The Effect of Collective Bargaining Legislation on Strikes and Wages

Peter Cramton, Morley Gunderson, and Joseph Tracy*
University of Maryland, University of Toronto, and Federal Reserve Bank of NY
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Abstract

   Using Canadian data on large, private-sector contract negotiations from January 1967 to March 1993, we find that strikes and wages are substantially influenced by labor policy. The data indicate that conciliation policies have largely been ineffective in reducing strike costs. In contrast, general contract reopener provisions appear to make both unions and employers better off by reducing negotiation costs without systematically affecting wage settlements. Legislation banning the use of replacement workers appears to lead to significantly higher negotiation costs and redistribution of quasi-rents from employers to unions.

Introduction

In this paper, we investigate the effect that collective bargaining legislation has on strike incidence, strike duration, and wage outcomes. From a policy perspective, it is important to assess whether labor legislation has its intended effects on bargaining outcomes. Often, collective bargaining legislation is enacted to improve the efficiency of negotiations, for example by reducing the incidence and duration of strikes. We evaluate the extent to which these policies are effective at reducing strike activity. Variations in the bargaining rules as determined by labor legislation are also likely to influence the balance of power between the union and the firm, and hence affect wage settlements. Indeed, the primary motivation of advocates of a particular legislative initiative may be distributional, even when their stated intentions are to improve efficiency. For this reason, we analyze the wage effects and potential welfare consequences of the various labor policies.

We utilize a data set that includes all private-sector contract negotiations in Canada involving 500 or more workers from January 1967 to March 1993. Canada is a good setting to carry out this type of study. First, its labor law is determined mainly at the provincial level, rather than the national level. Hence, there is variation in labor policy both among the provinces at a point in time and within provinces over time. Second, Canadian data are systematically collected through mandatory reporting requirements which should increase data reliability.

We find that conciliation policies have been largely ineffective in reducing strike costs. In contrast, general contract reopener provisions appear to make both unions and employers better off by reducing negotiation costs without systematically affecting wage settlements. Legislation banning the use of replacement workers leads to higher negotiation costs both by increasing the frequency and duration of strikes. In addition, replacement bans also result in significantly higher real wage settlements. The estimated average cost to employers from a replacement ban is around $4.75 million (1993 Canadian) dollars per contract.

We present our theoretical perspective and a description of the key Canadian collective bargaining legislation in the next section. In section 3 we describe our data more fully. Section 4 discusses the effects of labor policy on strike incidence, strike duration, and wages. Section 5 compares our results to the earlier literature. In section 6, we calculate the welfare implications of bargaining legislation for unions and employers.

2 Canadian Labor Legislation – A Theoretical Perspective

In this section, we briefly outline the structure of a bargaining model of labor negotiations. We use this model to help frame predictions for various Canadian collective bargaining legislation. For each type of legislation, we describe the nature, intent, and likely effect on strike activity and wage settlements.

2.1 A Precis on Strategic Bargaining Models

A detailed exposition of our theoretical wage bargaining model appears in Cramton and Tracy (1992, 1994a).[1] The union and firm are negotiating the wage to be paid over the life of the contract. The firm has private information about its willingness to pay. Offers are exchanged until a settlement is reached. Prior to settlement, the parties receive their threat payoffs. In the simplest model, the union decides between two possible threats — the union can strike or it can apply pressure on the firm while continuing to work under the expired contract, which we call holdout. The threat payoff to the union under a holdout is the wage from the expired contract.

The settlement wage consists of the union's threat payoff plus a share of the inefficiencies induced by the threat (the "pie"). The union strikes if the higher bargaining costs associated with a strike are more than made up for by a higher expected settlement wage. If the wage under the expired contract is sufficiently high, this is not the case and the union prefers the holdout threat. Policies that reduce the size of the pie should reduce settlement wages, while policies that increase the attractiveness of the strike threat to the union should increase settlement wages.

Dispute activity (strikes and holdouts) occurs because of the union's uncertainty about the firm's willingness to pay. The firm has an incentive to falsely claim that times are tough and therefore a low settlement wage is appropriate. The firm's willingness to endure a costly strike or holdout is one means of convincing the union to accept a lower wage. Testing this prediction is difficult since we do not observe the parties' private information.

Some of the predictions change when the model is extended to allow for time-varying threat payoffs (Cramton and Tracy 1994b). Threat payoffs change over time as replacement workers are hired and trained, as strikers find temporary jobs, as inventories or strike funds run out, or as public assistance to strikers varies based on the length of the strike. A basic finding is that if dispute costs increase in the long

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[1]See Kennan and Wilson (1989, 1993) for surveys of bargaining theory and its relation to strike data.

run, then dispute durations are longer and wages decline more slowly during the short run (and may even increase).[2]

The theory provides structure for empirical models of strike activity and wage settlements. Measures of strike activity should depend on the union's uncertainty regarding the firm's willingness to pay and variables reflecting the relative attractiveness of the strike and the holdout threats. Wage settlements should depend on the wage under the expired contract (since that is the union's threat value under a holdout), determinants of the union's threat value during a strike, and factors that affect the inefficiencies resulting from the labor dispute.

2.2 Canadian Labor Legislation

Since the legislated policy variables are the focus of the analysis they merit extended discussion. Compulsory conciliation is a form of third-party intervention by a government appointed official that is required after the contract has expired and before a strike can occur. The aim is to improve the efficiency of bargaining by reducing strike activity. Conciliation can be a one-step procedure involving a *conciliation officer* who acts as a catalyst to try to help the parties resolve the dispute. If a settlement does not occur, the officer reports to the Minister of Labour indicating the items that have been agreed upon, and those which are still in dispute. In some jurisdictions a two-step procedure involving both a *conciliation officer and a board* is required. The board is tripartite with a neutral chair and a representative of labor and of management. The board has a more normative role, since its recommendations are made public, with the intent of putting added pressure on the parties to settle.

While the conciliation process is intended to facilitate bargaining and to "cool-down" the negotiations, it has often been characterized as an impediment to direct serious bargaining which creates delays that "heat up" the negotiations and allow the parties to prepare for an eventual strike [Craig, 1983 p. 189]. Bargaining models would predict a reduction in strike activity if on balance conciliation improves the

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[2]Dispute duration is determined by the firm equating the marginal benefit of waiting (a lower wage) with the marginal cost of waiting (additional dispute costs). An increase in long run dispute costs magnifies the dispersion of wage settlements between the high value employers (who settle early) and the low value employers (who settle late). Hence, the overall incentive for signaling a low value increases with the long run dispute cost, but the dispute cost in the short run is constant, so the dispute duration must increase to balance the costs and benefits of waiting to signal a low value.

information flow between the union and the firm. Conciliation is intended to be neutral with respect to wage settlements.

Many jurisdictions require a *cooling-off period* after conciliation (if required) has concluded, and before a strike can begin. The intent is to give the parties one last chance to reconcile their differences before bargaining costs begin to escalate. Cooling-off periods can be viewed as a period of dispute where the union can exercise only the holdout threat. As such, cooling-off periods would be expected to slightly reduce strike incidence since some potential strikes will settle during the cooling-off period. For disputes that extend beyond the cooling-off period and involve a strike, the duration of the strike should be shorter. However, theory suggests that a day of holdout is equivalent to less than a day of strike. Thus, a ten day cooling-off period would be expected to reduce strike durations by less than ten days. Since the expected wage increase under the holdout threat is less than the expected wage increase under the strike threat, cooling-off periods may slightly reduce wage settlements to the extent that some strikes are prevented.

Mandatory strike votes require, whether or not the parties request it, that a majority of the union members vote in favor of initiating a strike.[3] The intent is to prevent the union leadership or a militant minority of members from forcing a strike on the majority. The effect of this policy on strike activity may be minimal, however, since many union constitutions require a strike vote (England 1983, p.254). Furthermore, unions are unlikely to initiate a strike without substantial support from the rank-and-file; therefore, the vote may simply impose additional delay and polarize the parties. Mandatory strike votes should have a limited effect on wage settlements.

An *employer initiated vote option* enables employers to request a strike vote on their last offer once during the negotiations. The intent is to give the employer the option to appeal directly to the rank-and-file. The optional feature of the vote, however, may give the union leadership an incentive to incite the-rank and-file in order to reduce the likelihood of losing a vote, and to refuse to concede during bargaining least it give the appearance that the parties are sufficiently close that a vote could end the strike. Formalizing this prediction into the basic strategic bargaining model would require modeling the agency problem between the union membership and the union leadership.[4]

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[3]In almost all jurisdictions the requirement is for a simple majority of those who vote.

[4]For a discussion of this agency problem see Ashenfelter and Johnson (1969).

A *compulsory dues checkoff* provision requires all employees in the bargaining unit to pay union dues whether or not they are members of the union. The intent is to eliminate strikes over negotiated checkoff provisions. At the same time, checkoff provisions enhance the financial security and hence the bargaining power of the union which should lead to more strike activity and higher wage settlements.

Legislation that *prohibits replacement* workers (often termed "anti-scab" legislation) has the ostensible purpose of reducing the picket line violence and the polarizing of positions that occurs when replacements are used. By enhancing the union's strike threat, replacement bans should encourage greater use of the strike threat and consequently higher wage settlements. Furthermore, a replacement ban prevents the firm from reducing its long run strike costs through hiring replacements. By keeping the firm's long-run strike costs high replacement bans should lead to longer strike durations.

Collective agreements generally prohibit strikes during the life of the agreement, and require grievance arbitration to settle disputes involving the interpretation of the existing agreement. Some jurisdictions, however, allow the parties to negotiate the *right to reopen the contract*, often restricting the negotiations to certain designated items and permitting a strike during the reopening. The rationale is to provide the parties with an opportunity to negotiate over important issues that may arise over the life of the agreement and which could not reasonably have been anticipated at the time of the contract renewal. This added contract flexibility should reduce strike activity. The theory does not suggest any particular effect on wage settlements.

Some jurisdictions require that at the union's request the contract be *reopened in the event of technological change*. The rationale is that technological change often cannot be anticipated at the time of the contract renewal, so it is difficult for the union to bargain over its expected effect at that time. Furthermore, if a union were forced to wait until the next round of bargaining to respond, the consequences of the technological change could have jeopardized the union's bargaining power. A technological change reopening provision should reduce strikes resulting from negotiations over job security language in the contract. If in the absence of technological change reopeners, unions give up some on wages in return for increased job security language in the contract, then this type of legislation might be expected to lead to higher observed wage settlements.

Table 1 summarizes the bargaining model's predictions on strike activity and wages for each type of legislation.

3 The Data

Our Canadian data comes from two main databases, both made available from Labor Canada. The *Major Wage Settlements* database includes wage and other information for all settlements with at least 500 workers. We selected all private sector contracts settled between January 1967 and March 1993. We merged strike duration and other dispute information from the *Work Stoppage* database. A detailed description of the data and our variable definitions is provided in the appendix.

Table 2 presents summary statistics about contracts, disputes, and wages for the combined data sets for both the public and private sectors. Private-sector strikes are both more frequent and longer in Canada than in the U.S. over the same period. (U.S. strike incidence was 10% with a mean duration of 45 days from 1970 to 1989, compared with the Canadian strike incidence of 16% and mean duration of 59 days.) We exclude public sector and construction contract negotiations from our analysis, since they are negotiated under substantially different labor law.

Our policy variables for 1967 to 1986 were taken from Gunderson, Kervin, and Reid (1989). We then extended their definitions to1993 using information from Labour Canada, *Industrial Relations Legislation in Canada* and CCH Canadian Ltd., *Canadian Labour Law Reporter*, as well as other sources. Furthermore, John Budd of the University of Minnesota provided us his coding of most of the legislative initiatives which was based on an examination of the original statutes. We use the effective date rather than the enactment date in defining the policy variables. Table 3 presents the labor relations policy variables for the federal jurisdiction and each of the ten Canadian provinces (Yukon and Northwest Territories are excluded because there are only a few contracts in these regions).

4 Effect of Labor Policy on Strike Incidence, Strike Duration, and Wages

The effect of collective bargaining legislation on strike activity has been previously investigated by Gunderson, Kervin, and Reid (1986, 1989), Gunderson and Melino (1990), and Budd (1996). Our analysis extends this literature by examining the legislative effects on settlement wages. We reexamine the legislative effects on strike activity for two reasons. First, we need to identify instruments for measures of strike activity in the wage settlement equation. Second, we need estimates of the legislative effects on strike activity in order to calculate the welfare implications of these policy variables.

4.1 Effect of Labor Policy on Strike Incidence

The effects of collective bargaining legislation on strike incidence are summarized in table 4. The table shows the change in the strike probability per unit increase in the independent variables. Specification (1) includes an indicator for a strike at the previous negotiation, while specification (2) replaces this prior strike indicator with a series of prior strike duration indicators. We estimate probit models with an error structure that does not include bargaining unit effects, but we compute the standard errors using a robust variance estimator that allows for nonindependence across negotiations by the same bargaining unit.[5]

The policy variables are jointly significant in the strike incidence specification. The largest marginal effect is the 12 percentage point increase in strike incidence associated with a ban on replacement workers, which is notable given that proponents of a ban on replacements have argued that the ban would *reduce* strike activity. This marginal effect just misses the 10% significance level in each specification. Although a ban on the use of strike replacements exists in three Canadian provinces (Quebec since February 1978, British Columbia since January 1993, and Ontario since January 1993) the limited variability of the replacement ban policy variable makes it difficult to pin down its marginal effect on bargaining outcomes.[6]

Legislation requiring conciliation reduces strike incidence, with the effect of two-stage conciliation being more than twice the effect of conciliation officers alone. Both effects, though, are imprecisely measured. Cooling-off periods following conciliation are found to have a small, negative and insignificant effect on the likelihood of a strike. The point estimates imply that a two-stage conciliation process combined with a two week cooling off period (e.g. Alberta, 1967) would on average reduce the incidence of strikes by 4.8 percentage points compared to a province without either conciliation or cooling off legislation (e.g. Saskatchewan, 1970s).

Mandatory strike votes are associated with over a 7 percentage point reduction in the likelihood of a strike. In contrast, employer initiated optional vote provisions have a positive but insignificant effect on strike incidence. The mandatory strike vote effect suggests that some strikes are initiated by unions without

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[5] A Breusch/Pagan lagrange multiplier (LM) test for the presence of bargaining unit error components yielded a $?^2(1) = 0.02$, which has a probability value of 0.89.

[6] Only five percent of the total variation in the replacement policy variable is independent of the other right-hand-side variables in the strike incidence specification.

majority support by the membership. This highlights that agency problems may be important in contract negotiations, and that it may be fruitful to incorporate them into strategic bargaining models.

Labor provisions that promote flexible contract durations appear to give rise to conflicting effects on the difficulty encountered in renewing these contracts. General reopener provisions are associated with a statistically significant 6 percentage point drop in strike incidence. In contrast, technological change reopeners are associated with a 4 to 5 percentage point increase in strike incidence. Finally, enhancing a union's financial security through dues checkoff provisions does not appear to alter the frequency of strikes.

Turning to the nonpolicy variables, strike incidence is lower in bargaining units which have experienced higher increases in their real wage during the prior contract. This is a prevalent finding in the empirical literature and is consistent with the shift in dispute composition predicted by the theory. Related to this, strike incidence is 5 to 6 percentage points lower during periods of wage and price controls. [7] Binding wage and price controls reduce the relative attractiveness of the strike threat by limiting the higher expected wage settlements associated with the strike threat without reducing the higher expected bargaining costs.

An important prediction from the theory is that dispute incidence is increasing in the level of the union's uncertainty over the firm's willingness to pay. At best, proxies for the union's uncertainty can be added to the empirical specification. If the union's uncertainty increases with the length of time since it last bargained with the firm, then we would expect strike incidence to increase with the prior contract duration. The data indicate a positive and significant relationship between the prior contract duration and the likelihood of a strike during the renewal of the contract. For example, increasing the prior contract duration from three years to five years is associated with a 1.8 percentage point higher strike probability.

As an additional proxy for uncertainty over the firm's willingness to pay, we also use a measure of the variance in Card's (1990, p. 642) real value-added price index – a measure of industry profitability. We use three-year moving averages of the variance of the detrended industry value-added index for 119 three-digit industries for the period 1971 to 1983. When we add this industry profit uncertainty measure to our strike incidence specification which includes both two-digit industry and year fixed-effects, we find a small positive and insignificant marginal effect. However, when we drop the industry and year fixed-effects, the

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[7]McConnell (1990) finds U.S. strike incidence to be roughly 5 percentage points lower during the first phase of the Nixon price controls.

marginal effect increases to 0.009 and is significant at the ten percent level. A one standard deviation change in this uncertainty measure is associated with a 1.1 percentage point increase in strike incidence.

Scale effects appear to be important determinants of strikes. A one percent increase in the size of the bargaining unit is associated with a 3 percentage point increase in the strike probability. This would be consistent with the theory if larger bargaining units are relatively more effective at imposing costs on the firm during a strike than during a holdout.

The theory predicts procyclical strike incidence, since strong economies favor the strike threat over the holdout threat by making production disruptions more expensive for the firm and part-time job opportunities more prevalent for the union. Controlling for province and year effects, we find that within-year variations in the provincial unemployment rate do not effect the likelihood of a strike. This finding does not contradict the previous empirical evidence that Canadian strikes are procyclical (see Harrison and Stewart, 1989, 1994). The overall effect of the business cycle on strike incidence is absorbed by the year effects. When we omit the year effects, the coefficient (standard error) on the provincial unemployment rate is !0.008 (0.003).

Card (1988) shows, using Canadian data, that strikes are more likely if there is a short strike in the prior contract, but less likely after a long strike. We extend Card's analysis by controlling for whether conciliation or mediation occurred during the prior contract negotiation. Our sample exhibits Card's finding that a strike is more likely following a short strike (less than 49 days), and less likely following a long strike (50-147 days). We also find that strikes are more likely if the prior contract negotiation involved either conciliation or mediation. Both events increase the likelihood of a strike at the current contract negotiation by 7 to 8 percentage points, which is similar to the weighted average marginal effect of a short strike (9.1 percentage points). One interpretation of these findings is that some bargaining units may consistently face greater uncertainty over their firm's willingness to pay. This would lead to past bargaining difficulties as evidenced by a strike or the use of conciliation/mediation being positively correlated with current bargaining difficulties. Long strikes, though, may deplete the union's strike fund causing a shift toward the holdout threat in the next negotiation.

4.2 Effect of Labor Policy on Strike Duration

Table 5 presents estimates of the effects of labor policy on strike duration. The first two specifications estimate strike duration for strikes involving 500 or more workers. Specification (1) includes

an indicator for a strike in the prior contract negotiation, while specification (2) replaces this with a series of prior strike duration indicators. Specification (3) estimates strike duration for strikes involving bargaining units of all sizes. Unfortunately, the complete sample of strikes does not contain contract-specific information; hence, the missing variables. As in the strike incidence analysis, then, we proceed with an error structure that does not include bargaining unit effects, but we compute the standard errors in specification (1) and (2) using a robust variance estimator that allows for nonindependence across strikes by the same bargaining unit.[8] This robust variance estimator is not used for specification (3), since we can not identify the panel structure in this sample.

A ban on replacement workers is associated with substantially longer strike durations. The magnitude of this effect depends on which sample is used in the estimation. In the sample of large strikes, the data indicate that a replacement ban is associated with well over a doubling in the average strike duration. In the sample of all strikes, a replacement ban is associated with a 50% increase in the average strike duration. We find this later estimate more probable, since the sample of all strikes is over 18 times the size of the sample of large strikes. The cost of using the larger sample of all strikes, however, is that we can not control for bargaining unit characteristics and outcomes in the prior contract negotiation.[9]

Conciliation in general is associated with longer strike durations, although the effects are imprecisely measured. This is opposite to the policy's intent. A possible explanation is that conciliation may be relatively more successful in preventing short strikes, thereby shifting the composition of observed strikes to ones that will take longer to resolve. Cooling off periods have a negative but insignificant effect on strike durations.

Both mandatory strike votes and employer initiated vote options tend to shorten strike durations. The mandatory vote effect is statistically significant in the sample of all strikes, while the employer initiated vote options is statistically significant in the sample of large strikes. If the primary effect of voting

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[8] The LM test for bargaining unit error components in specification (1) yielded a $?^2(1) = 0.16$, which has a probability value of 0.68.

[9] The increase in strike activity associated with a replacement ban seems inconsistent with the joint-cost hypothesis (Kennan 1980; Reder and Neumann 1980), which posits that strike activity should decrease when the joint costs of a strike increase. However, while the ban increases the cost of a strike to the firm, it reduces the cost of a strike to the union because the strike no longer includes a risk of replacement. Hence, the joint-cost hypothesis is ambiguous with respect to the expected effect of a replacement ban on strike activity.

provisions is to eliminate strikes which lack a majority backing from the union membership, then the data suggest that strikes which are initiated with strong membership support are resolved more quickly.

In addition, the bargaining model outlined in section 2.1 predicts that strike durations should be proportional to the contract duration, holding other factors constant. That is, to signal the same level of willingness to pay, employers signing three year contracts would have to endure proportionately longer strikes than similar employers signing one year contracts. Reopening provisions, by shortening the expected duration of the current contract, should shorten observed strike durations. The data indicate a negative but insignificant effect of both types of reopening provisions on strike durations in the sample of large strikes, and a negative and significant effect of general reopening provisions in the sample of all strikes.

Turning to the nonpolicy variables, the theoretical model predicts that real wage gains over the prior contract should result in increased strike incidence yet have no significant effect on strike durations. We find this pattern in the data. Wage and price controls appear to shorten strike durations, though the effect is significant only in the sample of all strikes.

If uncertainty increases with the length of the prior contract, then we would expect to see more frequent and longer strikes following long as opposed to short contracts. While the data indicates a positive association between strike incidence and the prior contract length, there is no significant relationship between strike duration and the prior contract length.

Scale effects are important for both strike incidence and strike durations. Larger bargaining units have significantly shorter strike durations. The estimated elasticity ranges from a low (in absolute value) of 8 percent in the sample of all strikes, to around 19 percent in the sample of large strikes. Recall, that larger bargaining units have a higher incidence of strikes. The theory would predict opposite incidence and duration effects if larger bargaining units are relatively more effective in reducing the firm' s profitability during a strike both by imposing more production inefficiencies and higher operating costs on the firm during the strike.

The data present a conflicting view of the effect of tightness in the local labor market on the length of strikes. There is a negative and insignificant relationship between local unemployment rates and strike durations in the sample of large strikes, and a small positive and significant relationship in the sample of all strikes. If tight local labor markets increase both the production inefficiencies and firm operating costs during a strike (by making replacement workers more difficult to find and more expensive), and increase

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the income to striking workers during a strike (by making part-time job opportunities more plentiful), then the theory would predict higher strike incidence but an indeterminate effect on strike durations.

4.3 The Effect of Labor Policy on Wages

Most studies have focused on how labor policy influences strike activity, ignoring the effect on wage settlements.[10] The effect of labor policy on wages, however, is sometimes more direct (at least in the theory) and is therefore a good candidate for evaluating the theory. This is the case for a ban on replacement workers, which makes the strike threat more attractive for the union; hence, we expect significantly higher wage settlements. The wage effects associated with labor legislation are also important components of a welfare analysis.

Table 6 presents estimates of the effects of labor policy on the real wage. We treat the bargaining unit error components as fixed-effects which we difference out to maintain consistency of our estimates.[11] The theory predicts that under the holdout threat the settlement wage equals the wage under the expired contract plus a share of the inefficiencies created by the holdout. This implies a coefficient of one on the prior wage in the wage equation. Under the strike threat, the threat value to the union is likely to be less than the wage under the expired contract. In the overall settlement sample, then, we expect to find a coefficient less than one on the prior contract wage. The data indicate a coefficient of around two-thirds. A consequence is that the long-run effects of policy variables will exceed the short-run effects listed in table 6.

The policy variable with the clearest theoretical predictions — the ban on replacement workers — is associated with slightly more than a 4 percent increase in real wages. The long-run effect of a replacement ban is around 14 percent. The significantly higher wage is consistent with the theory and reflects the wage advantage to the union associated with the strike threat. We will show in section 7 that this policy generates sizeable wealth transfers from employers to unions.

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[10]An exception is Budd (1996) which we discuss in section 5.

[11] The LM test for bargaining unit error components yields a $\chi^2(1) = 18.1$, which has a probability value less than 0.001. The data clearly supports the presence of bargaining unit error components. The Hausman test for whether these error components are correlated with the other right-hand-side variables yields a $\chi^2(46) = 626.4$, which has a probability value less than 0.001.

Conciliation has a positive but imprecisely estimated effect on wages. Cooling-off periods, in contrast, are associated with a significant reduction in wage settlements of around 4 percent per ten days. This finding is interesting since the intent of cooling-off periods is to facilitate settlements without systematically altering the terms of the settlements.

Mandatory strike votes and employer initiated vote options act to constrain the union' sability to undertake and sustain a strike. The data indicate no wage effect associated with mandatory vote requirements. In contrast, employer initiated vote options are associated with a surprising 1.4 percent wage increase. Stronger union security through dues checkoff provisions has no significant effect on wage settlements.

The last two policy variables deal with reopening of contracts. General reopening provisions do not appear to systematically shift the terms of the wage settlements. To the extent that technological change reopening provisions provide the union with more job security, then the data indicate that the union must pay for this through lower wage settlements.

A basic prediction of many bargaining models is that the settlement wage should decline with the duration of the strike. Card (1990), using Canadian contract data, finds no evidence of a downward sloping concession function. McConnell (1989) finds, using U.S. data, that wages decline 3% per 100 days of strike when she controls for bargaining unit fixed-effects. Both studies treat the strike indicator and strike duration variables as exogenous. Like Card (1990), if we treat the strike indicator and strike duration variables as exogenous and include bargaining unit fixed-effects we find no evidence of a negatively sloped concession function. The coefficient (standard error) on the presumed exogenous strike indicator is -0.006 (0.007), and for the presumed exogenous strike duration 0.003 (0.002).

Our strike incidence and duration specifications allow us to test for the endogeneity of the wage concession function. The presence of a COLA clause, whether a strike occurred, and the unconditional duration of the strike are all outcomes of the same negotiation process determining the wage. [12] We instrument the current COLA indicator with an indicator for a COLA clause in the prior contract. A prior COLA clause reduces the relative cost of including a COLA clause in the current contract since there is already agreement on the basic structure of the COLA. The strike indicator and strike duration are instrumented with the real wage change over the prior contract, the prior contract length, and indicators for conciliation, mediation, or a strike in the previous negotiation. The real wage change over the prior contract

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[12]The unconditional strike duration includes a duration of zero for all nonstrikes.

shifts the value of the holdout threat, and therefore the composition of labor disputes between strikes and holdouts. However, since the strike threat is unaffected, there should be no direct effect on the settlement wage. Similarly, greater uncertainty by the union increases both the likelihood of a strike and its expected duration, but does not affect the settlement wage conditional on a strike. We reject the hypothesis that the COLA indicator and wage concession variables are exogenous in the wage specification. [13]

When we instrument for the strike indicator and strike duration we find a positive average wage effect and a negative and significant slope to the concession function, which corresponds to roughly an 8% decline in wages per 100 days of strike. The average strike of 59 days, therefore, produces a 4.7 percent wage concession by the union.

Wage settlements negotiated under wage and price controls are 1.7 percent lower than otherwise. This helps to explain the earlier finding that the incidence of strikes is lower during periods of wage and price controls. By constraining the possible wage settlements, these controls reduce the relative attractiveness of the strike threat. COLA clauses do not provide bargaining units on average with higher real wages. Nonindexed contracts appear to equally compensate workers for inflation by factoring expected inflation into future deferred wage increases and "catch-up" for unexpected inflation over the prior contract in the initial wage increase (see Christofides, Swidinsky, and Wilton (1980)).

Bargaining unit size has no effect on wage settlements. Given the earlier findings that larger bargaining units experience more frequent but shorter strikes, the theory would predict that larger bargaining units would also experience higher real wage gains. Slack provincial labor markets at the time of the contract renewal result in lower wage settlements. High local unemployment hurts the union's strike threat and enhances the firm's strike threat (by making part-time jobs scarce and part-time workers plentiful) which lowers the strike settlement wage.

4.4 Robustness of Policy Variable Effects

A potential problem with our empirical estimates of these policy effects is our maintained assumption that the policy variation is exogenous to strike activity and the wage determination process. A

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[13]The joint test for the endogeneity of these three variables produces a $F(3,3506) = 8.66$, which has a probability value less than 0.001. This is a joint test for the significance in the wage equation of the residuals of the COLA indicator, strike indicator, and strike duration variables from their instrumented values.

formal statistical test of this exogeneity requires a set of instruments derived from an empirical model of the political process, an exercise beyond the scope of this analysis.

Given the lack of instruments, we have explored the exogeneity assumption in a more informal manner. Table 7 reports estimates of pre-adoption wage, strike incidence, and strike duration effects for the five-year period leading up to the adoption of a ban on replacement workers.[14] We report results for the three provinces that adopt replacement bans during our sample, and separately for Quebec.

One plausible scenario is that a replacement ban is more likely to be enacted when wage settlements and/or strike activity become significantly out of line with historical patterns. In particular, unions in the U.S. have been pushing for a replacement ban using the current *low* level of strike activity and *low* wage settlements as evidence that the relative bargaining power has shifted too much in favor of employers. This suggests that a replacement ban is more likely to be passed following a period of diminished strike activity and depressed wage settlements. This would result in an upward bias on the estimate of the increase in wages and/or strike activity due to the ban *if* collective bargaining outcomes would tend to revert back to their historical patterns even in the absence of any legislative changes.[15]

The data indicate that strike incidence was not significantly higher or lower in the overall pre-enactment period. However, strikes were *more* frequent in the five years prior to enactment of the replacement ban. The data provides some indication of an increase as well in strike durations in the three years preceding the enactment of a replacement ban. Finally, wage settlements in the overall pre-enactment period were not significantly different from the general pattern of wage settlements. However, in Quebec wage settlements were 1-2% higher in the three years prior to enactment of the replacement ban.

These findings suggest that a replacement ban is more likely to be passed following a period of relatively *high* strike activity. In particular, policy makers may react to increased picket line violence during periods of relative high strike activity. (See Boivin and Deom 1995, p. 470 for a discussion of legislator' sintent for replacement legislation to reduce picket line violence during work stoppages.)

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[14]We focus on replacement ban legislation due to the attention given to this policy variable in the empirical literature.

[15]If relative bargaining power has shifted away from unions for reasons that are not temporary, then there would be no reason to expect mean reversion to occur. In this case, there would be no bias to the measured replacement ban effects on strike activity and wage settlements.

If replacement legislation is passed during periods of temporary heightened strike activity and the ban itself does not significantly increase strike activity (that is, the measured replacement effect is spurious), then we should observe a declining pattern over time of the strike incidence and strike duration effects associated with the ban. To check this, we break up the Quebec post-enactment period into three subperiods. The effect on strike activity is higher in the second period following the ban (1984-1988) as compared to the first period (1978-1983). The effect on strike durations is not significantly different between the first and the third periods. The data do not support a claim that the effects are temporary and decline sharply over time.

5 Comparison with the Earlier Literature

In this section, we compare our findings with the existing literature. Gunderson, Kervin, and Reid (1986, 1989) (*GKR*) examine the effect of Canadian labor policies on strike incidence. The first paper examines negotiations occurring between 1971-1983, while the second paper extends the sample to 1985.

Restricting our sample to the period 1971 - 1985, we were able to fully replicate their incidence findings. Extending the sample to 1967 - 1993 impacts four policy variables in a significant manner. *GKR'* s estimate of the effect of a replacement ban on strike incidence is twice as large as our estimate. *GKR* find a negative and significant effect of conciliation officers and board policies, which in our analysis is much smaller in magnitude and insignificant. *GKR* find a large positive effect of employer initiated optional strike vote provisions, which again is much smaller and insignificant in our sample. Finally, *GKR* find a small positive and insignificant effect of reopener provisions on strike incidence, which is negative and significant in our sample.

Gunderson and Melino (1990) (*GM*) estimate the effect of Canadian labor policies on strike durations. They focus exclusively on the sample of all strikes from 1967 to 1985. The direction of the effects of the policy variables on strike durations in *GM* generally agree with our results. Using our sample of all strikes as a reference point, our implied marginal effects tend to be larger, though, than those of *GM*. For example, *GM* report a marginal effect of a replacement ban of around 7 days, whereas our implied marginal effect is around 24 days. Similarly, *GM* estimate that mandatory vote provisions are associated with a decrease in strike durations of 7 days, whereas our estimates suggest a decrease of 16 days.

Budd (1996) estimates the effect of a variety of Canadian policy variables on wage settlements and strike activity. His sample covers single province contracts in manufacturing during the period from 1965 -

1985. In his specification which includes bargaining unit fixed effects, Budd finds no significant wage, strike incidence, or strike duration effect associated with a ban on replacement workers.

Budd's sample and specifications both tend to weaken the finding of a significant effect of replacement bans on strike activity and wage settlements. Turn first to the replacement ban effect on strike activity. Budd uses a conditional logit rather than a simple logit model in order to eliminate any bargaining unit error components. Recall, that we find no evidence for bargaining unit error components in our strike incidence specification. The positive effect of a replacement ban on strike incidence falls to zero when the sample is restricted to manufacturing bargaining units over the period 1965-1985, and turns negative when we control for bargaining unit fixed-effects. For strike durations, Budd's finding of no replacement ban effects is primarily due to his choice of specification rather than his sample. In contrast, for wage settlements the differences across samples turns out to be more significant than the differences across specifications. Budd's finding of no effect of replacement bans on wage settlements is sensitive to the shorter time-period and narrower industry mix of bargaining units in his sample.

7 Effect of Labor Policy on Welfare

In this section, we calculate the welfare consequences of the labor policies which are summarized in Table 8. Following Currie and McConnell (1991), the calculations of strike cost are based on the conservative assumption that the joint cost of a strike is the lost wages, which amounts to $100 per person-day. Others have estimated strike costs to be much higher. For example, Imberman (1979), in an accounting study of strike costs at 28 firms, estimated the firms' strike costs to be about $900 (June 1993 Canadian dollars) per person-day.

The effect a policy has on strike costs reflects both changes in strike incidence and strike duration. The unconditional strike duration (that is, the average strike duration per contract negotiation) is calculated as the product of strike incidence and strike duration conditional on a strike. For our sample, the mean unconditional duration is 9.7 days. The change in strike cost associated with a policy is the change in the unconditional strike duration multiplied by the mean daily strike cost.

The wage gain from a policy is measured as the change in the wage bill over the life of the contract with and without the policy. To the extent that current wage changes are carried over to future contracts, this is an understatement of the policy's long term wage gain. In calculating the net gain from a policy, we

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assume that the strike cost is split equally between the firm and the union. Hence, the union's net gain is the wage gain less half the strike cost, and the firm's net loss is the wage gain plus half the strike cost.

Mandatory strike votes and contract reopening provisions appear to be the most successful at reducing expected strike costs at contract renewals. The data indicate a decline of $0.8 million (1993 Canadian dollars) per contract negotiation. Both policies are associated with a decline of around 6-7 days in the unconditional strike duration. We find no statistically significant distributional effects associated with these two policy variables. In contrast, conciliation provisions and cooling-off periods fail to significantly reduce expected strike costs.

Of all the policy variables, a ban on replacement workers is associated with the largest strike costs. Unconditional strike durations increase by roughly two weeks following a ban on the hiring of replacement workers. The estimated additional strike cost is $1.9 million per contract negotiation. The average wage gain is $3.9 million. Assuming that the strike costs are divided equally, unions gain on average $2.9 million per contract and employers lose over $4.8 million per contract. This is consistent with the considerable and opposing interest unions and employers have shown toward this type of legislation.

Offsetting at least some of the larger strike costs associated with a replacement ban is a reduction in strike related violence. Strike violence tends to escalate when replacements are used, since once replaced, violence is often the only means left for the union to put pressure on the firm. (Our data on U.S. strikes supports this claim, Cramton and Tracy (1995); we do not have data on the extent of violence in Canadian strikes.) Three factors, then, need to be considered when evaluating a replacement ban: the increase in strike costs stemming from increased strike activity, the redistribution of quasi-rents from employers to unions, and the reduction in strike related violence.

Conclusion

We estimate the effects of labor policy on wages and strike activity using a Canadian sample of 4,340 private sector contract negotiations involving 500 or more workers from 1967 to March 1993. We interpret our estimates in light of private information theories of wage bargaining.

Compulsory conciliation and cooling-off periods are found to be largely ineffective at reducing strike activity. These policies were introduced with the intent of reducing strike activity by facilitating communication and hence reducing uncertainty. Their failure may mean that parties voluntarily adopt

dispute resolution procedures, whenever they are effective, so requiring specific procedures will not further reduce dispute costs.

The theory makes unambiguous predictions about how a ban on replacement workers should effect wages and strike activity. This policy improves the union's strike payoff relative to the firm's payoff; hence, wages should increase. The increased attractiveness of the union's strike threat relative to the holdout threat means that strike incidence should increase. Strike duration should increase also, since the ban effectively increases uncertainty by eliminating an upper bound on the firm's willingness to pay and makes it less likely that strike costs will fall over time.

The data confirm each of these predictions. Wage settlements negotiated with a replacement ban in effect are on average over four percent higher. The unconditional strike duration increases by roughly two weeks in response to a replacement ban. This implies an increase in average negotiation costs of around $1.9 million (1993 Canadian) per contract. Unions receive sufficiently higher wage settlements to offset their share of these higher negotiation costs, while employers are made significantly worse off.

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Appendix

Data Definitions and Sources

The data comes from three main sources:

     1. *Wage file*. Labour Canada, Major Wage Settlements data base. Includes settlements with at least 500 workers. For settlements from 1967 to 1977, the data was provided on a tape labeled "J90Tape". For settlements from 1978 to March 1993, the data was provided on a diskette. Although the bargaining unit identifiers changed after 1977, a link file was included that permitted the linking of the pre-1978 tape data with the post-1977 identifiers. Data from the tape and diskette overlapped for the years 1978 to 1985. As a consistency check, we compared the two data sources for these years. The two sources were nearly identical (once minor coding changes were accounted for), except that a miscoding of the "settlement stage" variable on the tape was corrected on the diskette. The coding error, reported in Card (1990), exists on the tape for the years 1979 to 1981. It does not occur during the years for which we use the data from the tape.

     2. *Work Stoppage file*. Labour Canada, Work Stoppage data base, provided on diskettes. Includes all Canadian work stoppages that began between 1966 to April 1993. The procedure for linking the Wage file and the Work Stoppage file are described below.

     3. *Cansim*. Statistics Canada, Cansim data base, down-loaded from epas.utoronto.ca. Includes aggregate Canadian and provincial economic data through May 1993.

Real wage
Effective wage at the end of the contract deflated by the 1981 Canadian CPI. Source: Wage file.

Strike occurred
Work stoppage occurred before the parties settled. If the Wage file indicated a strike occurred, but there was no corresponding record in the Work Stoppage file, then the record was dropped. This was the case for seven out of the 888 strikes

(0.8%). Source: Wage file and Work Stoppage file.

Strike duration
The number of calendar days between the beginning and the end of the strike. Source: Work Stoppage file.

Policy variables
All nine policy variables indicate whether a particular policy was in effect at the time of settlement, monthly by province. See the text (Section 2) for details. Source: Gunderson, Kervin, and Reid (1988), Labour Canada, *Industrial Relations Legislation in Canada* and CCH Canadian Ltd., *Canadian Labour Law Reporter*.

Anti-inflation board
Wage and price controls in effect at the contract expiration, monthly by province. Source: Anti-Inflation Board, *Chronicles of the Anti-Inflation Board*.

Contract duration
The number of calendar days between the old contract expiration and the new contract expiration. Source: Wage file.

Prior real percentage wage change
Annual percentage change in the wage over the prior contract:

$$100[(w/w_0)^{\frac{12}{R}} - 1]$$

where w is the real wage at the end of the prior contract, w_0 is the real wage at the beginning of the prior contract, and R is the contract duration in months. Source: Wage file.

Percentage change in employment
Annual percentage change in the number of workers in the bargaining unit from the prior contract to the current contract:

$$100\frac{12}{R}\frac{n - n_0}{n_0}$$

where n is the number of workers in the current contract, n_0 is the number of workers in the prior contract, and R is the contract duration in months. Source: Wage file.

Wage is primary issue
Indicates that the wage was a primary issue in the work stoppage. Issue codes 100-201, 203-210, 401-404, and 1400-1516. Source: Work Stoppage file.

Lockout
Indicates the work stoppage was a lockout by the firm. Source: Work Stoppage file.

Rotating strike
Indicates the work stoppage was a rotating strike. Source: Work Stoppage file.

Provincial unemployment rate
Unemployment rate of persons 15 years or older, monthly by province. Source: Cansim codes D767289, D767842, D767980, D768118, D768256, D768418, D768602, D768734, D768872, D769010, D769173.

Consumer price index (CPI)
Canadian consumer price index for all items, 1981=100, monthly. Source: Cansim code D484000.

Provincial real manufacturing wage
Average hourly earnings of hourly wage-earners in manufacturing, monthly by province, includes all firms with 20 or more employees. Series terminates March 1983; Industry index of hourly earnings used to extend series. Source: Cansim codes D708311, D708602, D708660, D708710, D708765, D708963, D709312, D709411, D709513, D709612.

Industry index of hourly earnings
Fixed-weighted industry-aggregate index of average hourly earnings, monthly by province, includes all firms with 20 or more employees. Series starts March 1983; used to extend Provincial real manufacturing wage series. Source: Cansim codes L95705, L95717, L95718, L95719, L95720, L95721, L95722, L95723, L95724, L95725, L95726.

Industry real value-added price index
For each three-digit industry, the index is defined as the following.

$$\Delta \log v(t) = (\Delta \log q(t) - h \Delta \log r(t)) / (1 - h),$$

where $v(t)$ is the value-added price index, $q(t)$ is the price index for gross industry output, $r(t)$ is the intermediate inputs price index, and h is the average share of intermediate inputs in the gross value of output.

Linking the Work Stoppage and Wage Files

Unfortunately, strike durations are not included in the Canadian wage file. To get strike durations, one must link records from the work stoppage file. There is no simply way to perform this link. Below we document our approach in linking the 888 strikes from the wage file to the 15,639 private sector strikes from the work stoppage file.

We began by importing selected fields of each file into Paradox. Each record in the wage file is uniquely identified by the agreement number and the renewal number. Each record in the work stoppage file is uniquely identified by the current year and the work stoppage number. The fields common to both files are the three-digit SIC, jurisdiction, province, union, and company name. For the wage file, the contract expiration, the settlement date, and the number of workers in the bargaining unit were also included. For the work stoppage file, the beginning date of the strike, the ending date of the strike, and the maximum number of workers on strike were also included.

The first step was to identify the obvious matches: those records that match on all the common fields — SIC, jurisdiction, province, union, and company name — and have a settlement date that is within a few days of the strike ending date. This initial step successfully identified 606 matches (68%). We then successively relaxed the requirements for a potential match, allowing the union codes to differ

say, and then visually checking to see which of the potential matches seemed reasonable. In the end, a likely match was found for all but seven of the 888 strikes in the wage file. These seven contracts were then dropped from our sample.

Table 1: Predicted Impact of Labor Legislation on Strike Activity and Real Wages

Policy variables	Strike Incidence	Strike Duration	Real Wages
Conciliation officer	(!)	(!)	
Conciliation officer and board	(!)	(!)	
Cooling-off period	(!)	(!)	(!)
Mandatory strike vote	(!)		
Employer initiated vote option			
Compulsory dues checkoff	±	(+)	(+)
Prohibit replacement workers	+	+	+
Right to reopen negotiations	!		
Reopen if technological change	!		(+)

Notes: + denotes a positive effect, ! denotes a negative effect, ± denotes offsetting effects, and parentheses denotes a weak effect.

TABLE 2 — SUMMARY STATISTICS OF CONTRACTS, DISPUTES, AND WAGES

Statistic	500 or more workers		all contracts	
	Private Sector	Public Sector	Private Sector	Public Sector
Number of contracts	5,819	6,798	96,692[a]	41,127[a]
Conciliation incidence (percent)	31	17		
Mediation incidence (percent)	10	11		
Arbitration incidence (percent)	1	10		
Strike incidence (percent)[b]	16	8[c]		
Mean strike duration (days)	59	35[c]	49	32
Mean dispute duration (days)	108	202		
Mean person-days lost in strike (000s)	76	44[c]	8	9
Mean real wage (1986 Canadian dollars)	11.31	11.52		

Notes: Includes negotiations settled from 1967 to March 1993.
[a]Estimated assuming strike incidence is the same as when the contract covers 500 or more workers.
[b]Includes strikes that preceded an arbitrated or legislated settlement.
[c]From Currie and McConnell (1991) for the period 1964-1987.

TABLE 3 — LABOR RELATIONS POLICY VARIABLES, 1967 TO 1993

Policy Variable	Federal	British Columbia	Alberta	Saskatchewan	Manitoba	Ontario	Quebec	New Brunswick	Nova Scotia	Prince Edward Island	Newfoundland
						Province					
Conciliation officer only	72:7 to 93	67 to 68:11	68 to 81:2 88:12 to 93	—	67 to 72:12	67 to 86	67 to 78:1	72:4 to 93	67 to 93	67 to 93	—
Conciliation officer and board	67 to 72:6	—	67	—	—	—	—	67 to 72:3	—	—	67 to 93
Cooling-off period (days)	67 to 93 (7)	67 to 68:11 (2) 68:12 to 93 (3)	67 to 81:2 (14) 81:3 to 88:11 (3) 88:12 to 93 (14)	83:7 to 93 (2)	67 to 72:12 (7)	67 to 93 (14)	77:12 to 93 (2)	67 to 93 (7)	67 to 72:9 (21) 72:10 to 93 (14)	67 to 71:3 (7) 71:4 to 77:4 (21) 77:5 to 93 (14)	67 to 93 (7)
Mandatory strike vote	—	67 to 93	67 to 93	67 to 93	85:1 to 93	—	78:4 to 93	72:4 to 93	67 to 93	67 to 93	—
Employer initiated vote option	—	87:8 to 93	88:12 to 93	69:8 to 72:7 83:7 to 93	—	80:7 to 93	—	—	—	—	—
Dues checkoff	84:7 to 93	77:10 to 93	—	72:8 to 93	72:11 to 93	80:7 to 93	78:4 to 93	—	—	—	85:7 to 93
Prohibit replacement workers	—	93:1 to 93	—	—	—	93:1 to 93	78:2 to 93	—	—	—	—
Negotiated reopeners	67 to 93	—	—	67 to 93	67 to 93	—	67 to 93	67 to 93	67 to 93	67 to 93	67 to 93
Reopeners for technological change	72 to 93	74:3 to 93	—	72:8 to 93	73:1 to 93	—	—	89:4 to 93	—	—	—

Notes: Each cell indicates the period the legislation was in effect for the jurisdiction. For example, the first cell "72:7 to 93" indicates that conciliation by an officer only was required in the federal jurisdiction from July 1972 through all of 1993.

TABLE 4 — PROBIT ESTIMATES OF THE IMPACT OF LABOR POLICY ON
STRIKE INCIDENCE

	Probit MEs	
Variable	(1)	(2)
Policy variables:		
Conciliation officer	!0.015	!0.012
	(0.056)	(0.055)
Conciliation officer and board	!0.037	!0.035
	(0.053)	(0.053)
Cooling-off period (10 days)	!0.008	!0.011
	(0.043)	(0.043)
Mandatory strike vote	!0.075**	!0.073**
	(0.030)	(0.030)
Employer initiated vote option	0.040	0.030
	(0.027)	(0.026)
Compulsory dues checkoff	!0.013	!0.004
	(0.025)	(0.025)
Prohibit replacement workers	0.122	0.120
	(0.087)	(0.087)
Right to reopen negotiations	!0.062*	!0.066*
	(0.037)	(0.037)
Reopen if technological change	0.054*	0.048
	(0.033)	(0.032)
Other variables:		
Prior real percentage wage change	!0.004**	!0.004**
	(0.001)	(0.001)
Anti-inflation board	!0.057*	!0.060**
	(0.027)	(0.026)
Previous Contract duration (log days)	0.033**	0.040**
	(0.017)	(0.016)
Bargaining unit size (log)	0.030**	0.028**
	(0.007)	(0.007)
Provincial unemployment rate	!0.002	!0.001
	(0.004)	(0.004)

TABLE 4 — *Continued*

	Probit MEs	
Variable	(1)	(2)
Conciliation used in prior contract	0.072** (0.014)	0.072** (0.014)
Mediation used in prior contract	0.087** (0.024)	0.088** (0.024)
Strike in prior contract	0.031** (0.016)	
Indicators for prior strike duration:		
(a) 1-7 days (14%)		0.150** (0.046)
(b) 8-28 days (28%)		0.097** (0.032)
(c) 29-49 days (18%)		0.037 (0.031)
(d) 50-98 days (20%)		! 0.055** (0.021)
(e) 99-147 days (10%)		! 0.088** (0.021)
(f) 148+ days (10%)		0.023 (0.041)
Fixed Effects (number of variables):		
Season (3), Year (26)		
Region (5), Union (5), Industry (32)		
sample size	4,340	4,340
?² for policy variables [probability value]	17.71 [0.06]	18.49 [0.05]
Log likelihood	! 1,674	! 1,654

Notes: Coefficients measure the change in strike probability per unit increase in the variable evaluated at the mean strike probability for the sample. Standard errors are given in parentheses and have been adjusted for any nonindependence of negotiations for the same bargaining unit. *Statistically significant at 0.10 level. **Statistically significant at 0.05 level.

TABLE 5 — ESTIMATES OF THE IMPACT OF LABOR POLICY ON STRIKE DURATION

| | Log Strike Duration | | |
| | (large strikes) | | (all strikes) |
Variable	(1)	(2)	(3)
Policy variables:			
Conciliation officer	1.07	1.03	0.19*
	(0.78)	(0.77)	(0.11)
Conciliation officer and board	1.07	0.95	! 0.04
	(0.96)	(0.91)	(0.16)
Cooling-off period (10 days)	! 0.23	! 0.24	0.00
	(0.42)	(0.42)	(0.08)
Mandatory strike vote	! 0.20	! 0.21	! 0.27**
	(0.50)	(0.48)	(0.08)
Employer initiated vote option	! 0.43*	! 0.47*	0.08
	(0.25)	(0.25)	(0.07)
Compulsory dues checkoff	0.51*	0.59**	! 0.00
	(0.28)	(0.27)	(0.07)
Prohibit replacement workers	1.29*	1.26*	0.46**
	(0.75)	(0.75)	(0.13)
Right to reopen negotiations	! 0.56	! 0.56	! 0.33**
	(0.53)	(0.53)	(0.10)
Reopen if technological change	! 0.14	! 0.13	! 0.02
	(0.29)	(0.29)	(0.07)
Other variables:			
Prior real percentage wage change	! 0.02	! 0.02	
	(0.02)	(0.02)	
Anti-inflation board	! 0.14	! 0.14	! 0.27**
	(0.38)	(0.38)	(0.09)
Prior Contract duration (elasticity)	! 0.19	! 0.19	
	(0.17)	(0.17)	
Bargaining unit size (elasticity)	! 0.19**	! 0.19**	! 0.08**
	(0.07)	(0.07)	(0.01)
Provincial unemployment rate	! 0.03	! 0.03	0.02**
	(0.03)	(0.03)	(0.01)

Table 5 — *Continued*

	Log Strike Duration		
	(large strikes)		(all strikes)
Variable	(1)	(2)	(3)
Conciliation used in prior contract	0.11 (0.12)	0.12 (0.12)	
Mediation used in prior contract	! 0.05 (0.17)	! 0.03 (0.17)	
Strike in prior contract	0.39** (0.14)		
Indicators for prior strike duration:			
(a) 1-7 days (14%)		0.46** (0.22)	
(b) 8-28 days (28%)		0.51** (0.19)	
(c) 29-49 days (18%)		0.35 (0.22)	
(d) 50-98 days (20%)		! 0.35 (0.33)	
(e) 99-147 days (10%)		0.91** (0.29)	
(f) 148+ days (10%)		0.65* (0.34)	
Controls (number of variables): Season (3), Region (5), Union (5) Year (26), Industry (32)			
Sample size	706	706	12,929
F-test for policy variables [probability value]	1.38 [0.18]	1.43 [0.16]	3.26 [0.001]
R^2	0.28	0.29	0.09

Notes: Standard errors are given in parentheses and have been adjusted in specifications (1) and (2) for any nonindependence among negotiations by the same bargaining unit. Contract specific variables are missing from (3), since they are not included in the all strikes data set.
*Statistically significant at 0.10 level. **Statistically significant at 0.05 level.

TABLE 6 — ESTIMATES OF THE IMPACT OF LABOR POLICY
ON THE REAL WAGE

Variable	log Real Wage
Policy variables:	
Conciliation officer	0.028
	(0.020)
Conciliation officer and board	0.020
	(0.024)
Cooling-off period (10 days)	−0.042**
	(0.018)
Mandatory strike vote	0.009
	(0.011)
Employer initiated vote option	0.014**
	(0.006)
Compulsory dues checkoff	−0.003
	(0.005)
Prohibit replacement workers	0.044*
	(0.022)
Right to reopen negotiations	−0.003
	(0.023)
Reopen if technological change	−0.012
	(0.008)
Other variables:	
Real previous wage (log)	0.685**
	(0.015)
Anti-inflation board	−0.017**
	(0.007)
COLA clause in contract[1]	0.003
	(0.005)
Bargaining unit size (log)	−0.001
	(0.004)
Provincial unemployment rate	−0.004**
	(0.001)
Provincial real manufacturing wage (log)	−0.004
	(0.048)

TABLE 6 — *Continued*

Variable	log Real Wage
Strike occurred[1]	0.042 (0.028)
Strike duration (log days)[1]	! 0.046** (0.010)

Fixed Effects (number of variables):
Season (3), Year (26)
Bargaining Unit (785)

Sample size	4,340
F-test for policy variables [probability value]	27.90 [0.002]
R^2	0.93

Notes: Standard errors are given in parentheses.
*Statistically significant at 0.10 level. **Statistically significant at 0.05 level.
[1] Treated as endogenous.

Table 7: Pre- and Post-Replacement Ban Effects

		Log Real Wage		Strike Incidence Marginal Effects		Log Strike Duration	
		British Columbia, Ontario & Quebec	Quebec Only	British Columbia, Ontario & Quebec	Quebec Only	British Columbia, Ontario & Quebec	Quebec Only
Pre-Replacement Ban	Overall	−0.012 (0.033)	0.001 (0.032)	0.009 (0.062)	−0.049 (0.069)	−0.345 (0.573)	−0.766 (0.780)
	$t_0 - 5$ years[a]	−0.014** (0.007)	−0.021** (0.010)	0.155** (0.058)	0.226** (0.098)	−0.171 (0.289)	0.015 (0.404)
	$t_0 - 4$ years	0.023** (0.007)	0.047** (0.010)	0.071 (0.053)	0.026 (0.063)	−0.163 (0.357)	−0.290 (0.468)
	$t_0 - 3$ years	0.001 (0.007)	0.019* (0.011)	0.127** (0.060)	0.123* (0.085)	0.422 (0.352)	0.487 (0.452)
	$t_0 - 2$ years	−0.002 (0.007)	0.009 (0.010)	0.060 (0.052)	0.126* (0.078)	0.795** (0.358)	0.723* (0.429)
	$t_0 - 1$ year	−0.001 (0.007)	0.019* (0.010)	0.224** (0.074)	0.192** (0.096)	0.527 (0.414)	0.557 (0.494)
Post-Replacement Ban	1978 - 1983		0.040** (0.019)		0.112 (0.102)		1.730** (0.715)
	1984 - 1988		0.037* (0.019)		0.189** (0.118)		0.740 (0.722)
	1989 - 1993		0.047** (0.019)		0.055 (0.094)		1.537** (0.781)

Notes: Standard errors given in parentheses. Real wage specifications based on Table 6. Strike incidence specifications based on Table 4 (1). Log strike duration specifications based on Table 5 (3).

[a] t_0 denotes the effective date of the replacement ban

*Statistically significant at 0.10 level. **Statistically significant at 0.05 level.

Table 8 — Estimates of the Impact of Labor Policy on Welfare

Policy variable	Percent change in wage	Change in unconditional duration (days)	Million June 1993 Canadian dollars per contract			
			Strike cost	Wage gain	Union net gain	Firm net gain
Conciliation officer only	2.9	1	0.13 (0.44)	2.53* (1.50)	2.47 (1.52)	! 2.60* (1.52)
Conciliation officer and board	2	! 2.5	! 0.32 (0.41)	1.75 (1.77)	1.91 (1.78)	! 1.59 (1.78)
Cooling-off period (weeks)	! 2.9	! 0.3	! 0.04 (0.04)	! 2.62** (0.97)	! 2.60** (0.97)	2.64** (0.97)
Mandatory strike vote	1	! 6.6	! 0.84** (0.22)	0.82 (0.86)	1.25 (0.87)	! 0.40 (0.87)
Employer initiated vote option	1.4	3.3	0.42* (0.24)	1.24** (0.42)	1.03** (0.44)	! 1.45** (0.44)
Compulsory dues checkoff	! 0.3	! 0.8	! 0.10 (0.21)	! 0.29 (0.41)	! 0.24 (0.42)	0.34 (0.42)
Prohibit replacement workers	4.4	15.1	1.93** (1.01)	3.88** (1.66)	2.91* (1.74)	! 4.84** (1.74)
Right to reopen negotiations	! 0.3	! 6.7	! 0.86** (0.29)	! 0.29 (1.74)	0.15 (1.75)	0.72 (1.75)
Reopen if technological change	! 1.3	2.9	0.37 (0.26)	! 1.12* (0.60)	! 1.30** (0.62)	0.94 (0.62)

Notes: Standard errors are given in parentheses and reflect sampling variation in the estimated marginal effects of a policy variable on wage settlements, strike incidence, and strike duration. Overall impacts are based on a mean strike incidence of 0.165, a mean strike duration (D) of 59 days, a mean contract duration ($\bar{R}$) of 822 days, a mean real wage (w) of \$13.81 (June 1993 Canadian dollars), a mean bargaining unit size (n) of 1531 workers, a mean person-days lost due to the strike (d) of 76 thousand days, a mean number of hours worked per week (h) of 36, and a mean loss per strike ($L = w \cdot d \cdot h/5$) of \$7.50 million, equal to the lost wages. All of the above constants are calculated from our sample, except the mean number of hours worked per week, which is the average hours worked per week of persons in manufacturing industries from 1967 to 1991 (Cansim code I191206). The proportionate change in the real wage W_i is taken from Table 6; the change in unconditional strike duration D_i is calculated from Table 4, specification (1) and Table 5, specification (3), as described in the text; strike cost = $C_i = L \cdot D_i/D$; wage gain = $G_i = W_i \cdot n \cdot \bar{R} h/5$; union net gain = $G_i ! C_i/2$; firm net gain = $! G_i ! C_i/2$.
*Statistically significant at 0.10 level. **Statistically significant at 0.05 level