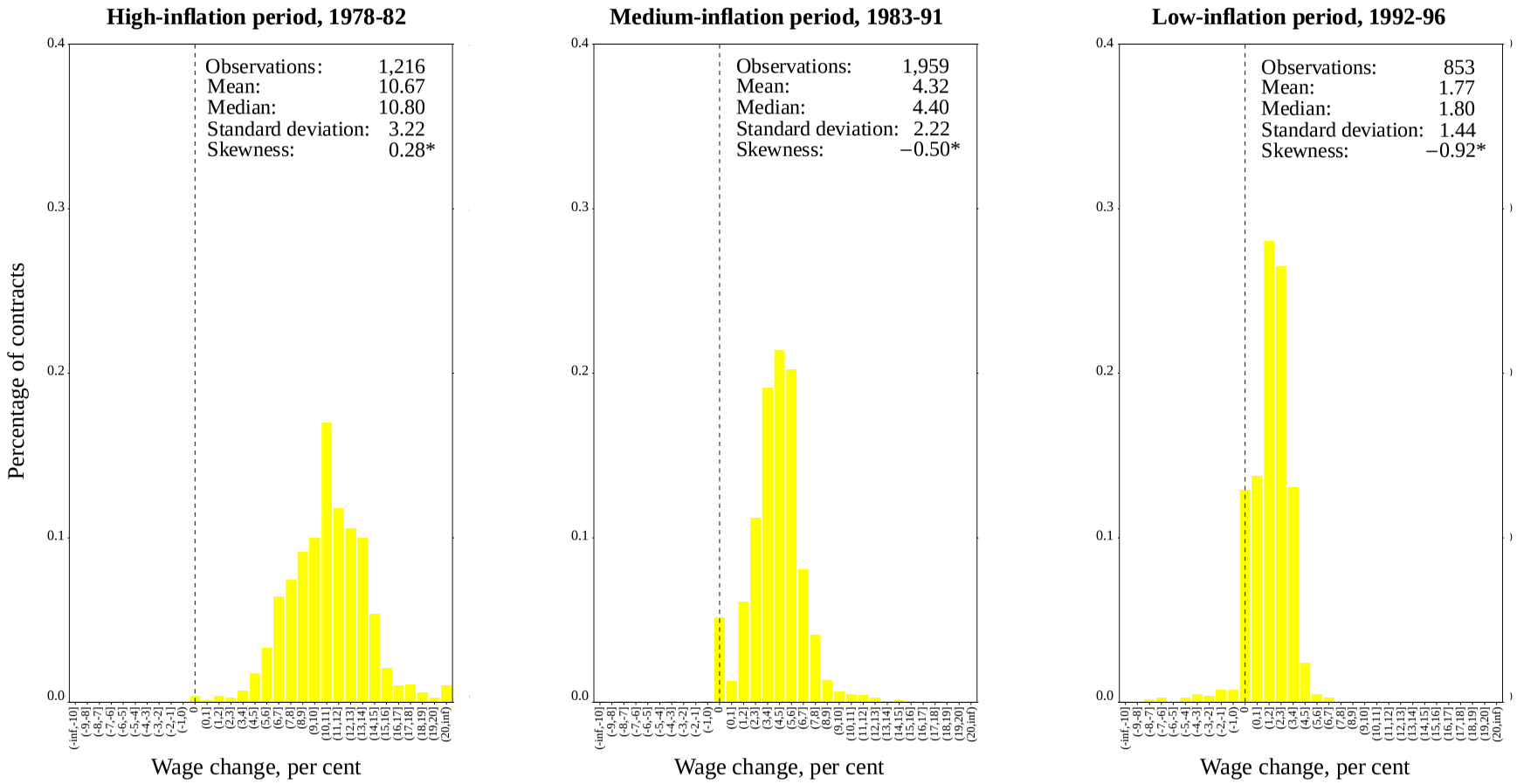
5. Intervals containing few contracts may not be readily distinguishable from those with no contracts, given the scale used in the histograms. With the lifetime measure, the percentage of contracts with a wage rollback during the 1983-91 subperiod was 0.2 per cent.

6. The frequency of rollbacks was 1.7 per cent and 2.7 per cent for the year-over-year and first-year definitions, respectively.

7. Crawford and Kasumovich (1996) provide some evidence that inflation uncertainty decreases at lower rates of inflation. Therefore the downward trend in the standard deviation may indicate that the dispersion of wage changes is positively related to inflation uncertainty.

Figure 3

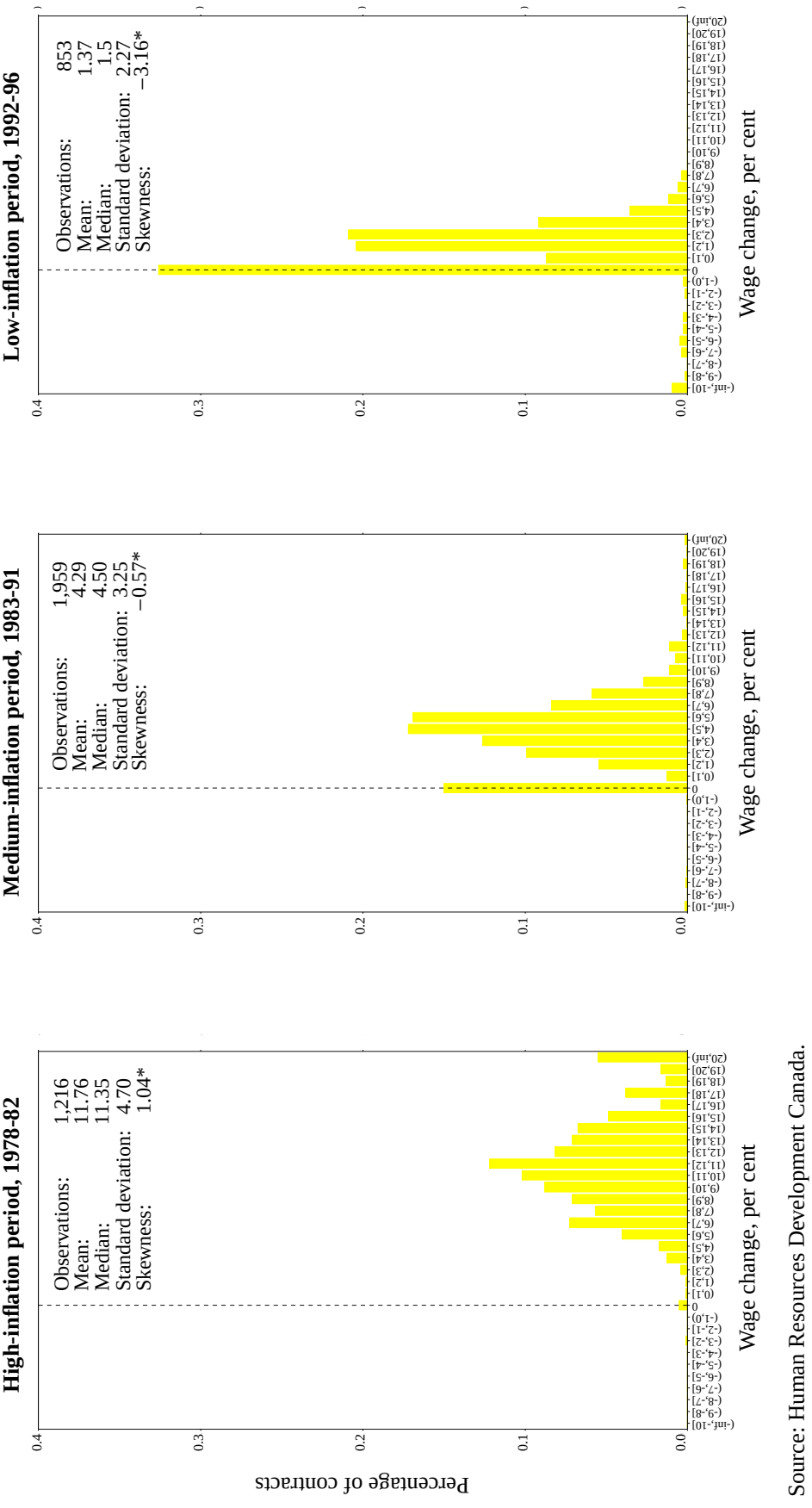
Distribution of Wage Settlements, Private Sector, Lifetime Definition



Source: Human Resources Development Canada.

Figure 4

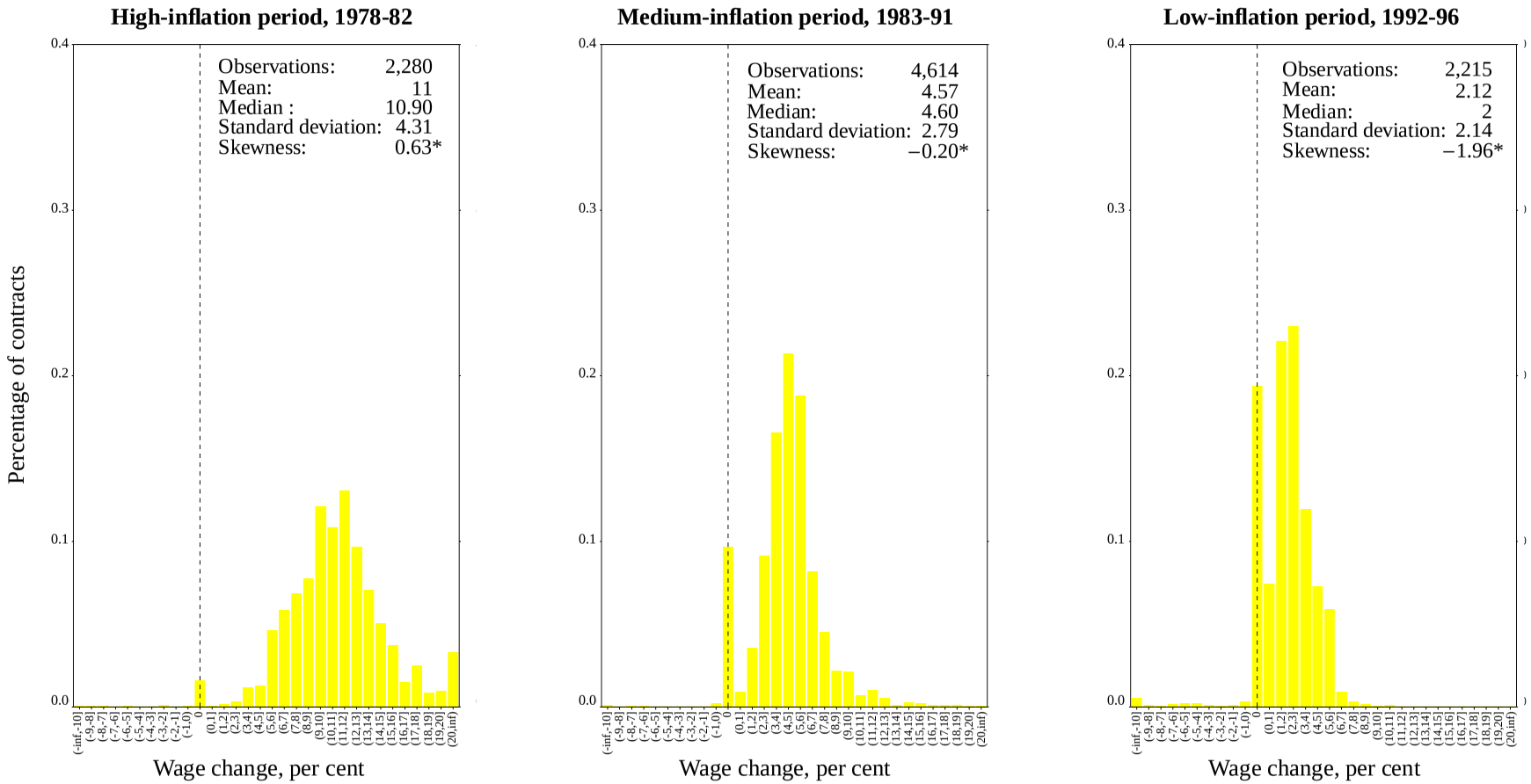
Distribution of Wage Settlements, Private Sector, First-Year Definition



Source: Human Resources Development Canada.

Figure 5

Distribution of Wage Settlements, Private Sector, Year-Over-Year Definition



Source: Human Resources Development Canada.

Asymmetries in the wage-change distribution have been proposed as another test for downward nominal rigidity. With perfect flexibility, the distribution of wage changes would reflect the distributions of the underlying determinants of wage growth at the firm level, such as price changes, productivity growth, and current demand conditions. If the shape of the underlying distributions were constant over time, but nominal wage floors were binding more frequently at lower inflation, the distribution of the wage changes would become increasingly skewed to the right at lower inflation (that is, the skewness coefficient of the distribution would become more positive at lower inflation). Contrary to this prediction, the skewness coefficient becomes *more negative* with movement to subperiods with lower inflation.[8] Skewness coefficients for individual years show the same pattern. However, the results of skewness tests should be treated with caution, because the effect of nominal wage floors may be obscured by other factors that would cause the shape of the wage-change distribution to vary over time.

In summary, using the lifetime definition the incidence of freezes in large, private sector union contracts was 13 per cent over the 1992-96 period. The combination of relatively few wage cuts and a large number of freezes suggests that nominal wage floors contribute to the spike at zero in the wage-change distribution. However, given the low rate of inflation during those years, we would expect to observe a large portion of the wage-change distribution in the neighbourhood of 0 per cent. Menu costs may result in much of the density in the neighbourhood of zero showing up as measured wage freezes rather than as small wage increases or decreases.[9] Tests reported in Section 2 evaluate whether downward rigidity contributes to the density at zero (that is, whether there is *excess density* at zero).

2 Conditional Tests of Wage Rigidity

The empirical significance of downward nominal wage rigidity can be estimated by comparing the observed wage-change distribution with a counterfactual distribution that would have occurred in the absence of wage rigidity. Since the latter is not observed, assumptions must be made about its shape. One approach, that of Card and Hyslop (1996), assumes that the

8. Distributions with a statistically significant asymmetry at the 5 per cent level are indicated by an asterisk (*) following the skewness coefficients reported in Figures 3 to 5. Skewness coefficients are calculated using the individual wage contracts.

9. Some of the histograms shown in Figures 3 to 5 appear to show an unusually low number of contracts providing small wage increases, which suggests that not all of the measured wage freezes are caused by downward wage rigidity. Card and Hyslop (1996) report U.S. evidence that some of the spike at zero in the wage-change distribution does come at the expense of small wage changes.

distribution would be symmetric about the median in the absence of wage rigidities, and that rigidities have no effect above the median. The counterfactual distribution above the median is then simply the actual distribution in this range; below the median, the counterfactual distribution is the mirror image of the actual distribution above the median.

Card and Hyslop impose symmetry in each year, but allow the counterfactual to vary over time. An alternative approach would be to use the shape of the observed distribution in years of relatively high inflation as the counterfactual distribution in years of relatively low inflation, on the grounds that when inflation is relatively high, the effect of downward rigidity is minimized. This remains a somewhat restrictive approach, however, since it still makes no allowance for the shape of the distribution to change over time.

For this reason, we consider instead an approach that builds on the work of Donald, Green, and Paarsch (1995). Its starting point is the relationship between a hazard function and a density function, namely,

$$h(y) = f(y) \,/\, [1 - F(y)],$$

where $h(\cdot)$ is the hazard function, $f(\cdot)$ is the density function, and $F(\cdot)$ is the cumulative density function. The hazard function, which is the conditional probability of observing a wage change in a given interval, is thus a transformation of the density function. Standard approaches to the estimation of hazards therefore allow the underlying density of wage changes to be retrieved; simultaneously they allow for both maximum flexibility in the estimated density and the introduction of covariates that affect the shape and position of this density.

The introduction of covariates is achieved by adopting a proportional hazard model. The hazard conditional on the covariate vector x of explanatory variables is

$$h(y|x) = \exp(xB)h\_\{0\}y,$$

where $h\_\{0\}y$ is the baseline hazard and B is a coefficient vector to be estimated.

Green and Paarsch (1996) applied this method to an analysis of the impact of the minimum wage on the distribution of wages, and the similarity of the question we are investigating to the issue they addressed is readily apparent. In both cases, the issues are (1) density at a particular point in the distribution, (2) an assessment of the extent to which this density can be deemed excess density, and (3) a consideration of variations in this density as the covariate values change.

We apply the estimation method to six samples, all derived from wage contract data for large unionized bargaining units. The samples combine the wage settlements data (1978-96) used in Section 1 with the information from the Wage Chronologies File and the Wage File, which allows us to consider contracts dating back to the early 1950s. Two extensive discussions of these two comprehensive data files are provided in the literature: Harrison (1996) includes an analysis of the appropriateness of combining the Wage Chronologies File and the Wage File; and Crossley, Harrison, and Ljutic (1996) look at variations over time in contract length.

The samples that we analyse are summarized in Table 2. We begin with data covering the period 1952-96. Because the Wage Chronologies File includes details of just the initial wage increase (what we have earlier called the first-year definition) and covers only a subset of manufacturing industries, we combine data from this source with an equivalent subset of the Wage File data to produce the first sample. The second sample includes only this subset of the Wage File (covering just the period 1965-96), to determine the effect of restricting attention to the subset of manufacturing industries. We do this by drawing comparisons with our third sample, which extends consideration to all manufacturing industries for the 1965-96 period. The fourth sample widens the scope still further by including all private sector contracts, again for the 1965-96 period.

These four samples include only the initial wage change (see Table 2a), but the Wage File does, of course, contain details of the average wage increase over the life of the contract (what we have earlier called the lifetime definition). We make use of this information in samples 5 and 6, shown in Table 2b. These samples are identical to the third and fourth samples, except that the average wage increase replaces the initial wage increase.

For each of the six samples, Table 2 reports the number of contracts for various sizes of nominal wage change, including a count of those contracts with a change of zero. When we compare the third and the fifth samples or the fourth and the sixth, we quickly see confirmation of our earlier observation about different definitions of the wage increase. Specifically, an initial wage change of zero is much more common than an average wage change of zero. For the manufacturing sample, some 2.9 per cent of the settlements between 1965 and 1996 had an average wage increase of zero over the life of the contract, but four times as many, 12.4 per cent of the total, had an initial wage increase of zero. For the entire private sector, the equivalent figures are 4.4 per cent and 15.1 per cent.

It is nonetheless true that, in certain years, the proportion of wage changes of zero by either definition is much higher, and the real issue is whether the particularly high proportions occur when inflation is low. In

what follows, we examine this question by analysing the effect of variations in price inflation (measured by the annual percentage change in the CPI) on the density at zero. As a precursor to this analysis, Table 2 summarizes the range of values of CPI inflation associated with the observations in each subsample of nominal wage changes. In the case of initial wage changes of zero, the median inflation rate is close to 4 per cent, suggesting that low inflation alone cannot be blamed when nominal wages are unchanged from one contract to the next.

That the relationship between the proportion of zero nominal wage changes and levels of price inflation is complicated is reinforced by an examination of Figures 6 to 11. These figures relate in turn to each of the samples introduced above and summarized in Table 2. Each figure shows the proportion of settlements in each year for which the nominal wage change was zero, compared with the annual rate of inflation. The upward surges in the proportion of wage freezes in the early 1980s and the early 1990s seem to have at least as much to do with *changes* in the underlying rate of price inflation as with the *levels* of price inflation.

That observation suggests that inflation uncertainty may play a role in determining the shape of the wage-change distribution and, therefore, of the density of nominal wage changes at zero. We plan to investigate this possibility in future work. For the moment, we confine our attention to a single covariate in our application of the method of analysis introduced by Donald, Green, and Paarsch (1995). The covariate, the all-items CPI inflation rate at the time the wage contract is settled, is nonetheless one that plays a critical role in moving the distribution of wage changes, as we show below.

This last statement remains true when other covariates are added. We have begun experimenting with a model that additionally includes a dummy indicating whether the contract included a cost-of-living (COLA) clause, and an annual measure of labour productivity growth (matched to each contract according to the year in which the settlement of the contract occurred). The impact of inflation is little changed in this model. A full application of this approach to the estimation of the distribution of nominal wage changes, and variation in the distribution as covariate values change, will be provided in a separate paper, now in preparation.

We have yet to mention a further benefit of the Donald, Green, and Paarsch method—its ability to allow covariates to affect different parts of the distribution differently. The underlying density is simply a transformation of a baseline hazard, which is approximated by a set of dummy variables, one for each baseline segment. We estimate coefficients for 44 baseline segments; the 45th segment is treated as censored (see Donald,

Table 2a

Initial Wage Settlements

Subsample	N	Inflation			
		Mean	Median	25th percentile	75th percentile
		per cent			
Sample 1: Manufacturing subset, 1952-96					
$\dot{w} = 0$	401	3.85	3.90	1.86	4.62
$0 < \dot{w} < 5$	1,063	3.13	2.52	1.31	4.19
$5 \leq \dot{w} < 10$	1,207	5.34	4.64	3.49	8.16
$\dot{w} \geq 10$	779	8.21	9.36	4.90	10.87
$\dot{w} > 0$	3,049	5.30	4.35	2.64	8.76
All settlements	3,454	5.13	4.19	2.52	8.44
Sample 2: Manufacturing subset, 1965-96					
$\dot{w} = 0$	354	4.24	4.00	2.42	4.91
$0 < \dot{w} < 5$	756	3.96	3.92	1.95	4.57
$5 \leq \dot{w} < 10$	1,070	5.85	4.99	3.88	8.55
$\dot{w} \geq 10$	753	8.44	9.41	5.24	10.88
$\dot{w} > 0$	2,579	6.05	4.91	3.76	9.17
All settlements	2,937	5.82	4.68	3.64	8.89
Sample 3: All manufacturing, 1965-96					
$\dot{w} = 0$	425	4.22	3.99	2.42	4.84
$0 < \dot{w} < 5$	850	3.99	3.93	2.00	4.57
$5 \leq \dot{w} < 10$	1,241	5.90	5.00	3.90	8.55
$\dot{w} \geq 10$	897	8.53	9.41	5.50	10.91
$\dot{w} > 0$	2,988	6.15	4.99	3.81	9.18
All settlements	3,417	5.90	4.75	3.72	8.96
Sample 4: All private sector, 1965-96					
$\dot{w} = 0$	897	3.90	3.96	2.14	4.55
$0 < \dot{w} < 5$	1,530	3.85	3.93	1.87	4.56
$5 \leq \dot{w} < 10$	2,030	5.87	5.00	4.01	8.44
$\dot{w} \geq 10$	1,461	8.36	9.36	4.98	10.91
$\dot{w} > 0$	5,021	5.98	4.84	3.81	8.96
All settlements	5,960	5.65	4.56	3.64	8.75

Notes: $\dot{w}$ means change in wage. N is the number of settlements.

Source: Wage Chronologies File and Wage File; Human Resources Development Canada.

Green, and Paarsch 1995 for further details). The effect of covariates cannot vary within a baseline segment, but can vary across baseline segments.

In practice (see, for instance, Green and Paarsch's 1996 analysis of the effect of the minimum wage) covariate segments are defined as groups of adjoining baseline segments; thus the effects of covariates are allowed to vary across these groups of baseline segments, but not within them. We define six covariate segments, one of which is the single baseline segment

Table 2b

Average Wage Settlements

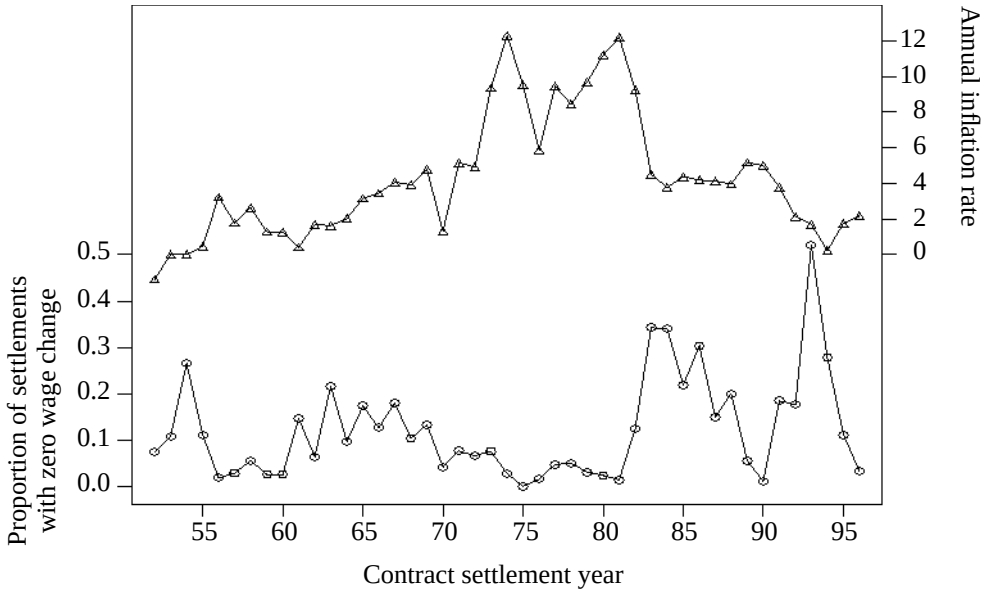
Subsample	N	Inflation			
		Mean	Median	25th percentile	75th percentile
			per cent		
Sample 5: All manufacturing, 1965-96					
$\dot{w} = 0$	100	4.02	4.00	1.87	5.34
$0 < \dot{w} < 5$	1,106	4.10	3.96	2.00	4.79
$5 \leq \dot{w} < 10$	1,325	5.78	4.86	3.88	8.40
$\dot{w} \geq 10$	887	8.55	9.41	5.78	10.91
$\dot{w} > 0$	3,318	5.96	4.79	3.76	9.07
All settlements	3,418	5.90	4.75	3.72	8.96
Sample 6: All private sector, 1965-96					
$\dot{w} = 0$	263	3.28	2.93	1.70	4.47
$0 < \dot{w} < 5$	2,063	3.86	3.95	1.87	4.57
$5 \leq \dot{w} < 10$	2,134	5.77	4.90	3.93	8.33
$\dot{w} \geq 10$	1,481	8.39	9.41	5.14	10.91
$\dot{w} > 0$	5,678	5.76	4.64	3.72	8.79
All settlements	5,941	5.65	4.56	3.64	8.75

Notes: $\dot{w}$ means change in wage. N is the number of settlements.

Source: Wage Chronologies File and Wage File; Human Resources Development Canada.

Figure 6

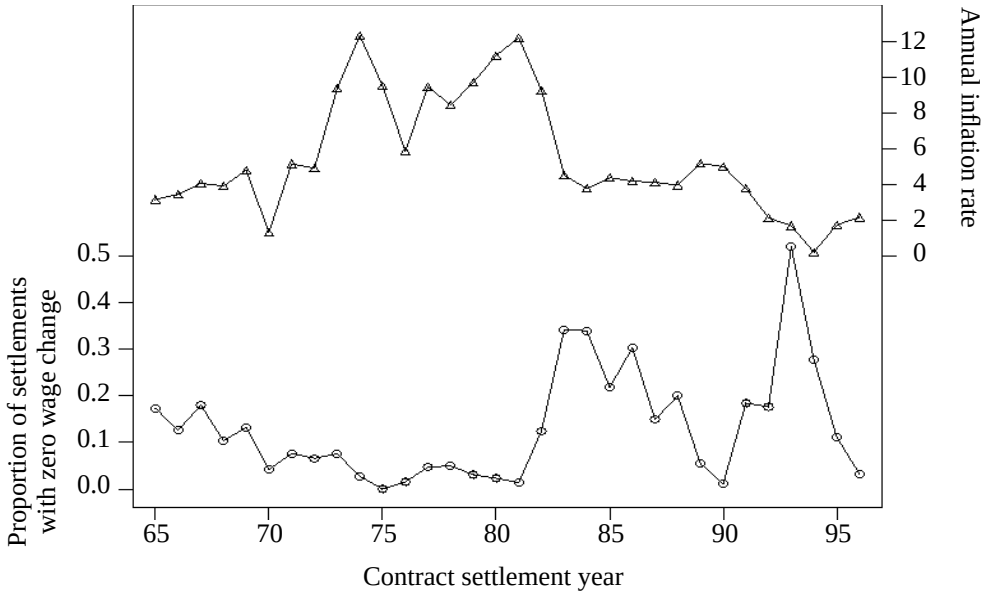
Sample 1: Initial Wage Settlements, Manufacturing Subset, 1952-96



Source: Wage Chronologies File and Wage File; Human Resources Development Canada.

Figure 7

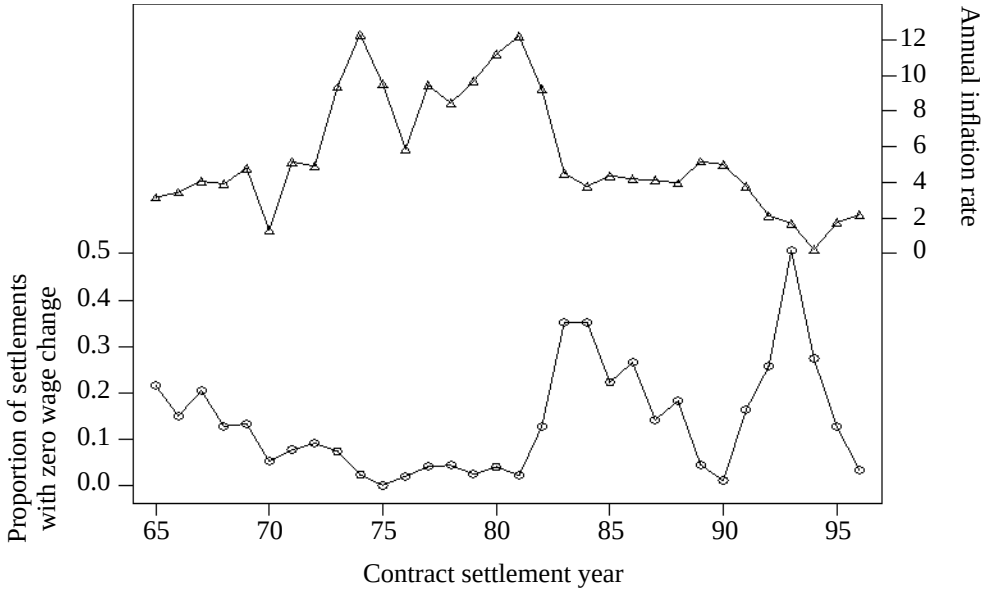
Sample 2: Initial Wage Settlements, Manufacturing Subset, 1965-96



Source: Wage Chronologies File and Wage File; Human Resources Development Canada.

Figure 8

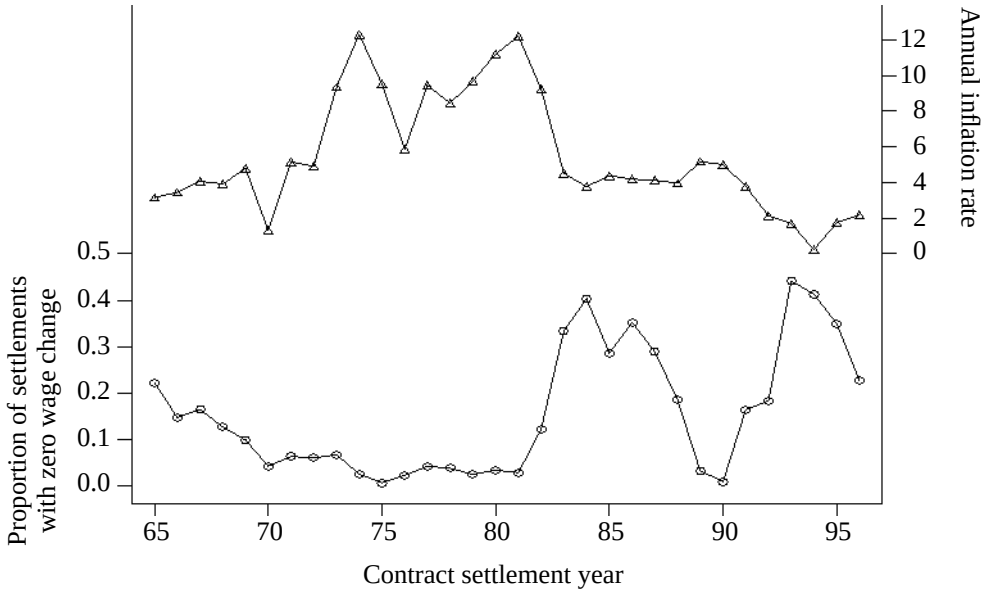
Sample 3: Initial Wage Settlements, All Manufacturing, 1965-96



Source: Wage Chronologies File and Wage File; Human Resources Development Canada.

Figure 9

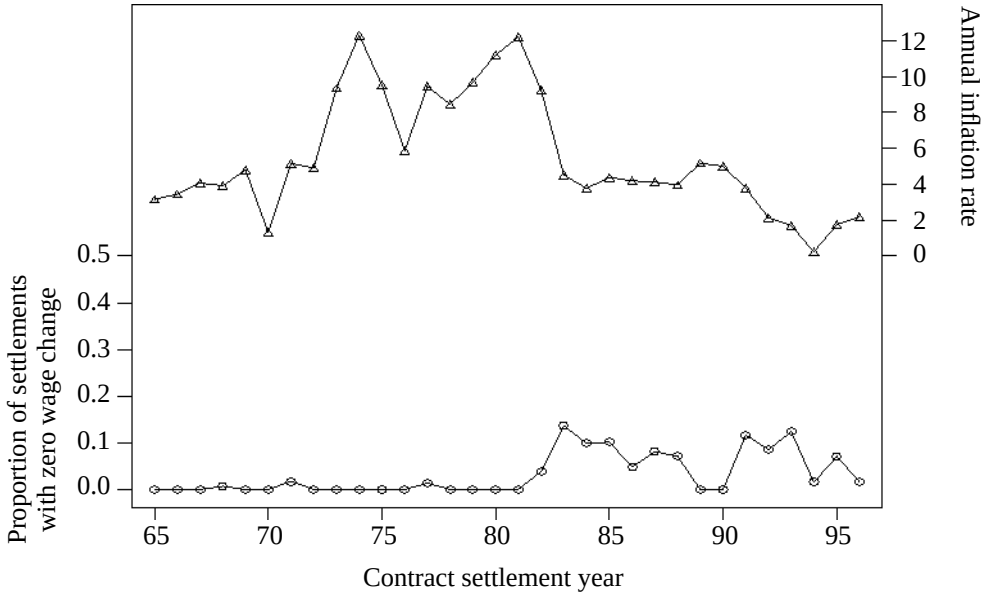
Sample 4: Initial Wage Settlements, All Private Sector, 1965-96



Source: Wage Chronologies File and Wage File; Human Resources Development Canada.

Figure 10

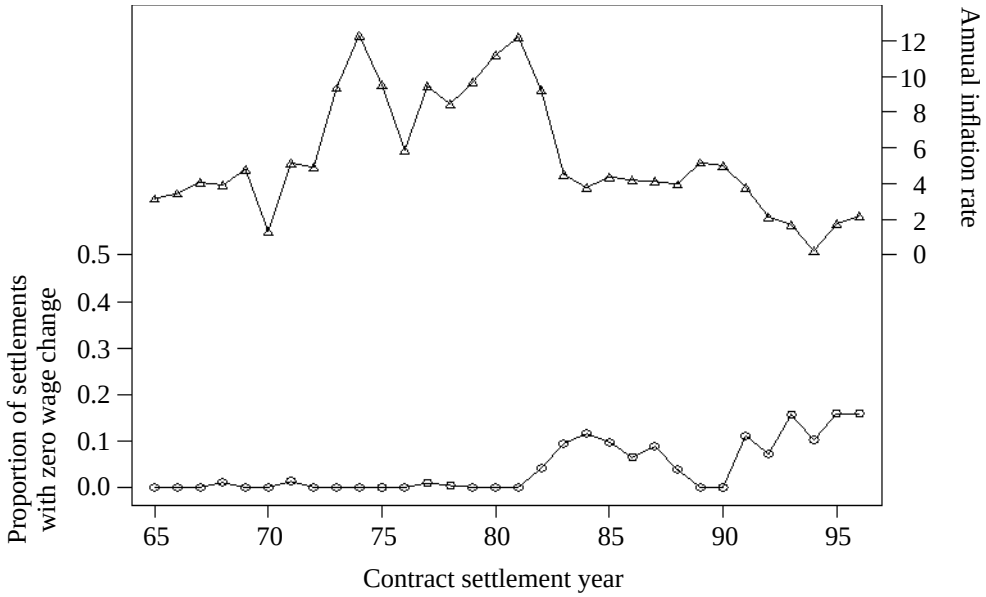
Sample 5: Average Wage Settlements, All Manufacturing, 1965-96



Source: Wage Chronologies File and Wage File; Human Resources Development Canada.

Figure 11

Sample 6: Average Wage Settlements, All Private Sector, 1965-96



Source: Wage Chronologies File and Wage File; Human Resources Development Canada.

that includes contracts with a nominal wage change of zero. This enables us to isolate the effect of different rates of price inflation on just this baseline segment.

Figures 12 to 17 show the fitted densities for the six samples summarized in Table 2. For each sample, the actual density is plotted together with three fitted densities. The fitted densities are calculated for rates of price inflation of 2, 6, and 10 per cent. All densities are based on ranges spanning wage increases of 1 percentage point. This means that the first interval includes all settlements with an increase of 0 to 0.99 per cent, not just those settlements that are exactly zero. Similarly, the second interval includes all settlements with an increase of 1 to 1.99 per cent, and so on. As a consequence, in what follows, when we talk about, for example, the density at a wage change of zero, we actually mean the density at values of the percentage wage change from zero up to, but not including, 1 per cent.

We begin with the first four samples, which all use the initial wage change. With this definition of wage change, the proportion of zero wage changes is appreciably higher than the proportion of wage changes at 1 per cent. One might be tempted to regard this as a priori evidence of excess density at zero, were it not for the observation that the phenomenon occurs even in the fitted densities based on an inflation rate of 6 per cent,

Figure 12

Sample 1 Densities: Initial Wage Settlements, Manufacturing Subset, 1952-96

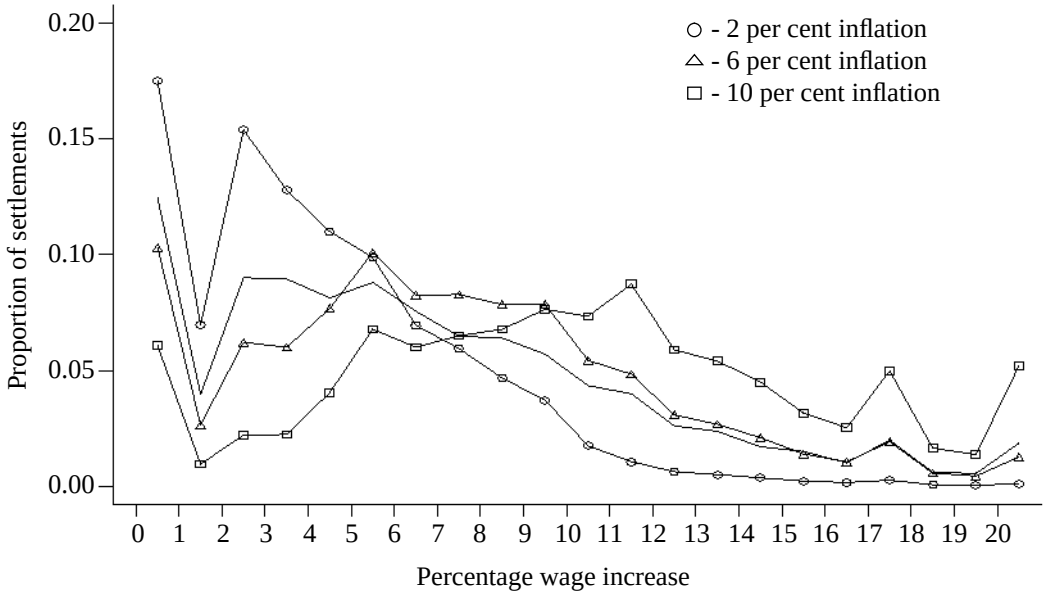


Figure 13

Sample 2 Densities: Initial Wage Settlements, Manufacturing Subset, 1965-96

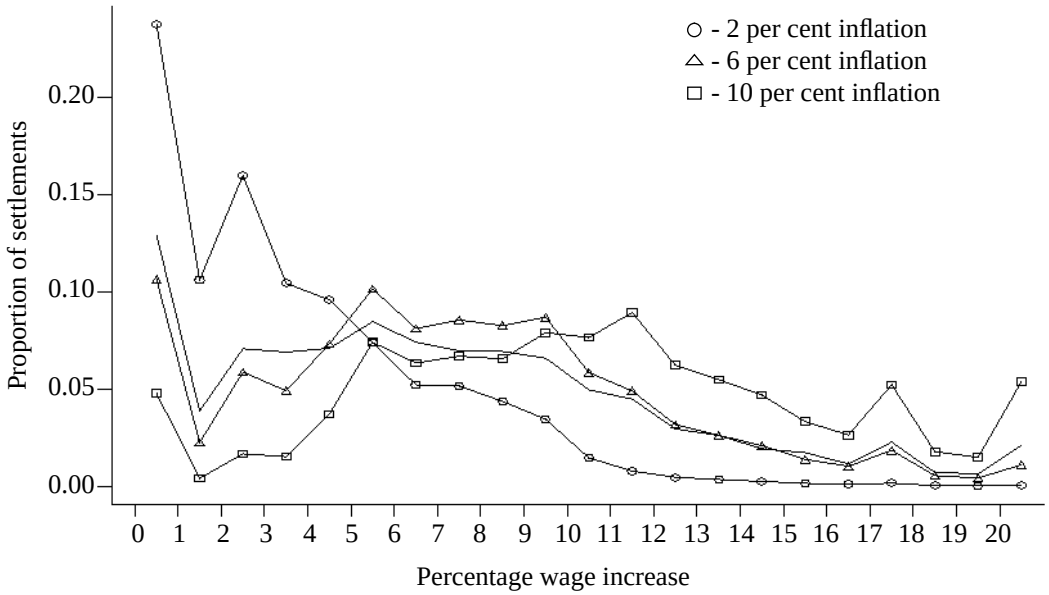


Figure 14

Sample 3 Densities: Initial Wage Settlements, All Manufacturing, 1965-96

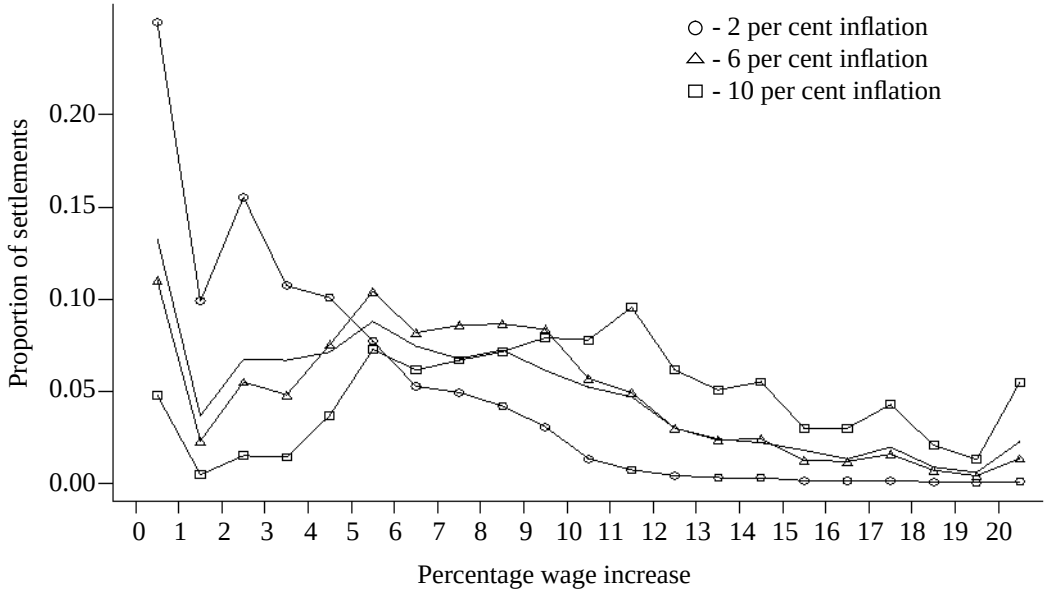


Figure 15

Sample 4 Densities: Initial Wage Settlements, All Private Sector, 1965-96

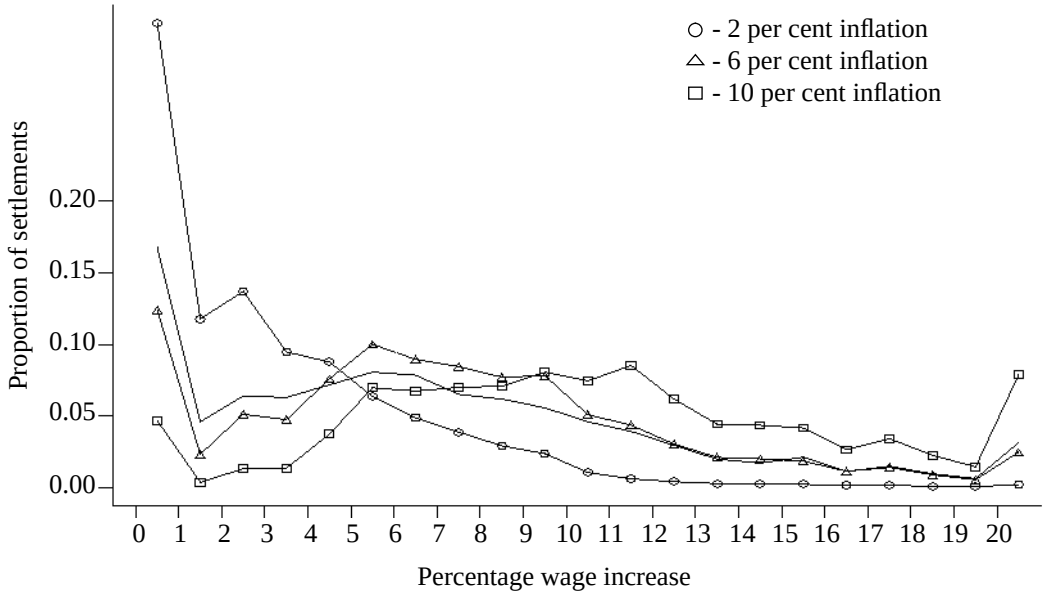


Figure 16

Sample 5 Densities: Average Wage Settlements, All Manufacturing, 1965-96

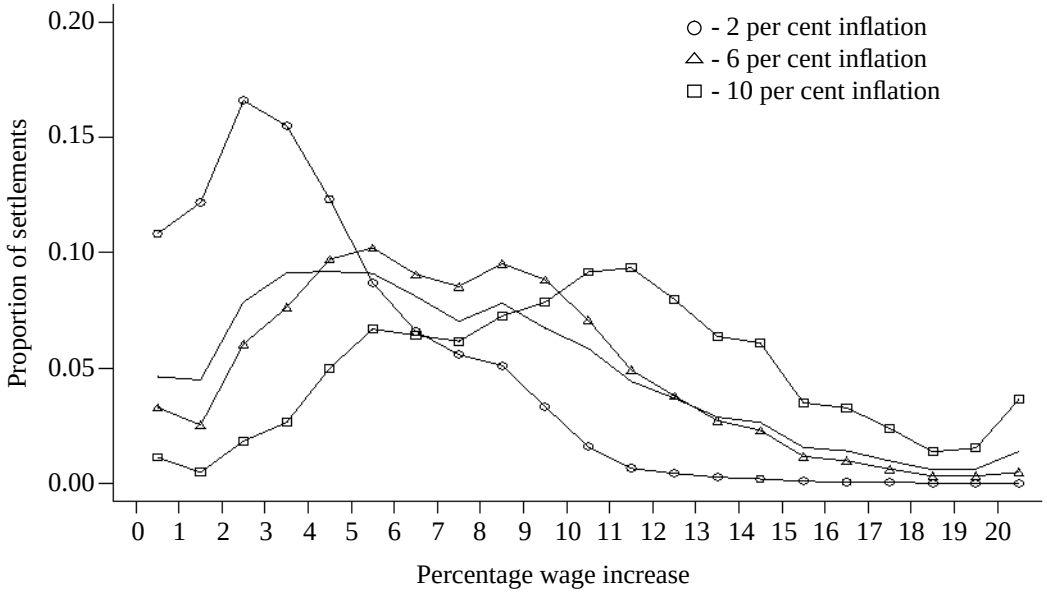
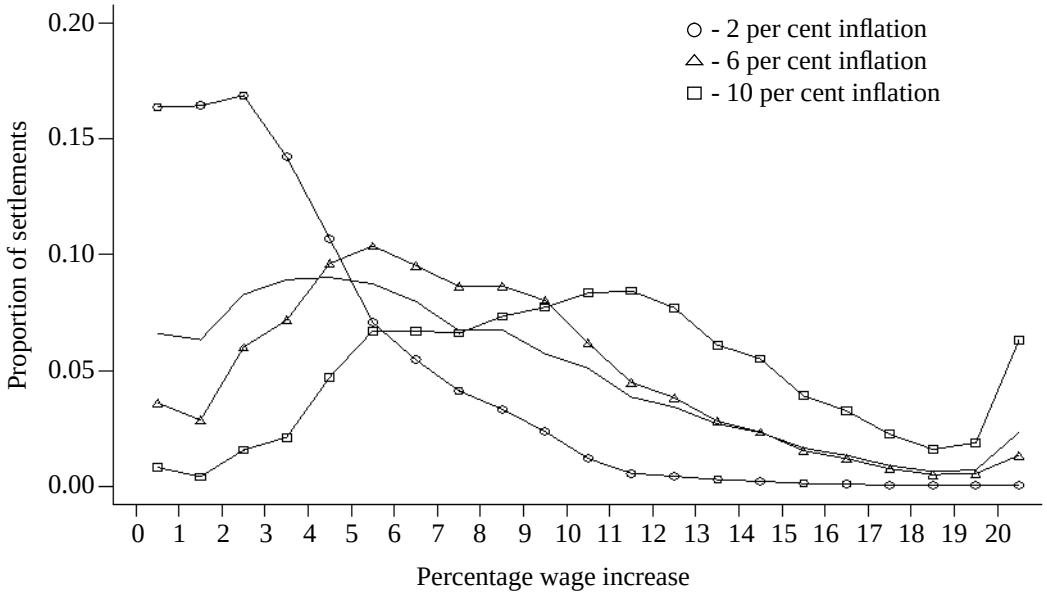


Figure 17

Sample 6 Densities: Average Wage Settlements, All Private Sector, 1965-96



when one would expect the effect of downward rigidity to be minimized. For this reason, we prefer to concentrate instead on comparisons of density at zero for different inflation rates.

For the interval from 0 to 0.99 per cent, the difference between the fitted density for an inflation rate of 2 per cent and the fitted density for an inflation rate of 6 per cent varies across samples from a low of 0.07, through 0.13 and 0.15, to a high of 0.20.[10] Not all of this increase in density at lower inflation can be attributed to downward wage rigidity; even in the absence of rigidity, the density in this interval should increase significantly because lower inflation would reduce the mean wage change and shift the entire distribution to the left. Thus, the increase in fitted density should be interpreted as an *upper-bound* estimate for the effect of rigidity on the proportion of union contracts in the interval from 0 to 0.99 per cent.[11]

The picture is more complicated when we turn to the final two samples, which use the lifetime definition of the wage change. The difference between the density in the (0, 0.99) interval when the inflation rate is 2 per cent and the density in this interval when the inflation rate is 6 per cent is 0.08 in the case of settlements in manufacturing, and 0.13 for settlements in the private sector overall. It is interesting to note that these values are quite similar to those obtained from the first four samples based on the first-year definition of wage change. There is, however, a large difference between the results from the first four samples and those from the last two when it comes to the proportion of settlements at 1 per cent. For the samples that use the lifetime definition of the wage change—that is, the average annual wage increase over the life of the contract—there is no appreciable difference between the proportion of settlements at 1 per cent and the proportion at zero.

What do we conclude from the results of this estimation? First, they confirm earlier indications of density at zero even when inflation is relatively

---

10. Standard errors are not currently available for these point estimates. Further work will investigate whether these estimates are statistically different.

11. A tighter estimate of excess density would require an explicit assumption for the shape of the counterfactual ("no rigidity") distribution at 2 per cent inflation. One strategy for identifying the counterfactual outcome would be to shift the fitted density at 6 per cent inflation to the left by 4 percentage points. Excess density would then be estimated as the difference in the (0, 0.99) interval between the density for the counterfactual distribution and the fitted density at 2 per cent inflation. This approach implicitly assumes that changes in inflation shift the mean of the counterfactual distribution with no effect on its variance. If instead, the variance decreases at lower inflation, the assumed counterfactual distribution could understate the density that would be observed near zero in the absence of rigidity (and thereby overstate the effect of downward rigidity on the observed distribution). Further work will examine this possibility.

high, a corollary of which is that density at zero cannot be attributed solely to low inflation. In particular, as we suggest above, uncertainty about inflation, generated by changes in the rate of inflation, could also be a factor. Second, the results show that differences arise when we use different measures of the wage change, most notably the absence of a spike at zero, relative to the proportion of settlements with a wage change of 1 per cent, when the lifetime definition is used. Third, although the incidence of wage freezes varies considerably depending on whether one uses the first-year or the lifetime definition of wage change, the upper-bound estimates of rigidity are similar for these two definitions. Finally, refinements to the model may provide point estimates of excess density in the distribution near zero rather than upper-bound estimates. Density at (or close to) zero may arise for reasons unrelated to nominal wage rigidity.

3 Other Data Sources

The wage settlements data set studied in Sections 1 and 2 has several potential weaknesses as an indicator of wage rigidity in the Canadian economy. First, since the data exclude the non-union sector and unionized agreements covering fewer than 500 employees, their coverage is restricted to about 10 per cent of paid employees in the private, non-agricultural sector. Table 3 gives further information on the composition of employment by union status and workplace size as obtained from Statistics Canada's Labour Force Survey (LFS).[12] According to the LFS data, workplaces with fewer than 100 employees account for a large share of employment in both the total economy and the manufacturing sector, particularly at non-union organizations. The narrow coverage of the wage settlements data base will not be a serious limitation if wage changes at large unionized firms are representative of wage flexibility in the total economy. However, if wages are more flexible in the non-union sector and at smaller firms, the wage settlements data will overstate the downward rigidity of wages.

A second limitation of the wage settlements data is that they measure changes only in the base salary. By ignoring changes in non-wage benefits and variable forms of compensation, such as bonuses and profit-sharing plans, the wage settlements data are likely to overstate the downward rigidity in total labour costs. To determine whether these limitations result in a false picture of the importance of wage freezes, this section reviews other

12. The LFS data are collected according to the number of employees at the location of employment (workplace size), whereas the wage settlements data are collected for bargaining units. Thus, the proportion of all employees reported for the size range 500+ will differ between the two data bases.

Table 3

Composition of Employment, Per Cent of Total

	Size[a]	Total economy	Manufacturing[b]
		per cent	
Private sector			
Unionized	< 100	5.8	8.0
	100-500	5.2	13.9
	> 500	3.7	10.2
Non-unionized	< 100	40.3	36.3
	100-500	8.1	18.4
	> 500	3.3	8.1
Self-employed	all	18.1	5.1
Public sector			
Unionized	all	11.2	
Non-unionized	all	4.3	
Total		100.0	100.0

a. Number of employees at the workplace (location of employment).
b. Represents 15 per cent of total employment in Canada.

Source: Statistics Canada, Labour Force Survey, March 1997.

data sources that provide evidence on the effects on wage flexibility of variable compensation, firm size, and union status.

3.1 Survey of Labour and Income Dynamics

A broader measure of wage change for individuals is provided by the Survey of Labour and Income Dynamics (SLID) panel data for Canada (see Statistics Canada 1996). In contrast to the wage settlements data, the SLID data include both union and non-union employees and individuals who work for employers with fewer than 500 workers. Using the SLID data for 1993, Statistics Canada has reported that 10 per cent of individuals received an hourly wage cut of at least 10 per cent in 1993.[13] The greater frequency of wage rollbacks in the SLID data is consistent with wages being much less rigid for non-unionized workers and employees of small firms—that is, those individuals that are not covered in the wage settlements data base.

One criticism of panel data is that reporting errors for wage changes may account for a high proportion of the measured wage cuts. McLaughlin

13. This number refers to paid employees who worked full-time for the same employer throughout the entire year. See Statistics Canada (1996).

(1994) contends that there is significant downward flexibility in the U.S. panel data even after adjusting for an estimate of measurement error. Further work is required to evaluate whether the SLID data can be used to study wage flexibility in Canada.

3.2 Effects of variable pay

The annual compensation survey of Sobeco Ernst and Young (referred to herein as the Sobeco survey) collects information on both base salaries and cash bonuses for six broad occupational categories at individual organizations. Cash bonuses are defined as payments from annual incentive plans, profit-sharing plans, or lump-sum merit awards. These data can be used to test whether a measure of total compensation is much more flexible than base salaries.

Unlike the wage settlements data, the Sobeco survey is not restricted to the unionized sector. (Explicit comparisons of union and non-union firms are not possible, however, because the questionnaire does not request information on union status.) Another advantage of the Sobeco survey is that it includes organizations of all sizes. Approximately 50 per cent of the survey participants have fewer than 250 employees. The wage settlements data, by contrast, are restricted to bargaining units with at least 500 employees. The private sector accounted for almost 95 per cent of the Sobeco sample in 1996.[14] Aggregate data for the total sample, as well as micro data for a subset of all organizations, are discussed below.

3.2.1 Aggregate data

Higher-paid occupations have a greater likelihood of receiving cash bonuses. In 1994, approximately 30 per cent of organizations in the Sobeco sample gave bonuses to employees paid at an hourly rate, while approximately 70 per cent gave bonuses to senior management. For those organizations that did give bonuses, Table 4 reports the average level of bonuses as a percentage of the base salary for six occupational groups.[15] As

14. The questionnaire is sent to about 10,000 organizations. Approximately 7,000 of these organizations are obtained from a Dun & Bradstreet mailing list of firms with at least $25 million in sales revenue and at least 100 employees. The questionnaire is sent to another group of 3,000 organizations that includes smaller firms. The number of survey participants has been in the 800-1,000 range with the exception of 1996, when the sample size fell to 410. According to a Sobeco representative, the decrease in sample size in 1996 cannot be attributed to a change in the number of organizations receiving the questionnaire or to any other change in survey methods.

15. The sample does not have a fixed composition, so some of the movement shown in the table may reflect changes in the mix of survey participants.

Table 4

Cash Bonuses as a Per Cent of Base Salary[a]

Occupational group	1989	1990	1991	1992	1993	1994	1995	1996
Management								
Senior management	14.4	15.1	11.3	9.7	12.0	13.0	17.2	16.2
Middle management	8.6	9.0	6.8	6.1	7.3	7.1	10.2	10.6
Supervisors	4.8	5.6	3.7	3.3	4.0	4.3	6.9	7.0
Non-management								
Professional and technical	na	na	3.1	2.8	4.1	3.8	6.4	6.5
Salaried[b]	2.9	3.5	1.9	1.7	2.4	2.7	4.9	5.3
Hourly	2.1	2.2	1.2	1.1	2.1	2.1	5.7	4.3
Number of responses	1,000	1,000	900	850	890	800	864	410

na means not available.

a. Excludes organizations that did not give bonuses.

b. Clerical and administrative staff beginning in 1994.

Source: Sobeco Ernst and Young, *Compensation Trends and Projections*, various issues.

expected, bonus pay is a significantly larger share of total compensation for the management categories. A noteworthy feature is the cyclical decline in bonus payments for all occupational groups over the 1990-92 period. This pattern suggests that wage measures that include variable pay will react more quickly to cyclical conditions, and show greater flexibility, than measures that cover only base salaries. When allowance is made for the procyclical movement in variable pay, there is evidence of a trend increase in the relative importance of bonus pay, because the levels in 1996 are above 1989 values for each occupational grouping.[16]

3.2.2 Micro data

More information on the role of variable pay is obtained by examining three measures of wage change in a sample of individual organizations from the Sobeco survey. The wage variables are the change in the base salary and two measures of the change in total compensation (defined as the sum of the base salary and cash bonuses). Since the survey questionnaire records information only for the level of cash bonuses in a given year, the change in cash bonuses (and therefore the change in total compensation) can be calculated only for those organizations that responded

16. The level of bonus pay moves procyclically. Therefore, since 1989 was the peak of the previous cycle and 1996 was a recovery year, the change in the level of bonuses over this period probably understates the increase in the underlying trend for bonus pay.

to the survey in consecutive years. This requirement limits the study to wage changes in 1996.[17]

A total of 229 organizations answered at least part of the survey in both 1995 and 1996. Among these organizations, 113 reported quantitative information on base salaries for individual occupational categories.[18] It is uncertain whether these 113 organizations are sufficiently representative to give unbiased measures of the frequencies of freezes and reductions in total compensation in the overall economy. However, the sample does cover a broad range of firm sizes, with organizations employing fewer than 500 employees accounting for about 55 per cent of all employees in the sample. The sample is *not* restricted to organizations that gave bonuses.

Some survey participants did not provide information on the level of bonuses in each year. In these cases, two alternative assumptions were used to calculate the change in total compensation. The first series for total compensation, TC_1, assumes there is *no change* in the level of bonuses in 1996 if an organization did not provide an explicit response for the level of bonuses in either 1995 or 1996. Since some of the missing observations are probably cases where there was no bonus pay, TC_1 will understate the frequency of reductions in the total compensation at firms in the sample. The second series for total compensation, TC_2, assumes that the *level* of bonus payments is equal to zero whenever no explicit response for bonus payments was made by the survey respondent. Relative to TC_1, the series for TC_2 will show greater variation in bonus payments and, therefore, a greater number of reductions in compensation. The actual frequency of rollbacks probably lies between the frequencies calculated from TC_1 and TC_2.

In addition to the observations shown in Table 5, there were 25 observations for which no response was provided for the change in base salary in 1996, although a bonus was reported in at least one of the years 1995 and 1996. Of these 25 additional observations, most (18) involved management occupations. These cases are discussed later.

Base salaries

Table 5 shows that freezes in the base salary were most common for hourly paid employees (9.8 per cent) and for senior management

17. Survey results for earlier years were not stored in a way that would allow a given organization's responses in consecutive years to be easily compared.

18. The average number of observations for the six individual occupational categories is approximately 100 because some participants did not report wage data for each category. With two exceptions, the sample is from the private sector.

Table 5

Incidence of Wage Freezes and Rollbacks, by Occupational Groups, 1996

Occupational group	Number of observations	Freezes			Rollbacks		
		Base salary	TC_1	TC_2	Base salary	TC_1	TC_2
		per cent					
Management							
Senior management	105	11.4	5.7	4.8	0.0	18.1	34.3
Middle management	109	5.5	3.7	1.8	0.0	12.8	28.4
Supervisors	103	5.8	2.9	1.9	0.0	10.7	22.3
Non-management							
Professional and technical	109	6.4	5.5	4.6	0.0	7.3	21.1
Clerical and administrative	111	6.3	2.7	2.7	0.0	3.6	7.2
Hourly	82	9.8	6.1	7.3	0.0	1.2	7.3
Total[a]	619	7.4	4.4	3.7	0.0	9.2	20.5

a. Entries are the percentage of observations reporting a freeze or rollback, not the percentage of employees subject to either.

Source: Sobeco Ernst and Young, unpublished data.

(11.4 per cent). The average across all occupations was 7.4 per cent. There were no decreases in the base salary.

Among those organizations with at least 500 employees, the incidence of freezes in the base salary was 6.6 per cent in the Sobeco sample (see Table 6). For comparison, 18 per cent of the large private sector contracts in the wage settlements data base examined in Section 1 had a freeze in the base salary in 1996 using the year-over-year definition. Since the Sobeco data include both union and non-union firms, while the wage settlements data are restricted to union agreements, the difference in results may indicate that freezes were less common in the non-union sector.

Total compensation

Both measures of total compensation suggest that base salaries overstate the downward rigidity of overall wage costs. Before discussing the individual occupational groups, we comment briefly on the entire sample (the final row in Table 5). The incidence of freezes in the total sample falls from 7.4 per cent to the 4 per cent range when the effects of variable pay are considered using the data for TC_1 and TC_2. More dramatic changes are observed for the proportion of rollbacks, which increases from 0 per cent in

Table 6

Incidence of Wage Freezes and Rollbacks, by Size of Firm, 1996

Firm size[a]	Number of Observations	Freezes			Rollbacks		
		Base salary	TC_1	TC_2	Base salary	TC_1	TC_2
		per cent					
1-499	330	8.2	5.5	4.8	0.0	9.1	22.1
1-99	88	10.2	10.2	10.2	0.0	11.4	21.6
100-499	242	7.4	3.7	3.1	0.0	8.3	22.3
≥ 500	289	6.6	2.9	2.8	0.0	9.0	18.7
Total[b]	619	7.4	4.4	3.7	0.0	9.0	20.5

a. Total employment of firm.
b. Entries are the percentage of observations reporting a freeze or rollback, not the percentage of employees.

Source: Sobeco Ernst and Young, unpublished data.

the base salary measure to approximately 10 per cent and 20 per cent for the two measures of total compensation.

The totals in Table 5 represent the proportions of the 619 observations subject to freezes and rollbacks. The proportion of *employees* receiving freezes or rollbacks cannot be reported because the Sobeco survey does not record separate employment numbers for the six occupational categories. Since rollbacks are more common for management employees, and these occupations represent approximately 20 per cent of total employment in the sample, the proportion of employees receiving rollbacks is lower than the levels reported in the final row of Table 5. Nevertheless, more detailed examination of the individual occupations reinforces the view that total compensation is significantly more flexible than are base salaries. For each occupation, there is greater dispersion in the distribution for the change in total compensation than for the change in base salary. Decreases in total compensation occur for each occupational group, and there are fewer freezes in total compensation than in base salaries.

Hourly paid employees have the highest incidence of freezes and the lowest incidence of reductions in total compensation.[19] However, even for this group, the base salary understates wage flexibility. The number of wage freezes decreases when variable pay is considered, and the proportion of rollbacks reaches 7 per cent with the TC_2 measure of total compensation.

19. The questionnaire defines “hourly employees” as those employed in production, maintenance, or warehouse activities, usually paid at an hourly rate.

Decreases in total compensation are more common than freezes for each of the other occupational groupings. The proportion of rollbacks ranges from 3.6 to 18.1 per cent for the measure of total compensation (TC_1) that understates the number of rollbacks. Rollbacks are more common for the higher-paid groupings, consistent with the greater relative importance of variable pay for these groups. One implication of this result is that wage costs may become more flexible in the future if the rising trend for the relative share of variable pay continues.

As mentioned above, 25 additional observations gave no response for the question on the change in base salary in 1996, although a bonus level was reported in at least one year. If these observations are added to the sample, and any non-responses for the change in base salary or the level of the bonus are assumed to be zero, there are an additional eight freezes and 13 rollbacks in the TC_2 measure of total compensation. The frequencies of freezes and rollbacks in TC_2 rise slightly to 4.8 and 21.7 per cent, respectively.

Table 6 reports results by firm size. The frequencies of both freezes and rollbacks are marginally greater among organizations with fewer than 500 employees. However, for all firm sizes, when variable compensation is considered the proportion of rollbacks is considerably greater than the proportion of freezes.

This suggests that the wage settlements data tend to understate the flexibility in total labour costs. The greater flexibility in the measure of total compensation occurs either because firms would rather cut bonuses than base salaries, or because firms giving bonuses need not rely on cuts in the base salary when there are pressures to reduce wage costs.

3.3 Effects of firm size and union status

The Alliance of Manufacturers and Exporters Canada conducts a survey of its members to collect information on the level of wages for narrowly defined occupational categories, both hourly paid and salaried (referred to herein as the Alliance data set). The wage variable for hourly paid employees is the straight-time hourly wage rate exclusive of any variable compensation. Since this survey covers firms of all size ranges and includes both union and non-union firms, it should provide some insight into the effects of union status and firm size on the flexibility of the general wage structure within firms.

We analysed data for the percentage change in wage rates for hourly paid employees at a subset of 111 firms in the Alliance data set. Broadly consistent with the composition of employment shown in Table 3, the sample of firms is heavily weighted towards the non-union sector and towards firms

with fewer than 500 employees.[20] Each firm could report up to five wage categories for each hourly paid occupation. In total, the sample includes 589 observations for the year-over-year percentage change in wage categories at the 111 firms in 1996.[21] Table 7 shows the incidence of freezes and rollbacks according to union status and firm size for the 589 wage categories. Table 8 reports a similar breakdown by the number of employees (firm size).

Unconditional tests based on the frequencies of freezes and rollbacks suggest that downward wage rigidity is greater at unionized firms than at non-unionized firms in the manufacturing sector. Freezes in the base wage rate were received by 6.3 per cent of all unionized employees, compared with only 1.8 per cent of non-unionized employees (Table 8). The proportion of unionized employees with rollbacks (3.5 per cent) was about half that reported in the non-unionized sector (7.5 per cent).

The number of firms with more than 500 employees is quite small (11) in the Alliance data base reported in Tables 7 and 8.[22] However, comprehensive coverage of wage changes at large (unionized) firms is provided by the wage settlements data base examined in Section 1. Thus, we combine the wage settlements and the Alliance data to examine the relationship between firm size and the frequencies of freezes and rollbacks in the manufacturing sector.

The Alliance data are consistent with the wage settlements data in showing that rollbacks are relatively infrequent at the large unionized firms (Table 8). The proportion of employees with rollbacks rises from about 2 per cent for all large firms to 6 per cent for the middle category of firms and to almost 20 per cent for the smallest firms.

Turning our attention to wage freezes, approximately 9 per cent of workers at firms with fewer than 500 employees experienced a freeze, while no employees had a freeze at the 11 firms with more than 500 employees in the Alliance data set. However, the incidence of freezes is similar across

---

20. The sample includes 41 unionized firms and 70 non-unionized firms in the manufacturing sector. Approximately 50 per cent of all firms had fewer than 100 employees, while 10 per cent had 500 or more employees. Since the questionnaire records information on the level of wages in each year, and the analysis focusses on wage changes, the sample is restricted to firms that responded to the survey in consecutive years. Wage changes are available only for 1996 because the data base did not record identifier numbers for firms before the 1995 survey.

21. In some cases, a firm reported a different number of wage categories for a given occupation in 1995 and 1996. These cases were excluded from the final sample of 589 observations. The wage change variable reported in Tables 7 and 8 is comparable to the year-over-year definition in the wage settlements data.

22. There are six unionized firms and five non-unionized firms with at least 500 employees.

Table 7

Percentage of Wage Categories with a Freeze or Rollback, 1996

Firm size[a]	Number of firms reporting	Wage categories	Freeze			Rollback		
			Union	No union	All firms	Union	No union	All firms
					per cent			
1-100	56	246	16.7	9.3	11.8	6.0	19.1	14.6
101-500	42	224	20.3	9.4	15.2	5.9	11.3	8.5
> 500	11	105	0.0	0.0	0.0	5.4	16.7	8.7
All sizes	109[b]	589[b]	13.1	8.3	10.7	5.5	16.7	11.2

a. Total number of employees of firm.
b. Two firms out of the original 111 surveyed did not report their employment levels.

Source: Alliance of Manufacturers and Exporters Canada, unpublished data.

Table 8

Percentage of Employees with a Freeze or Rollback, 1996

	Freeze			Rollback		
Firm size[a]	**Union**	**No union**	**All firms**	**Union**	**No union**	**All firms**
			per cent			
1-100	18.3	5.9	9.5	5.2	24.9	19.2
101-500	16.5	1.7	8.6	8.8	3.5	6.0
> 500	0.0	0.0	0.0	1.1	2.3	1.7
All sizes[b]	6.3	1.8	4.1	3.5	7.5	5.4

a. Total number of employees of firm.
b. Two firms out of the original 111 surveyed did not report their employment levels.

Source: Alliance of Manufacturers and Exporters Canada, unpublished data.

firm sizes when the wage settlements data are used to measure the incidence of freezes at larger firms.[23]

In conclusion, the incidence of rollbacks is greater for small firms, whereas the incidence of freezes is similar across firm sizes. Employees at firms with fewer than 100 employees in the Alliance data set were more than twice as likely to have a wage cut as a wage freeze. On balance, the evidence from these unconditional tests suggests that downward nominal wage rigidity is less common at smaller firms.

3.4 Industry survey

The Bank of Canada surveyed wage practices as part of its program of industry visits in October 1996.[24] Employers were asked if they had implemented a wage freeze or a rollback at any time. Of the 62 responses, 43 employers had unionized workers. Approximately 95 per cent of the survey participants were from the private sector. The final row in Table 9 shows that 24 per cent of the total sample (15 of 62 participants) reported a wage rollback at some time. Half of the employers indicated that they had implemented a wage freeze at some time.

When a participant reported that a wage freeze had been implemented, a follow-up question asked which of three scenarios best

23. No freezes occurred at the six unionized firms with at least 500 employees in the Alliance data set, whereas 7.3 per cent of the contracts in the wage settlements data base from the manufacturing sector contained a freeze in 1996 (year-over-year definition).

24. The organizations included in the industry visits were chosen (before it was decided to undertake the wage survey) as being representative of the major industries in each of four regions: western Canada, Ontario, Quebec, and the Atlantic provinces.

Table 9

Per Cent of Employers with Wage Rollbacks and Freezes

Type of employer	Number of firms	Per cent with rollbacks[a]	Per cent with freezes: All reasons[b]	Due to "menu costs"[c]	Existing wage still appropriate[d]	Due to downward rigidity[e]
Unionized	43	23	58	7	26	30
Non-unionized	19	26	32	0	11	16
All employers	62	24	50	5	21	26

a. "Has your firm ever reduced the hourly wage rate (either across-the-board for all employees or for specific job categories)?"
b. "Has your firm ever instituted a general wage freeze for a period of 12 months or more?"
c. "Conditions may have justified a small wage increase (less than 1 per cent), but it was not worthwhile to make such small adjustments to wages in that year."
d. "The previous level of the wage rate was still appropriate given the current conditions."
e. "There were underlying pressures for a decrease in the wage rate, but the firm was unwilling or unable to reduce wages (perhaps out of concern about potential effects of a wage cut on the morale of employees)."

described the conditions facing the firm when the freeze was instituted: (1) conditions may have justified a small wage increase (less than 1 per cent), but it was not worthwhile to make such small adjustments to wages in that year (this scenario was intended to capture the potential effect of menu costs on the observed number of small wage increases);[25] (2) the previous level of the wage rate was still appropriate, given the current conditions; or (3) there were underlying pressures for a decrease in the wage rate, but the firm was unwilling or unable to reduce wages.

Approximately half the reported freezes were attributed to downward nominal rigidity. Since about half the firms reported that they had implemented a wage freeze, this means that about one-quarter of all the employers surveyed reported that a nominal wage floor had constrained their wage setting at some time (the final column of Table 9). The other two explanations for wage freezes—menu costs and "no need for wage adjustments"—were cited by survey participants as often as downward nominal wage rigidity.[26]

25. The number reported for menu-cost effects in Table 9 may understate the total effect of menu costs, since such costs may also have reduced the number of small wage *decreases*.

26. Note that the total frequency of wage freezes in the column headed "All reasons" is not identical to the sum of the individual explanations for freezes (the last three columns) because a few employers with freezes reported more than one (or no) explanation. Multiple responses are valid if the employer instituted a wage freeze more than once.

The incidence of freezes was much higher for employers with unionized workers than for those without any unionized workers (58 per cent versus 32 per cent).[27] Similarly, employers in unionized firms were almost twice as likely as those in non-unionized firms to report that nominal wage floors had caused them to implement wage freezes (30 per cent versus 16 per cent). If the samples are representative, this difference suggests that downward nominal wage rigidity is less pronounced in the non-union sector. This conclusion is consistent with the evidence reported in Subsection 3.3 for the manufacturing sector.

The numbers reported in Table 9 are based on the answers to the formal questions in the survey. In some cases, the survey participants provided additional comments indicating that the survey responses may understate the flexibility in the wage structure. The management of one firm reported a wage freeze (in terms of the base wage) that it attributed to downward nominal rigidity, but then indicated that various concessions had resulted in a 20 per cent cut in the effective wage rate.[28] Another employer reported that there had been no wage cuts, although lower-paid workers were providing some services as a result of "contracting-out." In other cases, by contrast, the survey answers summarized in the table may overstate the flexibility of wage rates; for example, one employer reported a wage cut that was limited to management.

It is interesting to note that the frequency of wage cuts in the Canadian survey reflects the findings of similar U.S. surveys. Bewley and Brainard (1993) reported that in a survey of 61 firms, 11 of them (18 per cent) had implemented wage cuts at some time. Blinder and Choi (1990) found a similar incidence of wage cuts (26 per cent) in their small-scale survey of firms.

3.5 Summary

Table 10 summarizes the main conclusions we draw from the three alternative data sources discussed in this section. Although many organizations do not provide cash bonuses to all employees, there is evidence that variable compensation contributes strongly to wage flexibility in the overall

---

27. The measured incidence of freezes at unionized firms is higher in this survey than in the wage settlements data, which is not surprising given that the survey question did not constrain the time horizon to any particular period (it asked if there had *ever* been a freeze lasting 12 months or more).

28. Another firm that reported a wage freeze it attributed to downward nominal rigidity revealed that the existing wage rate had been only "a little too high" and that the freeze covered only the first year of a contract, with wage gains of 1 per cent and 1.5 per cent in the second and third years. Under these circumstances, it is unlikely that the reported wage freeze had significant effects on the firm.

Table 10

Summary of Observations from the Three Data Sources

Characteristic	Sobeco Ernst and Young	Alliance of Manufacturers and Exporters	Bank of Canada
Variable pay	Fewer freezes and significantly more rollbacks for the change in total compensation than for the change in base salary	—	—
Union status	Explicit comparisons not possible for union versus non-union firms, but freezes in the base wage at larger firms are less common in Sobeco data than in wage settlements data	Fewer freezes and more rollbacks in the base wage rate at non-unionized organizations	Fewer freezes and more rollbacks in the base wage rate at non-unionized organizations
Firm size	For each firm size, rollbacks are more common than freezes when variable compensation is considered	Rollbacks in the base wage most common at smaller firms, particularly in the non-union sector	—

wage structure at all firm sizes. We also observe more rollbacks, but fewer freezes, at non-unionized organizations. It is difficult to know how representative some of these data sources are. Nevertheless, although each source provides data that tell only part of the story, together they suggest that the wage settlements data for large union contracts understate the overall flexibility in wage costs at the aggregate level.

Conclusions

The proportion of contracts with wage freezes reached its highest levels during the low-inflation years of the 1990s. Since the mean of the wage-change distribution varies with the rate of inflation, however, we should in any case expect to see a large proportion of contracts with wage changes close to 0 per cent during low-inflation periods. The important question is the extent to which downward rigidity contributes to the observed density at zero (what we have termed earlier "excess density"). Preliminary results from a hazard model suggest that the *upper bound* for

the effect of rigidity on the proportion of freezes in the base salary in large unionized contracts is in the range of 10 to 15 percentage points (based on a comparison of inflation rates of 2 per cent and 6 per cent). We hope to obtain a more precise estimate of excess density in future work by constructing a more explicit counterfactual distribution to represent the distribution that would have been observed in the absence of downward rigidity. Further work will also investigate the effects of adding more explanatory variables to the hazard model.

The relatively low number of rollbacks in the wage settlements data is often used as evidence that nominal wage rates are quite rigid downward in Canada. Analysis of the Sobeco data would lead us to draw similar conclusions if we focussed only on changes in the base salary, since there was not a single decrease in the nominal wage rate in that sample. We must draw very different conclusions, however, when we examine broader wage measures. The proportion of wage cuts rises from 0 per cent under the base salary measure to approximately 10 per cent and 20 per cent for the two measures of total compensation that include cash bonuses. The greater flexibility in the measure of total compensation occurs either because firms would rather cut bonuses than base salaries, or because, when pressured to reduce total wage costs, firms giving bonuses need not rely solely on cuts in the base salary.

This paper reports evidence from various data bases that cover organizations of all sizes and both the union and non-union sectors, in contrast to the wage settlements data. On balance, the evidence suggests that the wage settlements data overstate downward rigidity in the total economy, since variable compensation is a significant source of flexibility, and base wage rates appear to be more flexible in the non-union sector and at smaller firms.

Other sources of flexibility were not examined in this study. For example, non-wage benefits can be adjusted, and changes in union agreements may provide for improvements in productivity while maintaining the original level of the base wage. Future research could examine whether the employment effects of wage rigidity at individual firms are mitigated if the unemployed in rigid-wage sectors move into more flexible sectors.

References

Akerlof, G. A., W. T. Dickens, and G. L. Perry. 1996. “The Macroeconomics of Low Inflation.” *Brookings Papers on Economic Activity* (1): 1-76.

Bewley, T., and W. Brainard. 1993. “A Depressed Labor Market, as Explained by Participants.” Unpublished.

Blinder, A. S., and D. H. Choi. 1990. “A Shred of Evidence on Theories of Wage Stickiness.” *Quarterly Journal of Economics* 105 (November): 1003-15.

Card, D., and D. Hyslop. 1996. “Does Inflation ‘Grease the Wheels of the Labor Market’?” NBER Working Paper No. 5538. National Bureau of Economic Research, Cambridge, Mass.

Crawford, A., and M. Kasumovich. 1996. “Does Inflation Uncertainty Vary with the Level of Inflation?” Working Paper No. 96-9. Bank of Canada, Ottawa.

Crossley, T., A. Harrison, and M. Ljutic. 1996. “The Determinants of Contract Length.” Unpublished, September. McMaster University.

Donald S. G., D. A. Green, and H. J. Paarsch. 1995. “Differences in Earnings and Wage Distributions Between Canada and the United States: An Application of a Semi-Parametric Estimator of Distribution Functions with Covariates.” Discussion Paper No. 95-34. University of British Columbia, Vancouver.

Fortin, P. 1996. “The Great Canadian Slump.” *Canadian Journal of Economics* 29(November): 761-87.

———. 1997. “Monetary Policy and the Unemployment Target.” Paper prepared for the panel on Monetary Policy and Inflation Targets at the annual conference of the Canadian Association for Business Economics, “*The Economic Outlook and Macroeconomic Policies: When Will We Get the Benefits of Lower Inflation?*” 20-21 March, Ottawa.

Green, D., and H. Paarsch. 1996. “The Effect of the Minimum Wage on the Distribution of Teenage Wages in Canada.” Unpublished, August. University of British Columbia.

Harrison, A. 1996. “Contracts and Strikes in Canada, 1952-1988.” *Canadian Journal of Economics* 29 Sp. Iss. Part 1 (April): S76-83.

Hogan, S. 1997. “What Does Downward Nominal-Wage Rigidity Imply for Monetary Policy?” Working Paper No. 97-13. Bank of Canada, Ottawa.

Human Resources Development Canada. *Major Wage Settlements*. Quarterly publication, various issues.

———. *Wage Settlements Bulletin*. Monthly publication, various issues.

McLaughlin, K. J. 1994. “Rigid Wages?” *Journal of Monetary Economics* 34 (December): 383-414.

Schultze, C. L. 1959. *Recent Inflation in the United States*. Study Paper No. 1, prepared for the Joint Economic Committee of the U.S. Congress. Washington, D.C.: U.S. Government Printing Office.

Sobeco Ernst and Young. *Compensation Trends and Projections*. Various issues.

Statistics Canada. 1996. “Transition in the Labour Force.” *Labour and Income Dynamics* 5 (June): 1-6.

Tobin, J. 1972. “Inflation and Unemployment.” *American Economic Review* 62 (March): 1-18.