COST-OF-LIVING ESCALATORS IN MAJOR UNION CONTRACTS

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This paper analyzes the price-indexation provisions of a sample of major Canadian collective bargaining agreements concluded between 1968 and 1975. Under these contracts, escalated wage increases comprised about one-third of total wage increases and represented a major source of erosion in the relative wages of skilled workers. The author argues that indexation provisions are usefully characterized by the marginal elasticity of the contractual wage rate to increases in prices. Measures of this responsiveness indicate that, on average, contractual wage rates are only slightly less than unit elastic with respect to price increases. There is considerable variation across industries, however, in the extent to which wages respond to price changes.

WAGE-INDEXATION provisions are contained in a substantial portion of major union contracts.[1] Cost-of-living escalators are therefore an important determinant of the evolution of wages at the contract level and of the behavior of aggregate wages.[2] One interpretation of the role of cost-of-living wage increases in long-term contracts is that they protect the real value of the wage package negotiated at the start of the contract.[3]

This interpretation, however, immediately raises two questions: why are the noncontingent wage increases announced in some indexed contracts so large, and why are the wage gains attributed to indexation over the life of the contract so low, relative to price increases over the same period? For

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[1]In November 1980, 38 percent of major collective bargaining agreements included cost-of-living-adjustment formulas. Since escalation provisions are more common among larger agreements, the fraction of workers covered by major agreements whose wages were subject to indexation was 57 percent. See Douglas R. LeRoy, "Scheduled Wage Increases and Cost of Living Provisions in 1981," *Monthly Labor Review,* Vol. 104, No. 1 (January 1981), pp. 6-12.

[2]The role of indexation provisions in the erosion of relative skill differentials in the steel industry is emphasized in Jack Stieber, "Steel," in Gerald Somers, ed., *Collective Bargaining: Contemporary American Experience* (Madison, Wis.: Industrial Relations Research Association, 1980), pp. 151-208. The impact of wage escalators on the adjustment of the economy to real and nominal shocks is analyzed in Stanley Fischer, "Wage Indexation and Macroeconomic Stability," in K. Brunner and A. Meltzer, eds., *Stabilization of the Domestic Economy and International Economy,* Carnegie-Rochester Conference on Public Policy No. 5 (Amsterdam: North-Holland, 1977), and in JoAnna Gray, "Wage Indexation: A Macroeconomic Approach," *Journal of Monetary Economics,* Vol. 2, No. 3 (April 1976), pp. 221-36.

[3]This interpretation probably originated in discussions of the earliest escalated contracts in the automotive industry. See Joseph W. Garbarino, *Wage Policy and Long Term Contracts* (Washington, D.C.: The Brookings Institution, 1962), pp. 19-20.

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example, the ratio of escalated wage increases to the percent increase in prices over the life of the contract is typically one-half or less.[4] At the same time, a comparison of indexed and nonindexed contracts reveals only small differences between the size of noncontingent increases announced at the signing dates of the two types of contracts.[5]

This paper argues that both questions are easily answered once the substitutability of contingent and noncontingent wage increases is recognized. A new set of measures of the responsiveness of indexed wage changes to concurrent price changes is then constructed for a sample of Canadian labor contracts. These measures reveal two important facts about cost-of-living escalation provisions in long-term contracts. First, the marginal elasticity of wages with respect to prices is much higher than indicated by previous studies.[6] Second, there are significant differences in the responsiveness of escalated wage increases to price increases across different industries. Both findings are potentially important in understanding the microeconomic and macroeconomic implications of indexation.

Characteristics of Indexation Provisions

Indexation provisions in long-term union contracts share a number of common features. First, in a substantial number of indexed contracts, the escalation formula is restricted in some way: either by limiting the range of prices over which the escalator is operative or by specifying a maximum or minimum wage change to result from price escalation. Table 1 reports the incidence of these kinds of restrictions in a sample of 281 major Canadian contracts written between 1968 and 1975.[7] For comparative purposes, the table provides detail by year of settlement, industry, and union.

One widespread restriction is the specification of a maximum absolute escalated wage increase. Provisions of this nature were included in 35 percent of the contracts and turned out to place a limit on the size of cost-of-living wage increases in 91 percent of cases. Although the proportion of contracts with ceilings (or caps) on escalation increases shows some variation over time and across industries, the proportion of cap provisions that actually limited contingent wage increases ex post facto was fairly stable. Caps were less common among nonmanufacturing contracts and among contracts signed by the United Automobile Workers (UAW). They were more common in the basic iron and steel industries and among contracts signed by the United Steelworkers (USW).

Provisions to delay the start of escalation until the second or third year of the contract are also widespread. Restrictions

[4]For major U.S. union contracts written between 1968 and 1975, the average ratio of escalated wage increases to realized price increases over the life of the contract was .49. See H.M. Douty, "Cost of Living Escalator Clauses and Inflation," Council on Wage and Price Stability staff report (Washington, D.C.: COWPS, August 1975), Table 8. Among major contracts signed in 1977, this ratio was .57. See Victor Sheifer, "Cost of Living Indexation: Keeping Up with Inflation?" *Monthly Labor Review,* Vol. 102, No. 6 (June 1979), pp. 14-17.

[5]Douty, "Cost of Living Escalator Clauses," Table 12, pp. 37, compares the levels of noncontingent increases announced in escalated and nonescalated contracts signed in 1973 and 1974. For indexed contracts negotiated in 1974, the average annual rate of increase in wages announced at the signing of the contract was 9.6 percent. For nonindexed contracts, this increase was 10.2 percent. Similar findings for Canadian contract data are reported in David A. Wilton, "An Analysis of Canadian Wage Contracts with Cost of Living Allowance Clauses," Economic Council of Canada Discussion Paper No. 165 (Ottawa: ECC, March 1980).

[6]Previous empirical analyses of escalation provisions have suggested that wages rise about one-half percent for each one percent increase in prices. See Douty, "Cost of Living Escalator Clauses," or Wilton, "An Analysis of Canadian Wage Contracts."

[7]In Canada, major contracts include those with 500 or more employees. From January 1968 to the imposition of wage and price controls in October 1975, there were 1,405 major contracts signed in the private sector. Among these, 385 contracts contained some form of cost-of-living-allowance clause. Excluding contracts with only noncontingent cost-of-living allowances and contracts with incomplete information reported in the appropriate issue of Labor Canada, *The Collective Bargaining Review* (Ottawa: The Queen's Printer, various years), generates a sample of 281 contracts. This sample is a strict subset of the 328 escalated contracts analyzed in Wilton, "An Analysis of Canadian Wage Contracts." I am grateful to David Wilton for supplying the relevant pages of *The Collective Bargaining Review.*

Table 1. Incidence of Selected Restrictions.

Subsample	Number of Contracts	Percentage of Contracts in the Subsample With: Caps	Percent of Caps Binding†	Time Delay	Trigger	Early Stop Date
All Contracts	281	35.2	90.9	35.1	12.8	22.8
By Year						
1968	12	55.5	60.0	22.2	11.1	11.1
1969	12	58.3	85.7	41.7	8.3	75.0
1970	22	54.5	83.3	50.0	9.1	31.8
1971	30	23.3	100.0	33.3	6.7	20.0
1972	16	62.5	100.0	31.2	0.0	31.2
1973	32	40.6	100.0	43.8	9.4	21.9
1974	93	29.0	92.6	31.2	21.5	20.4
1975	64	23.4	86.7	35.9	10.9	14.0
By Union						
UAW	70	21.4	80.0	18.6	10.0	10.0
USW	54	53.7	100.0	40.7	0.0	25.9
Other Unions	157	35.0	89.1	40.8	18.5	27.4
By Industry						
Manufacturing	202	38.1	89.6	32.2	8.9	19.6
Food Products	19	42.1	100.0	47.4	15.8	31.6
Automotive	45	22.2	90.0	24.4	8.8	17.8
Iron and Steel	30	63.3	89.5	26.7	0.0	36.7
Electrical Equipment	33	48.5	93.7	66.7	9.1	15.2
Nonmanufacturing	79	27.8	95.4	43.0	22.8	31.6

†Percentage of contracts with caps in which contingent wage adjustment was halted before the end of the contract because the cap was met.

Source: The data are based on individual contract extracts reported in various issues of Labor Canada, *The Collective Bargaining Review* (Ottawa: The Queen's Printer, various years).

of this kind were included in 35 percent of the contracts overall, although in only 19 percent of the contracts signed by the UAW. In contrast to a specific time delay in the start of indexation, some escalation clauses base index-linked wage adjustments on the increase in prices over and above a preannounced trigger price level.[8] Trigger prices were specified in 13 percent of the contracts overall, although in relatively fewer manufacturing contracts and in none of the contracts in the basic iron and steel industries.

In yet another indexation scheme, index-linked wage increases continue only partway through the contract. According to this scheme, escalated wage increases are based on increases in the price level up to some date preceding the end of the contract. Overall, 23 percent of the contracts specified such a final date for calculation of contingent wage increases.[9] Provisions of this kind were relatively common in nonmanufacturing indus-

[8]Among contracts with triggered escalation clauses, the average markup of the trigger price level over the signing-date price level was 8.3 percent.

[9]Each cost-of-living-allowance clause specifies a review period for recalculation of the contingent wage adjustment. With a quarterly review, for example, the cost-of-living wage allowance is adjusted every three months in response to price developments over the preceding quarter. Typically, there is no provision for recalculating the wage adjustment at the end of the last review period in the contract. While there is some ambiguity in the contract abstracts reported in *The Collective Bargaining Review,* contracts are classified as having an early stop date only if the escalation provisions explicitly stop *before* what would otherwise be the last review period.

Table 2. Components of Changes in Base Wage Rates.

Subsample	*Percent Increase in Wages Resulting from:* Noncontingent Nondeferred	Noncontingent Deferred	Contingent Deferred	*Shares of Contingent Increases in:* Total	Deferred	*Ratio of Wage Increases to Price Increases for:* Noncontingent Deferred	Contingent Deferred
All Contracts	6.39	5.16	5.25	30.9	46.6	.58	.54
By Year							
1968	2.16	3.58	1.80	25.2	41.1	.88	.43
1969	4.11	4.24	1.13	12.0	20.2	1.04	.30
1970	4.99	4.42	2.05	18.5	31.4	.97	.45
1971	2.97	4.15	5.27	41.6	53.7	.48	.62
1972	3.83	3.74	3.85	29.1	41.5	.32	.33
1973	4.31	4.58	5.71	37.2	50.4	.37	.49
1974	7.63	5.75	6.35	33.3	49.3	.51	.58
1975	9.61	6.16	6.32	28.5	50.2	.61	.62
By Union							
UAW	2.83	3.64	6.61	48.6	61.4	.48	.74
USW	7.16	5.04	4.96	25.3	41.3	.56	.46
Other Unions	7.72	5.88	4.76	24.9	41.6	.63	.48
By Industry							
Manufacturing	5.43	4.77	5.32	33.6	48.9	.55	.56
Food Products	6.35	5.67	3.61	21.7	37.5	.62	.36
Automotive	3.08	3.91	5.86	44.3	56.5	.48	.64
Iron and Steel	5.25	4.34	3.81	25.2	39.9	.58	.42
Electrical Equipment	6.27	4.91	4.36	27.4	44.2	.57	.47
Nonmanufacturing	8.86	6.16	5.09	24.0	40.5	.66	.48

tries and basic iron and steel industries and relatively uncommon among UAW contracts.

A second aspect of many indexed labor contracts is the presence of substantial noncontingent wage increases. Among major U.S. contracts negotiated between 1968 and 1974, Douty found that the proportion of total realized wage increases resulting from escalation never exceeded 20 percent.[10] Table 2 reports average contingent and noncontingent increases in the base wage rate over the life of the contract for the Canadian contract sample.[11] Noncontingent increases are broken out into two components: increases taking effect at the start of the contract and deferred increases. Also reported are the proportion of contingent increases to total increases over the life of the contract and the proportion of contingent increases to total deferred increases. Finally, in an analysis of the impact of deferred components on real wage changes, total contingent increases and noncontingent deferred increases are expressed as fractions of the percent increases in prices during the contract period.

For the sample as a whole, the average annual rate of increase of base wage rates over the life of the contract was 16.8 percent.[12] This number reflects in part the

[10]Douty, "Cost of Living Escalator Clauses," Table 9, p. 31.

[11]The base rate is the wage rate of the lowest-paid workers in the bargaining unit and typically reflects the wage rate of janitors and cleaners in manufacturing contracts. A breakdown of the relative components of wage change for other rates in the contract would be roughly similar, although only base wage rates and the highest contractual wage rate are available for most of the contracts in the sample.

[12]Wilton, "An Analysis of Canadian Contract Data," Table 7, p. 19, reports average annual percentage

high rate of inflation experienced in Canada during the sample period, in part the significant growth of real base wage rates during the period, and in part the large "catch up" increases awarded in many contracts signed in the later years of the sample period. Slightly more than one-third of nominal wage increases took the form of increases effective at the signing date of the contract, whereas a slightly smaller share of increases were in the form of noncontingent deferred increases. Averaged over all contracts, the share of wage increases resulting from contingent escalation increases was about one-third; but the relative shares of contingent and noncontingent increases shows some significant variability by union and by industry. In particular, in contracts in the automobile parts and assembly industries, and in contracts signed by the UAW, the share of total increases resulting from contingent increases is relatively high.

The last two columns of Table 2 indicate the percent increase in wages resulting from noncontingent deferred increases and realized contingent increases, respectively, as fractions of the percent increase in prices over the contract period.[13] For the sample as a whole, these two fractions sum to about 1.1. On average, total deferred increases maintained and in fact increased the real value of the wage increases incorporated at the signing date of the contract. Further, although the values of the two fractions show considerable dispersion by industry and by union, their sum is less variable, suggesting that the two forms of deferred increases can be viewed as alternative means of offsetting price increases over the life of the contract.[14] Although different unions and different industries rely to a greater or lesser extent on contingent or noncontingent deferred increases, the net effect of total deferred increases is more nearly constant.

A third common feature of many indexed contracts is the provision for a fixed, absolute increment to each worker's wage in response to a given absolute increase in the price level. In fact, 94 percent of the contracts in the sample specified escalation formulas of this type.[15] Indexation rules that translate absolute price increases into absolute wage increases have two important properties. On the one hand, since they generate the same cost-of-living adjustment for all wage rates in the contract, the proportional increase in the unskilled wage rate exceeds the proportional increase in the skilled wage rate. This in turn implies that skill differentials will be steadily eroded during the course of indexation.[16] On the other hand, escalation formulas that link absolute wage increases to absolute price increases do not exhibit a constant proportional responsiveness of wages to prices during the course of indexation.[17]

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increases in the base wage rates of major *nonescalated* contracts signed from 1968 to 1975 as follows: 1968, 7.2 percent; 1969, 8.0 percent; 1970, 8.3 percent; 1971, 8.1 percent; 1972, 9.6 percent; 1973, 11.1 percent; 1974, 14.6 percent; 1975, 17.7 percent. His figures for the escalated contracts (based on a slightly larger sample than the one in this paper) are very similar to the figures obtained by summing the first three columns of Table 2 by year. Apparently, workers in escalated contracts fared somewhat better than their counterparts in nonescalated contracts throughout the sample period.

[13]In these two columns only, deferred noncontingent and contingent increases are expressed as percentages of the base wage rate at the start of the current contract, rather than the base wage rate at the end of the previous contract.

[14]Of course, noncontingent deferred increases may play other roles in the contract. For example, most of the automobile assembly contracts in the sample included across-the-board noncontingent deferred increases of 3 percent per year, presumably to reflect desired real wage growth in response to improving productivity.

[15]Douty, "Cost of Living Escalator Clauses," p. 41, suggests that the relative share of nonproportional escalation clauses among major U.S. contracts remained constant at about 95 percent from 1963 to 1975.

[16]In his 1963 study, Garbarino, *Wage Policy and Long Term Contracts,* p. 94, remarked that this aspect of escalation clauses confounded their successful application in the iron and steel industry. More recently, Stieber, "Steel," p. 193, has noted that the steel industry skill differentials were heavily eroded by cost-of-living wage increases awarded between 1971 and 1977. Nonproportional indexation provisions have also been identified as one source of the discontent among the skilled trades within the UAW. See Robert M. MacDonald, *Collective Bargaining in the Automobile Industry* (New Haven, Conn.: Yale University Press, 1963), pp. 150-52.

[17]A nonproportional indexation formula gives the wage rate as the sum of the noncontingent wage (w_n) and a cost-of-living increment that is proportional to

Table 3. Components of Relative Wage Changes.

Subsample	Percent Change in Relative Wage Resulting from: Noncontingent Nondeferred Increases	Noncontingent Deferred Increases	Contingent Deferred Increases	Total Increases
All Contracts	−0.73	−0.62	−1.40	−2.74
By Year				
1968	−1.02	−0.24	−0.35	−1.61
1969	0.40	−0.20	−0.34	−0.14
1970	−0.77	−0.27	−0.61	−1.65
1971	−0.48	−0.57	−1.49	−2.54
1972	−0.59	−0.29	−0.94	−1.82
1973	−0.95	−0.50	−1.74	−3.19
1974	−0.80	−0.84	−1.79	−3.43
1975	−1.19	−0.75	−1.40	−3.34
By Union				
UAW	0.00	−0.54	−1.80	−2.34
USW	−1.00	−0.47	−1.41	−2.88
Other Unions	−0.93	−0.70	−1.22	−2.85
By Industry				
Manufacturing	−0.48	−0.63	−1.50	−2.61
Food Products	−0.64	−0.63	−0.80	−2.07
Automotive	0.33	−0.33	−1.51	−1.51
Iron and Steel	−0.47	−1.41	−1.22	−3.10
Electrical Equipment	−1.33	−1.10	−1.70	−4.13
Nonmanufacturing	−1.33	−0.58	−1.15	−3.06

Some evidence of the impact of cost-of-living wage adjustments on relative skill differentials is presented in Table 3, which analyzes the evolution of the ratio of the highest contractual wage rate to the base wage rate over the life of the contract.[18] The percent change in the ratio of high-skilled to low-skilled wage rates is approximately the sum of three components: the difference between the percent increases in high-skilled and low-skilled wage rates awarded at the signing date; the difference between the percent increases in high-skilled and low-skilled wage rates resulting from deferred increases; and the difference between the percent increases in high-skilled and low-skilled wage rates resulting from escalated wage increases.

For the sample as a whole, the relative wage of skilled workers declined at an annual rate of 2.7 percent per year. On average, about one-half of the decline in relative wage rates of skilled workers was attributable to nonproportional escalation, while the other half was attributable to less-than-proportional noncontingent increases for more-highly-paid workers. The rate of decay in the relative wage rate of skilled workers was fairly constant across industries and unions, although, not surprisingly, the contributions of the three components of wage change were more variable. In nonmanufacturing contracts, noncontingent, nondeferred increases were a more important source of relative wage erosion, whereas in UAW contracts, increases at the start of the contract tended to be proportional. Table 3 also indicates a more rapid

the increase in prices from the start of escalation: $w = w_n + a(p - p_0)$, where a is contractually specified. The elasticity of wages with respect to prices is $e = ap/[w_n + a(p - p_0)]$, which is increasing or decreasing in p as a is less than or greater than w_n/p_0.

[18]The data preclude analysis of wage rates other than the base wage rate and the highest contractual wage rate. In most contracts, the highest wage rate is paid to workers in the skilled trades, such as maintenance electricians and tool and die makers.

decline in the relative wages of skilled workers in the later sample period. That change was mainly the result of the larger cost-of-living adjustments in the period after 1972, although noncontingent wage increases also contributed to the more rapid decline of relative skilled rates in the later sample period.

Escalated labor contracts thus have three important features in common: the inclusion of noncontingent wage increases; restrictions on the range of price and wage movements covered by escalation; and formulas that yield equal absolute increments to workers at all skill levels. As the data in Tables 1 through 3 illustrate, however, there is considerable diversity of detail within the general framework of a typical escalated contract. For example, one interesting feature of the data is the systematic difference between UAW and USW contracts. Although contracts in the automobile parts and assembly industries tended to follow the pattern of the original General Motors-UAW escalated contracts, and rely heavily on contingent cost-of-living adjustments as a source of inflationary wage adjustments during the life of the contract, USW contracts were more likely to delay indexation, include larger noncontingent, deferred increases, and rely less on contingent wage adjustments to offset inflation during the contract period.

The diversity of indexed contracts has an important implication for the interpretation of escalated wage increases. Realized escalated wage changes depend both on the responsiveness of wages to prices during the course of indexation and on the delay provisions and other restrictions in the escalation clause. In contracts with delayed escalation, part of the increase in prices over the contract period is covered by escalated increases, and part is covered by the noncontingent increases announced at the signing of the contract in anticipation of the increase in prices. Hence, it is not surprising that the ratio of escalated wage increases to realized price increases over the life of the contract is, on average, something less than unity. This ratio, which has been described as an ex post elasticity of indexation, provides very little information on the actual responsiveness of indexed wage changes to price increases. Since this responsiveness is what is typically described by theoretical models of indexation, some alternative characterization of escalation provisions is clearly desirable.[19]

Interpreting the Indexation Provisions

Following the description of typical escalation formulas offered in the previous section, the level of the wage rate in period t of an indexed labor contract can be written as:

$$(1) \qquad w(t) = w(0) + n(t) + min\{c, a \cdot max\,[0, p(t) - p(s)]\},$$

where $w(0)$ is the wage rate at the signing date (incorporating noncontingent, nondeferred increases); $n(t)$ is the level of deferred noncontingent increases in period t; c is the cap amount or maximum increase allowed by indexation; a is the contractually specified increase in wage rates per point increase in prices; $p(t)$ is the price level in period t; and $p(s)$ is the price level at the start of indexation.[20] A complete specification of the contract amounts to a specification of $w(0)$, $n(t)$, c, a, and $p(s)$. In contracts with delayed escalation, $p(s)$ is the price level at some future date, s, which is uncertain ex ante. On the other hand, in contracts that announce a trigger price p^*, $p(s)$ is fixed ex ante at p^*. In these contracts, however, the exact date at which indexation will commence is uncertain. This in turn implies

[19]Confusion between the ex post elasticity of indexation and the point responsiveness of index-linked wage increases to concurrent price increases accounts for a puzzle raised in a recent study of wage determination, Daniel J.B. Mitchell, *Unions, Wages and Inflation* (Washington, D.C.: The Brookings Institution, 1980), pp. 132-35. Using individual contract data, Mitchell finds that deferred wage increases are approximately unit elastic with respect to current-period price increases. This elasticity, he notes, is not consistent with measured ex post elasticities on the order of one-half or less. In the case of restricted escalation clauses, however, there is no direct connection between the ex post elasticity and the marginal elasticity of wages with respect to prices during the course of indexation.

[20]This specification abstracts from the timing interval for review of the cost-of-living wage allowance (see footnote 9). The parameter a is just the "cents per point" awarded by the escalation clause.

that the wage rate at the start of indexation is uncertain at the signing date of a triggered contract.

One interpretation of this formula is that it represents a piecewise linear approximation to a constant-elasticity wage-price schedule.[21] Let e^* indicate the desired proportional responsiveness of wages to prices. Figure 1 illustrates the desired and actual wage-price schedules over the contract period, under the assumptions that indexation is delayed for one period, $p(s) = p(1)$; that escalated wage increases are capped; and that $e^* < 1$. Treating the observed indexation rule as an approximation to a constant-elasticity rule requires that the two formulas yield approximately the same wage rates, at least in some relevant range of prices. If e^* is not too far from unity and the range of prices over the life of the contract is relatively small, the deviation of the actual wage path from the desired path can be kept small.[22] This suggests that the desired elasticity of indexation can be estimated by the marginal elasticity of the cost-of-living-adjustment formula during the course of indexation. This marginal elasticity is:

(2)
$$e(t) = a \frac{p(t)}{w(0) + n(t) + a[p(t) - p(s)]},$$

if the escalator is operative, and equals zero if otherwise. Define $e(0)$ as $a\,p(0)/w(0)$, and observe that:

(3)
$$e(t) = e(0) \frac{w(0)}{p(0)} / \frac{w(t)}{p(t)},$$

whenever the escalator is operative. The elasticity of indexation in any period differs from $e(0)$ to the extent that real wages have risen or fallen since the signing date of the contract. If intracontract real wage changes are small, $e(0)$ is likely to be a reasonable estimator of the desired elasticity, e^*. Furthermore, since $e(0)$ is simply the ratio of the "cents per point" awarded by the escalator to the real contractual wage rate at the start of the contract, it is easily constructed from observable contract data.

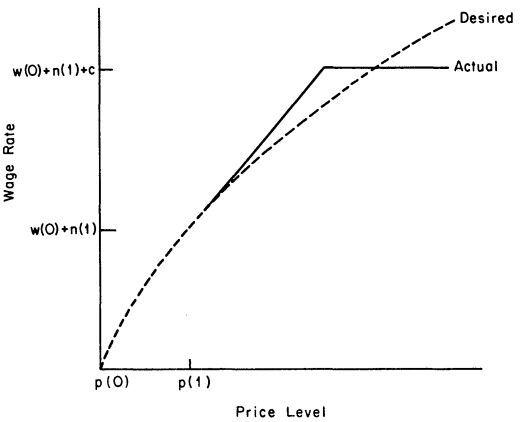

Figure 1.
Desired and Actual Wage Schedules.

An alternative estimator can be obtained by assuming that the desired and actual wage-price schedules correspond exactly at some wage-price pair. In particular, as illustrated in Figure 1, assume that the desired and actual schedules coincide when prices and wages are equal to their expected values at the start of indexation. Define $e' = a\,E[p(s)]/E[w(s)]$ as the expected marginal elasticity at the start of indexation.[23] Given expectations on the path of prices over the contract period, e' can be constructed as an alternative estimator of e^*.[24]

The marginal elasticity of the cost-of-living-adjustment clause is one plausible

[21]Since many simple models of indexation are characterized by a single parameter—the elasticity of wages with respect to prices—it is useful to have an interpretation of observed escalation formulas in terms of such a single-parameter model. At the very least, such an interpretation provides a framework for organizing the empirical content of a sample of escalated contracts.

[22]If $e^* = 1$, the desired wage schedule is a linear function of p.

[23]Strictly speaking, e' is the expected elasticity at the start of indexation if and only if $E[p(s)/w(s)] = E[p(s)]/E[w(s)]$.

[24]There is, in fact, a family of estimators corresponding to different assumptions about the coincidence of the desired and actual wage schedules. An alternative estimator could be obtained by assuming that the escalator formula is designed to minimize some expected distance from the desired constant elasticity formula.

estimator of the desired elasticity of indexation. On the other hand, it has been suggested that the marginal elasticity of indexation is likely to overstate the desired elasticity of indexation in contracts that are capped or delayed.[25] According to this interpretation, caps in particular are designed by the contracting parties to limit the yields of overly generous escalators. This view unambiguously predicts that caps are more likely in contracts with *higher* marginal elasticities. Figure 1 clearly suggests, however, that the role of caps in the framework adopted here is to limit the contingent wage increases in contracts where the desired and marginal elasticities of indexation are relatively low, yielding the prediction that caps are more likely in contracts with *lower* marginal elasticities. In fact, the incidence of caps is *negatively* correlated with the marginal elasticity of indexation.[26] Although this fact alone cannot distinguish the "correct" interpretation of observed indexation formulas, it does provide some evidence in favor of the framework adopted in this paper.

In contrast to the marginal elasticities $e(0)$ and e', the ex post elasticity defined in the last section depends on the presence or absence of restrictions on the escalation formula. From the general formula for the wage rate under escalation, the ex post elasticity is given by:

$$(4)\quad e^x = min\,\{c,\ a\ max\,[0,\ p(m) - p(s)]\} \bullet \frac{1}{w(0)} \frac{p(0)}{p(n) - p(0)},$$

where $p(m)$ is the price level at the end of the indexation period and $p(n)$ is the price level at the end of the contract. In the absence of delay and capping restrictions, $e^x = e(0)$, provided that the cap provision is not binding by the end of the contract. Otherwise, if the cap provision is binding or if indexation is delayed, such that $p(s) > p(0)$, or if escalation stops before the end of the contract, such that $p(m) < p(n)$, then $e^x < e(0)$. Even if $e^* = 1.0$ in every contract, one would expect to find ex post elasticities less than unity in a sample of contracts with delay and capping restrictions on escalation.

The assumption that an observed indexation formula approximates a desired constant-elasticity wage function leaves unanswered the question of how the delay in indexation is determined. One possibility is that delay provisions are designed to limit contingent wage increases in contracts with relatively high marginal elasticities of indexation. Consistent with the interpretation of marginal elasticities as desired elasticities, however, the sample correlation of the incidence of delay provisions with the size of the marginal elasticity is essentially zero.[27] On the other hand, if workers are strongly attached to firms, then the timing of inflationary wage increments has a relatively small impact on the allocative efficiency of the contract. Longer delays in indexation, in combination with larger noncontingent deferred increases, may be tolerated in order to satisfy other objectives of the contract. One hypothesis in this regard is that union leaders prefer larger noncontingent increases and smaller contingent increases in order to emphasize their own role in wage determination and to deemphasize the role of automatic wage adjustments.[28] An alternative hypothesis is that since cost-of-living wage adjustments tend to distort the relative wage structure of the contract, there is an incentive to reduce their importance in the overall wage-determination process. This hypothesis is consistent with the fact that the relative share of contingent wage increases in total wage increases is negatively correlated with the size of the maximum relative wage

[25]I am indebted to an anonymous referee for this point.

[26]The correlation of cap incidence with the estimator $e(0)$ of the marginal elasticity of base wage rates is $-.16$, with a marginal significance level below one percent.

[27]The correlation of the marginal elasticity of base wage rates with the incidence of delay provisions is 0.04 and insignificantly different from zero at the 25 percent level.

[28]The problems posed for union security by automatic wage-adjustment formulas were apparently recognized in the first escalated General Motors - UAW contract. In that contract, GM assented to a form of the union shop for the first time. See Garbarino, *Wage Policy and Long Term Contracts*, p. 62.

differential observed in the contract.[29] The hypothesis does not address, however, the more fundamental question of why cost-of-living escalation provisions typically generate the same absolute wage adjustment for workers at every skill level.

Consideration of the nonproportionality of many escalation clauses introduces an additional difficulty in the interpretation of observed indexation formulas. Let $w_1(t)$ and $w_2(t)$ represent the wage rates of unskilled and skilled workers, respectively, and let $\overline{w}(t)$ represent the skill-weighted geometric mean of $w_1(t)$ and $w_2(t)$. Without a formal model of the aggregation of heterogeneous workers' preferences, it is natural to assume that observed indexation provisions represent an average of the provisions that different groups would prefer in isolation. Define the skill-specific analogues of $e(0)$ and e' as:

$$(5) \quad e_j(0) = a\,p(0)/w_j(0), j = 1,2$$

and

$$(6) \quad e_j' = a\,E[p(s)]/E[w_j(s)], j = 1, 2,$$

and define the skill-weighted average-elasticity measures as:

$$(7) \quad \bar{e}(0) = a\,p(0)/\overline{w}(0),$$

and

$$(8) \quad \bar{e}' = a\,E[p(s)]/E[\overline{w}(s)].$$

Under the assumption that a is determined ex ante as a geometric average of the derivatives appropriate for unskilled and skilled workers, $\bar{e}'$ can be interpreted as a geometric average of the desired ex ante elasticities of the two groups of workers.[30] On the other hand, if the majority of the union members are unskilled, union policy regarding escalation may be determined entirely by the preferences of unskilled workers. In that case, the marginal elasticity of unskilled workers' wages can be interpreted as an estimate of the desired responsiveness of unskilled wages to prices.

Responsiveness of Wages to Prices During Indexation

This section analyzes sample distributions of the measures of the marginal elasticity of indexation proposed in the previous section. The measures that depend on the levels of wages and prices at the start of the contract were constructed directly.[31] The measures that depend on expected wage rates and price levels at the start of indexation required calculating expected inflation rates by year. The details of these calculations are reported in the appendix. Table 4 summarizes the distributions of six different measures of the marginal elasticity, corresponding to the unskilled, skilled, and average-wage-rate elasticities, as measured at the start of the contract and at the start of indexation. For comparative purposes, ex post elasticities are also reported. Of particular interest are two features shared by all six measures of the marginal elasticity of indexation: the relatively high estimated elasticities and the dispersion of elasticities across different industries. As expected, elasticities defined relative to real wage rates at the start of the contract are similar to elasticities defined relative to expected real wage rates at the start of indexation.

[29]The correlation over the 281 contracts is −.12. Since wage differentials in the steel industries tend to be larger than those in the automotive industries, this is also consistent with the greater importance of contingent wage adjustments in UAW contracts than in USW contracts.

[30]Suppose $\log(a) = (1 - v)\log(a_1) + v\log(a_2)$, where v is the proportion of skilled workers, and a_1 and a_2 are the derivatives of wages with respect to prices desired by the two groups. If e_1^* and e_2^* are the desired elasticities of unskilled and skilled workers' wages, respectively, and if the observed and desired wage schedules correspond at the start of indexation, then $\log \bar{e}' = (1 - v)\log(e_1^*) + v\log(e_2^*)$.

[31]To construct the skill-weighted average elasticities, it is necessary to estimate the proportions of skilled and unskilled workers by contract. Since the contract data do not report employment levels, contracts were matched to three-digit SICs, and industry skill proportions were calculated. For lack of suitable Canadian data, skill proportions were computed by industry for three-digit U.S. industries and then matched to the contract data by matching Canadian and U.S. industry classifications. The proportion of skilled workers is taken to be the proportion of craft employment to the total employment of crafts workers, operatives, and laborers, by industry, as reported in the 1970 U.S. Census. A comparison of the estimated skill proportions with estimated skill proportions for manufacturing industries constructed directly from unpublished Canadian census data by Michael Abbott revealed only minor discrepancies.

Table 4. Measures of the Elasticity of Indexation.

	Elasticity Measure							
	Start of Contract			*Start of Indexation*			*Ex Post*	
Subsample	$e_1(0)$	$e_2(0)$	$\bar{e}(0)$	e_1'	e_2'	$\bar{e}'$	e_1^x	e_2^x
All Contracts	.92	.67	.83	.93	.68	.84	.54	.40
By Year								
1968	.82	.64	.76	.81	.64	.76	.42	.33
1969	.79	.58	.71	.80	.58	.71	.29	.20
1970	.89	.67	.81	.89	.66	.81	.45	.32
1971	.91	.66	.83	.91	.66	.83	.62	.45
1972	.78	.58	.70	.78	.59	.70	.33	.26
1973	.88	.59	.76	.89	.60	.76	.49	.34
1974	1.00	.70	.89	1.01	.71	.90	.58	.42
1975	.94	.74	.87	.94	.74	.87	.62	.50
By Union								
UAW	.90	.65	.81	.90	.65	.81	.74	.54
USW	.86	.61	.76	.86	.61	.76	.46	.34
Other Unions	.95	.71	.87	.96	.71	.88	.48	.36
By Industry								
Manufacturing	.90	.65	.82	.90	.65	.82	.56	.41
Food Products	.83	.65	.78	.82	.65	.78	.36	.29
Automotive	.90	.65	.82	.90	.65	.83	.64	.47
Iron and Steel	.80	.55	.70	.80	.56	.70	.42	.30
Electrical Equipment	.97	.61	.85	.97	.61	.85	.47	.30
Nonmanufacturing	.98	.74	.88	.99	.74	.89	.48	.39

The average estimate of the marginal elasticity of indexation of the base wage rates is .92, clearly much greater than the average ex post elasticity of .54. The average estimate of the marginal elasticity of indexation of the combined wages of skilled and unskilled workers is .83. Approximately 12 percent of all escalators yield greater than unit-elastic responsiveness of combined wages to the CPI. Marginal elasticities are lowest in the basic iron and steel industries and highest in nonmanufacturing industries, where about 20 percent of the escalators exhibit a greater than unit-elastic responsiveness of combined wages to prices. Observe that marginal elasticities in UAW and USW contracts are similar, in spite of the noted dissimilarities in the contracts of the two unions in other respects. This similarity suggests that the dispersion in desired elasticities of indexation may be among industries, rather than among unions.

The sample distributions of the ex post elasticity of base wage rates and the marginal elasticity of base wage rates, $e_1(0)$, are illustrated in Figures 2 and 3. Whereas the distribution of ex post elasticities is highly skewed to the left, the distribution of the marginal elasticity has a more nearly symmetric shape about its modal value of 0.95. The presence of escalators with delays, caps, and other restrictions is indicated by the concentration of ex post elasticities in the interval between zero and the minimum of the marginal elasticity of the base wage rates.[32] The presence of a small number of contracts with proportional and unit-elastic escalation provisions (most of which are from nonmanufacturing industries) increases the sample density of $e_1(0)$ at the unit-elastic point.[33]

[32]Recall that in the absence of restrictions, the ex post elasticity of base wage rates is equal to $e_1(0)$.

[33]Most escalators that link percent increases in wages to percent increases in prices exhibit a marginal

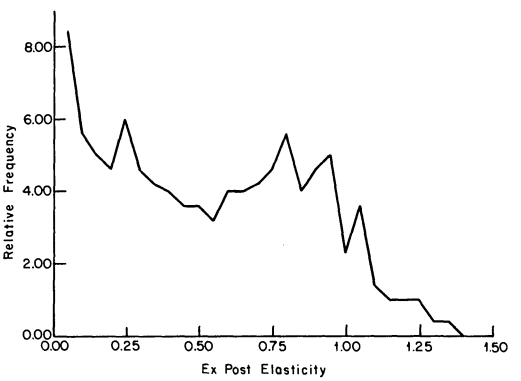

Figure 2.
Sample Distribution of
Ex Post Elasticity of Base Wage Rate.

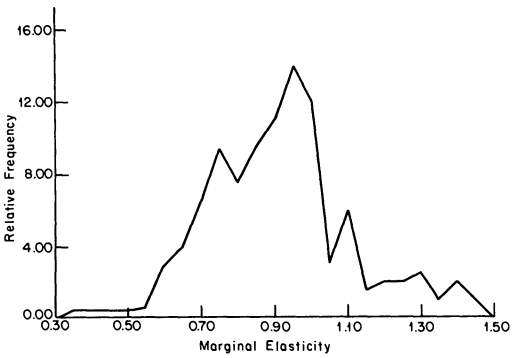

Figure 3.
Sample Distribution of
Marginal Elasticity of Base Wage Rate.

As Figure 3 illustrates, there is a wide range in the measured marginal elasticity of indexation of contractual base wage rates. In fact, this is a characteristic of all six elasticity measures. The data in Table 4 suggest that the dispersion in measures of the marginal elasticity of indexation may be the result of differences across industries in the desired responsiveness of wages to prices during the course of indexation. On the other hand, the same data also indicate substantial differences among indexation provisions in contracts negotiated in different years. A number of hypotheses can be addressed by analyzing the variance in measures of the elasticity of indexation and by controlling for interindustry differences in mean elasticities. First, are there statistically significant differences in elasticities among industries? Second, can differences in elasticities by year be explained by the industry composition of contracts signed in each year? Third, do particular unions systematically influence marginal escalation elasticities? Fourth, what additional factors influence the within-industry dispersion of marginal escalation elasticities?

Table 5 reports an analysis of variance of the six marginal elasticity measures. Interindustry differences are captured by a set of 60 fixed effects by three-digit industry. As the first row of the table indicates, about 96 percent of the variation in the marginal-elasticity measures is attributable to interindustry differences. Under the null hypothesis that these elasticities vary by industry but not by the year in which the contract was signed, a set of fixed effects for the different years of the sample should be insignificant in a regression that includes fixed effects by industry. The F statistics for this null hypothesis are reported in the second row of Table 5. The probability values of the test statistics are of the order of 3 percent, indicating some evidence against the null. The pattern of the estimated year effects points to an increase in elasticities within each industry between 1968 and 1975. The trend is uneven, however: relative to 1975 contracts, contracts signed in 1968, 1969, 1972, and 1973 had elasticities some 6 to 15 percent lower, whereas contracts in other years had about the same elasticities.

The next row of the table presents F statistics for the joint significance of a set of fixed effects by union.[34] Since only a few unions organize workers outside of one or

elasticity of unity. In contracts with proportional indexation, all six marginal-elasticity measures are equal. Even contracts that specify a one percent increase in all wage rates for each one percent increase in the CPI do not necessarily yield ex post elasticities equal to unity in the presence of restrictions on escalation. One-half of the contracts with proportional indexation provisions were either delayed or capped.

[34]The unions included were the UAW, the USW, Teamsters, the IAM, the Carpenters, the Retail, Wholesale and Bakery Workers, the Food and Commercial Workers, the Electrical and Radio Workers, and OCAW.

Table 5. Analysis of Variance of Elasticity Measures.

	Elasticity Measure					
	Start of Contract			*Start of Indexation*		
Summary Statistics	$e_1(0)$	$e_2(0)$	$\bar{e}(0)$	e_1'	e_2'	$\bar{e}'$
1. R^2 for 60 Industry Fixed Effects	.96	.96	.97	.96	.96	.97
Standard Error	.20	.15	.17	.21	.15	.18
F-ratio	100.2	91.4	110.8	97.1	93.1	109.7
(probability value)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
2. F-ratio for 8 Time-Period Fixed Effects	2.32	2.78	2.28	2.28	2.69	2.19
(probability value)	(.02)	(.01)	(.02)	(.02)	(.01)	(.03)
3. F-ratio for 9 Union Fixed Effects	.37	.62	.38	.37	.59	.36
(probability value)	(.95)	(.78)	(.94)	(.95)	(.80)	(.95)
4. F-ratio for 2 Contract-Length Fixed Effects	.26	1.90	.83	.19	1.72	.68
(probability value)	(.77)	(.15)	(.44)	(.83)	(.18)	(.51)
5. *t*-ratio for New COLA Fixed Effect	1.45	.81	1.39	1.05	.56	1.03
(probability value)	(.15)	(.42)	(.17)	(.30)	(.57)	(.30)

two industries, the number of fixed effects by union that can be estimated is low. The test statistics are uniformly insignificant at conventional levels; thus, it does not seem possible to isolate union-specific effects on the marginal elasticity of contractual wages with respect to prices, after controlling for industry.[35]

The last two rows of Table 5 report the results for significance tests of two alternative sets of variables that explain deviations of escalation elasticities from three-digit industry means. The first set of variables comprises fixed effects for contract length. The test statistics offer no evidence to suggest that contract length is an important determinant of the intra-industry dispersion in marginal elasticities of indexation. The second variable is an indicator of whether the escalation clause is a new feature in the contract. Again, there is no evidence that differences in escalation elasticities within industries are correlated with the past experience of the bargaining unit in designing cost-of-living provisions.

Table 6 completes this analysis of the interindustry pattern of marginal escalation elasticities by identifying the industries with the highest and lowest marginal elasticities of indexation.[36] The high-elasticity group is composed mainly of textile industries and service industries, with two metal fabricating industries and electric utilities also included. The low-elasticity group is less homogeneous, including several durable manufacturing industries, as well as tobacco products, paper bag and box producers, and automobile transport. As the table suggests, service industries are overrepresented among the high-elasticity group. In fact, the only service industry with an industry-specific mean elasticity less than the all-industries mean is the automobile transport industry, which has strong economic ties to the automobile assembly industry. On the other hand, most durable manufacturing

[35]This result is robust to the level of disaggregation of industry effects. Including only 19 fixed effects by industry group, fixed effects by union are still insignificant in explaining elasticities of indexation.

[36]The rankings are based on the elasticity of base wages. Rankings on the basis of any of the marginal elasticity measures are very similar.

industries, including the basic iron and steel industries and durable consumer goods industries, have mean elasticities below or equal to the all-industries mean.

Table 6. Industries with Highest and Lowest Elasticities of Indexation.
(three-digit SIC numbers and standard errors in parentheses)

Industry Description	*Average Base Wage Elasticity*	
Ten Highest Elasticities		
1. Hotels and Restaurants (881)	1.51	(.11)
2. Synthetic Textiles (183)	1.32	(.20)
3. Wool Textiles (182)	1.31	(.14)
4. Office Equipment (318)	1.29	(.20)
5. Retail Department Stores (642)	1.24	(.14)
6. Grocery Stores (631)	1.13	(.08)
7. Cotton Textiles (181)	1.13	(.14)
8. Miscellaneous Metal Fabrication (309)	1.12	(.20)
9. Electric Utilities (572)	1.11	(.06)
10. Automotive Fabrics (188)	1.09	(.12)
Ten Lowest Elasticities		
1. Major Appliances (332)	.60	(.14)
2. Truck Bodies (324)	.66	(.14)
3. Tobacco (153)	.70	(.12)
4. Steel Pipe and Tubing (292)	.70	(.07)
5. Paper Bags and Boxes (273)	.71	(.20)
6. Iron and Steel (291)	.73	(.06)
7. Meat Products (101)	.73	(.09)
8. Rolling Stock (326)	.73	(.12)
9. Miscellaneous Furniture (266)	.74	(.20)
10. Automobile Transport (507)	.75	(.07)

Summary and Implications

Escalation clauses in long-term labor contracts have a number of features that are not predicted by simple theoretical models of indexation. Among these are sizable noncontingent increases, which often appear in combination with restrictions on the range of wage and price changes covered by indexation, and escalation formulas that provide for equal absolute wage increases to skilled and unskilled workers. Although a complete model of indexation in long-term contracts would necessarily account for these features, it is nonetheless useful to provide an interpretive link between the observed provisions and the escalation formulas that arise from the simple models.

The framework developed in this paper suggests that it is possible to extract from a particular escalation clause the ex ante desired responsiveness of wages to prices, by calculating the marginal elasticity of indexation when the escalator is operative. Measures of the marginal elasticity of indexation are found to have a wide dispersion across contracts. In the sample of contracts studied, the marginal elasticity of indexation of base wage rates ranges from a low of .70 or less in contracts in durable manufacturing industries to a high of 1.3 or more in some contracts in service industries and textile industries.

In contrast to measures of the marginal elasticity of indexation, measures of the total yield of escalator provisions depend on both the responsiveness of wages to prices during indexation and on the range of wage and price increases over which the escalator is operative. Restrictions that delay the start of indexation or limit the maximum escalated wage increase are found to be fairly common among indexed labor contracts. As a result, the total increase in wages that results from escalation, as a fraction of total price increases over the life of the contract, is typically smaller than the actual elasticity of indexation when the escalator is operative. The ratio of realized escalated wage increases to price increases during the contract period is an incomplete characterization of escalation provisions and provides no information on the desired ex ante responsiveness of wages to prices, in general.

An analysis of the variation in marginal elasticities indicates that interindustry differences in mean elasticities are a major source of the total dispersion in measured elasticities. On the other hand, the effects of different unions and different contract durations are judged to be insignificant determinants of the intra-industry dispersion of escalation elasticities. There is some evidence of a trend toward increasing elasticities of escalation over the 1967–75 period, however.

The implications of this pattern of escalation elasticities are twofold. First, a

simple model of complete real wage insurance via unit-elastic indexation is rejected by the data.[37] Likewise, models that predict elasticities to be uniformly less than unity are clearly at variance with the facts.[38] Second, the interindustry dispersion of elasticities provides an obvious testing ground for theoretical models of indexation. To the extent that the implications of contract-theoretic models of the labor market have proved elusive under empirical scrutiny, the opportunity to test their predictive content against the pattern of escalation elasticities across industries is a valuable one.

[37]This is a prediction of the early literature on implicit contracts. See, for example, Costas Azariadis, "Implicit Contracts and Underemployment Equilibria," *Journal of Political Economy*, Vol. 83, No. 6 (December 1975), pp. 1183 - 1202.

[38]Indexation elasticities between zero and unity are predicted by models like that in Gray, "Wage Indexation: A Macroeconomic Approach."

Appendix

This appendix illustrates the calculation of the expected price level and wage rate at the start of indexation in contracts with delayed escalation. In contracts with specific time lags in escalation, the wage rate at the start of indexation is known, and the problem is one of forecasting the price level at some future date. An autoregression was fit to annual CPI data and used to generate a set of expected inflation rates. The forecasting equation used was:

$$\log p(t) - \log p(t-1) = -.013 + .003t + .92[\log p(t) - \log p(t-1)] - .67[\log p(t-2) - \log p(t-3)],$$

where $t = 1$ in 1956. This equation generates one-year-ahead inflation forecasts of 4.7 percent in 1967 and 8.2 percent in 1974, for example.

In contracts with indexation triggered at a preannounced price level, the problem is one of forecasting the time interval required for the CPI to reach the trigger price level. Given an expected date for the start of indexation, the expected wage rate at the start of indexation can be found in the schedule of noncontingent wage rates. Although not formally justified, the following procedure was adopted to determine the expected date for the start of indexation. First, the markup of the trigger price over the current price level was computed. This markup was then divided by the one-year-ahead expected inflation rate to obtain an estimate of the expected time delay in indexation. Finally, this estimated delay was added to the signing date of the contract to obtain the expected date for the start of indexation.