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Early Contract Renegotiation: An Analysis of U.S. Labor Contracts from 1970 to 1995

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Abstract

This paper examines the ex post flexibility of U.S. labor contracts during the 1970-95 period by investigating whether unanticipated changes in inflation increase the likelihood of a contract being renegotiated prior to its expiration. We find empirical support for this hypothesis. Specifically, our results indicate that renegotiations are triggered principally by large and infrequent price shocks of either sign. When combined with evidence that ex ante contract durations are shorter during episodes of increased inflation uncertainty, our results suggest that these contracts are flexible both ex ante and ex post to changes in the evolution of inflation.

Key words: labor contract, early renegotiation

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Fischer (1977) and Taylor (1980) show how labor contracts with nominal rigidities and fixed durations can provide Central Banks with leverage to influence and improve the performance of the economy through activist monetary policy. This leverage can be limited by a variety of factors, including the degree to which labor contracts are flexible on an ex ante and ex post basis to changes in the economic environment. A theoretical literature has examined the optimal duration of labor contracts in the face of both nominal and real uncertainty.[1] This is an example of ex ante flexibility. While not specific to labor contracts, a theoretical literature has also explored the question of when contracts should be renegotiated prior to their planned expiration date.[2] This is an example of ex post flexibility.

With regard to the ex ante flexibility of contracts, empirical research has examined the degree to which the durations of union labor contracts respond to inflation uncertainty, as well as to proxies for nominal and real uncertainty.[3] There is a growing consensus that North American labor contracts are ex ante shorter during periods of higher inflation uncertainty specifically and increased nominal uncertainty more generally. The evidence on the impact of real uncertainty on the ex ante duration of labor contracts is more mixed. Rich and Tracy (2004) find that U.S. labor contracts are shorter when negotiated during periods of higher real uncertainty, while Fay and Lavoie (2002) find no relationship between the ex ante duration of Canadian labor contracts and real uncertainty. To date, however, no comparable analysis has been conducted to investigate if labor contracts are also flexible on an ex post basis to inflation surprises through early renegotiation.

For U.S. union labor contracts, early renegotiations are not an unusual occurrence. Over the period from 1970 to 1995, seven percent of the contracts were renegotiated prior to their planned expiration date. For contracts that involve an early renegotiation, the renegotiation occurs on average seven months prior to the expiration date. The hazard rate for early renegotiations is given in Figure 1.[4] Two points are worth noting. First,

[1] See for example Gray (1978), Canzoneri (1980) and Danziger (1988).
[2] See for example Shavell (1984) and Hart & Moore (1998).
[3] See for example Christofides and Wilton (1983), Christofides (1985, 1990), Vroman (1989), Murphy (1992), Rich & Tracy (2004) and Fay and Lavoie (2002).
[4] For each quarter, the hazard rate is computed as the number of contracts that renegotiate early divided by the number of contracts that are on-going during that quarter.

most time periods covered by the data exhibit at least some early renegotiations. Second, there is clear evidence that early renegotiations can rise sharply during certain episodes. This second feature of the data suggests that changes in the economic environment might contribute to the likelihood that a labor contract ends through an early renegotiation.

In this paper, we investigate if unanticipated changes in the evolution of inflation affect the likelihood that a labor contract is renegotiated prior to its planned expiration. The empirical evidence from our study provides support for this hypothesis. Specifically, we find that contracts are more likely to be renegotiated when inflation deviates significantly from the forecast profile generated at the time the contract was signed. Moreover, we find that this feature is evident regardless of whether actual inflation turns out to be higher or lower than the forecast, which is consistent with efficient renegotiation.

Taken together, the results of this study and those of Rich and Tracy (2004) suggest that U.S. labor contracts are flexible both ex ante and ex post to changes in the dynamics of inflation. The durations of these labor contracts show evidence of downward ex ante flexibility in response to periods of increased inflation uncertainty, as well as downward ex post flexibility in response to inflation shocks. These findings also suggest Central Banks have less ability to leverage nominal rigidities in labor contracts than would be the case if contract durations were fixed both ex-ante and ex-post. Moreover, Rich and Tracy (2004) show that U.S. labor contracts are more likely to contain a COLA clause and a scheduled reopening during periods of heightened inflation uncertainty. These contract provisions reduce the degree of nominal rigidity in the contracts, and thereby act to further limit the efficacy of any activist monetary policy pursued by a Central Bank.

II. Literature Review

U.S. labor contracts[5] have the feature that when they are signed the document containing the specific terms of the contract indicates an explicit expiration date.[6] We

[5] Labor contracts in the U.S. are in fact agreements and not contracts in the legal sense of being governed by contract law. The agreements we analyze are governed by specific statutory law (Wagner Act and its

define the ex ante duration of the contract as the length of time between the negotiation date and the planned expiration date of the contract as stipulated in the written agreement. However, at any time during the course of the contract both parties can mutually agree to renegotiate the existing contract and replace it with a new one effective immediately.[7] If this occurs, then the ex post duration of the labor contract is shorter than the ex ante duration. In addition, longer contracts may contain one or more scheduled reopening dates.[8] These are more restrictive than an early renegotiation because the bargaining is limited to determining the size of the deferred wage increase at the predetermined date.

Another feature of U.S. labor contracts is that the terms and conditions of the agreement dealing with the relationship between the firm and the union workers can extend beyond the expiration of the contract so long as a bargaining impasse has not taken place.[9] As a consequence, the ex post duration of labor contracts can effectively be longer than the ex ante duration. Cramton and Tracy (1992) report that 47% of U.S. contract renewals take place two or more days after the expiration date of the prior contract, and that 63 days is the average time between the expiration of the old contract and the negotiation of the new contract. Cramton and Tracy (1992) refer to these contract extensions as holdouts.[10]

Returning to the issue of the ex ante duration of labor contracts, Gray (1978) posits that the ex ante duration will vary inversely with the degree of nominal uncertainty prevailing at the time the contracts are signed. In her model, the optimal ex ante duration

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subsequent amendments) and case law (determined by the National Labor Relations Board rulings by subsequent court decisions). For convenience, we will refer to these agreements as labor contracts.

[6] There are a few exceptions in the data that the Bureau of Labor Statistics calls "evergreen" contracts. These agreements have no pre-set expiration date. Rather, there is a notice provision whereby one party indicates to the other party their intention to end the agreement.

[7] In contrast, an "early settlement" occurs if the union and the firm negotiate the new contract prior to the expiration date of the existing contract, but set the effective date of the new contract to immediately follow the expiration date. The incidence of early settlements among major U.S. contract negotiations where the negotiation date precedes the expiration date by at least 30 days is 1.9% for the period from 1970 to 1995.

[8] In our sample, 4.2 percent of contracts have a scheduled reopening date.

[9] In contrast, the features of the contract that regulate the relationship between the union and the firm such as automatic dues withholding are not extended. A strike is the most common example of a bargaining impasse.

[10] There are three views of holdouts in the literature. Cramton and Tracy (1992) treat holdouts as a form of labor dispute. Gu and Kuhn (1998) model holdouts as a strategic delay where the union and firm are waiting to learn relevant information from other on-going negotiations. Finally, Danziger and Neuman (2005) and Danziger (2006) incorporate holdouts as an outcome of risk-sharing between the union and the firm.

involves a tradeoff between the benefit of amortizing the fixed costs of negotiating the contract over a longer duration against the cost that the terms of a longer contract will likely depart significantly from their desired level at some point due to unforeseen nominal shocks. These costs arise due to imperfect indexation of the terms of the contract.[11] In another study, Danziger (1988) argues that labor contracts can also provide a means of risk sharing between the union and the firm. He posits that the ex ante duration of labor contracts will vary positively with the degree of real uncertainty at the time the agreement is signed.[12]

These earlier papers abstracted from allowing a contract to be renegotiated ahead of its intended expiration date. Danziger (1995) extends these models to incorporate the option to reopen the contract in an economy that is subject to both real and nominal shocks. It is assumed that the shocks can be of two types: those that are frequent and small in size as well as those that are infrequent and large in size.[13] Workers would prefer to have their wage fully indexed with respect to nominal shocks. However, the available price index reflects both the impact of real and nominal shocks. As a consequence, indexation is incomplete which exposes workers to expected utility losses during the contract.[14] Danziger demonstrates that contracts may be reopened in response to a large shock, but will not be reopened as a result of an accumulation of small shocks. He stresses that empirical work should differentiate between the effects of large and small shocks both on the ex ante and the ex post contract duration.

[11] An implicit assumption of the Gray model is that the firm and union cannot renegotiate the agreement prior to the planned expiration date if a large nominal shock materializes.
[12] Danziger assumes that firms are risk neutral and union workers are risk averse. Firms agree to provide some real wage insurance against adverse productivity shocks. Faced with more real uncertainty, firms and unions will extend the insurance provided by signing agreements with longer ex ante durations.
[13] Danziger (1992) shows that fixed length contracts are preferred to contracts with reopeners in an economy only subject to frequent but small price shocks.
[14] For a discussion of the role of incomplete contracts as a motivation for contract reopening see Shavell (1984), Dye (1985), Harris & Holmstrom (1987) and Dewatripont and Maskin (1990). Shavell also examines the use of breach damages. For debt contracts see Hart and Moore (1998) and Garleanu and Zwiebel (2009).

III. U.S. Labor Contract Data and Estimation Methodology

We now turn to the first empirical examination of the determinants of early renegotiation of U.S. labor agreements.[15] We use the Bureau of Labor Statistics (BLS) data on major collective bargaining agreements which cover bargaining situations involving at least a thousand workers. We exclude contracts involving public sector bargaining units as well as bargaining units covered by the Railway Labor Act.[16] Our contracts were negotiated between 1970 and 1995. The data provide a unique identifier for each bargaining unit as well as the negotiation, effective, and expiration date of the contract. Information is also provided on the firm(s) and union(s) in the bargaining unit, the geographic location of the bargaining unit, the firm(s) major industry as well as the number of workers covered by the contract.

The BLS discontinued collecting this data after 1995 due to budget cuts. However, many of the bargaining units continued to send in hardcopies of their contracts even after 1995. We coded the dates from the physical contracts that were available at the BLS. In addition, the Bureau of National Affairs (BNA) provided data that they gathered from public sources on collective bargaining which we merged into the BLS data.[17] We used these two data sources to ascertain the subsequent negotiation and effective dates for those contracts that were ongoing as of 1995, thereby allowing us to determine which of these contracts experienced an early renegotiation.[18] Our analysis does not include any of the subsequent contracts negotiated after 1995. We have a total of 6,325 contracts, of which we observe the complete history for 5,459 contracts.

We define an early renegotiation to be a situation where a bargaining unit negotiates a contract more than 30 days prior to the expiration date of the current contract, and makes the new contract effective immediately. For those contracts where

[15] Matvos (2010) examines renegotiation of individual NFL player agreements within the umbrella of a broad labor agreement with the league.

[16] Public sector labor contracts are governed by state law. The Railway Labor Act covers private bargaining units in the railway and air transportation industries. All other private sector contracts are governed by the Wagner Act and the associated case law.

[17] The effective and expiration date are clearly identified in the physical contracts. We used Nexis searches to verify the negotiation date when this date was unclear from the physical contract or was missing from the BNA data.

[18] For those contracts that were on-going in 1995 where we could not find the subsequent contract, we treat the information on early renegotiation as censored after the fourth quarter of 1995 when the BLS data ends.

we observe their complete history, 7 percent experienced an early renegotiation. The incidence of early renegotiation varies positively with the ex ante duration of the contract as shown in Table 1. As a caution, we only have a small number of one year contracts as well as contracts that are four years or longer. However, we do see that the incidence of early renegotiation rises with longer contracts when we compare contracts that are two years versus three years in length.

The timing of early renegotiations within the contracts is shown in Figure 2. The hazard rate for early renegotiations is roughly flat at a low level over the penultimate year of the contract. There is a spike in early renegotiations roughly a year prior to the planned expiration date. This likely reflects a desire for bargaining units to have their contracts expire in a given quarter of the year. A prominent feature of the data is that there is a high percentage of contracts with durations that are multiples of 12 months, with changes in the ex ante contract durations when they occur also being dominated by multiples of 12 months.[19] The incidence of early renegotiations picks up in the final year of the contract, and is significantly higher in the last six months. The average number of months remaining on a contract that ends in an early renegotiation is seven months.

For each labor contract we divide the ex ante duration into quarterly intervals. A contract is "at risk" of an early renegotiation if it has not been renegotiated up to that point in the contract. We create an indicator variable I_{ijkt} that takes a value of one if that contract was renegotiated early during a specific quarter following the negotiation date and up through the planned expiration date. We use these indicator variables to examine the probability of an early renegotiation. In particular, we model this probability as a function of observable characteristics using a Probit framework, with the estimated impact of inflation forecast errors central to the analysis. For contract *i*, negotiated in state *j*, with a firm involved in industry *k* that is at risk to an early renegotiation at time *t*, the net benefit to an early renegotiation is given by an unobserved index function I^*_{ijkt} which we assume takes the following linear form:

$$I^*_{ijkt} = \beta_1 X_i + \beta_2 X_j + \beta_3 X_k + \beta_4 X_t + \varepsilon_{ijkt} ,$$

[19] See Rich and Tracy (2004) for details.

where X_i contains bargaining unit specific variables including the time elapsed and the time remaining in the current contract, X_j industry specific variables, X_k state specific variables and X_t macro variables. The bargaining unit agrees to an early renegotiation if this unobserved net gain is positive:

$$I_{ijkt} = \begin{matrix} 1 \text{ if } I^*_{ijkt} > 0 \\ 0 \text{ otherwise} \end{matrix}$$

The probability that the contract will be renegotiated early in period *t* is given by:

$$\Pr\left(I_{ijkt} = 1\right) = \Phi\left(X_i\beta_1 + X_j\beta_2 + X_k\beta_3 + X_t\beta_4\right)$$

We report the marginal effect of each variable on the probability of a renegotiation. We scale these marginal effects by the sample average probability that a contract is renegotiated in any quarter ($\bar{p}$):

$$\text{ME}_{X_k} = \frac{\partial\Phi/\partial X_k}{\bar{p}}\left(\bar{X}\hat{\beta}\right)$$

We evaluate these scaled marginal effects at the sample means of the data.

IV. Measuring Inflation Forecast Errors and Other Model Control Variables

A. The Inflation Forecasting Procedure

We measure inflation as the quarterly growth rate in the Consumer Price Index (CPI) and generate forecasts from an estimated autoregressive (AR) specification, where we use the Bayesian Information Criterion to choose among lag lengths that can vary from 1 to 4 quarters. Our strategy is not to impose a single model on the firms, but rather to allow firms to adjust the lag length of the AR model based on an evaluation of recent forecast performance. In an effort to be consistent with the information set of bargaining units, the model selection process is undertaken in a real-time manner. That is, model selection at time *t* is undertaken only using information available through time *t*. We also

maintain a rolling 40-quarter window for estimation, with the estimates from the selected model used to generate dynamic out-of-sample forecasts over a twenty quarter horizon.[20]

The most frequently selected model included a single lagged value of inflation, with the AR(1) model used for forecasting purposes principally at the beginning and the end of the sample period. The model specification, however, initially switched to an AR(4) process in early 1981, followed by a switch to an AR(3) process around 1987, before switching back to an AR(1) process around 1991. Last, the persistence of the inflation process, as measured by the sum of the estimated AR coefficients, was quite high during most of the sample period before displaying a marked decline around 1991.[21]

Defining notation, let π_t denote the inflation rate between quarters *t*-1 and *t*, let π_{t+h} denote the inflation rate similarly defined between quarters *t+h-1* and *t+h*, and let $\{\hat{\pi}_{t+h|t}\}_{h=1}^{20}$ denote the sequence of inflation forecasts over a 20-quarter horizon conditional on information available through quarter *t*. We can construct the series $\{\hat{\epsilon}_{t+h|t}(=\pi_{t+h}-\hat{\pi}_{t+h|t})\}_{h=1}^{20}$ that represents the ex post inflation forecast errors over the 20-quarter horizon associated with a contract signed at time *t*. We then move the sample forward by one quarter, dropping the earliest quarterly observation and including the latest quarterly observation, and repeat the estimation and forecasting exercises. For the analysis, the model is initially estimated over the sample period 1960:Q1-1969:Q4, with the initial forecast profile constructed for 1970:Q1-1974:Q4.

We merge these vintage specific series of inflation forecast errors into the contract data by selecting the specific vintage that corresponds to the information available to the firm and union when the contract was signed based on the negotiation date. Consequently, at a given point in time, different bargaining units will experience different inflation forecast errors depending on the dates that their contracts were negotiated. This is illustrated in Figure 3 which shows the range of inflation forecast errors from the estimation sample for each quarter covered by our data. There is a clustering of the large

[20] It is well documented that inflation forecasting models, including Phillips Curve models, exhibit considerable instability. While the CPI is not subject to revision, this is not the case for auxiliary variables that have been used to explain inflation dynamics. Our use of a univariate model to forecast CPI inflation, with a specification that can change over time, allows us to address the issue of time variation in inflation forecasting models as well as circumvent the real-time data considerations that would greatly complicate the extension to a multivariate model. See Stock and Watson (1994, 1999) for further discussion.

[21] The persistence varied from 0.7–0.9 through 1990, and then declined to a range between 0.3 and 0.4.

inflation forecast errors during three episodes. Not surprisingly, the first two episodes of 1973-75 and 1978-81 correspond to the effects of the first-and second rounds of food and oil shocks, and are associated with a marked under-prediction of inflation. The third episode of 1982-83 corresponds to the Volcker disinflation period and is associated with notable over-prediction of inflation.

The empirical literature on ex ante contract durations typically uses the effective date of the contract to denote the beginning of the contract. For U.S labor contracts, Rich and Tracy (2004) show that backdating is quite common where the effective date is set prior to the negotiation date. In these cases, using the contract's effective date would lead to merging in the incorrect vintage of inflation forecast errors. The heterogeneity in the inflation forecast errors arising from multi-period forecast horizons and vintage specific data associated with different contract negotiation dates is a key feature of the empirical analysis.

B. Other Determinants of Early Renegotiation

If there are fixed costs associated with an early contract renegotiation, then contracts covering a larger number of workers would be more likely to be terminated early since the benefits to an early renegotiation are likely to increase with the size of the bargaining unit *ceteris paribus*. We include the size of the bargaining unit to capture this effect. This size variable varies both across bargaining units at a point in time and within bargaining units over time. Given the differences in the ex ante contract durations, we can control for both length of time the current contract has been in force (the standard notion of duration dependence) and the remaining duration of the contract if it runs to its planned expiration. We measure the length of time the contract has been in force as the number of quarters between the negotiation date and the current date regardless of whether the contract was backdated.

We control for both trend and cyclical conditions in the state and industry where the bargaining unit is located. We gauge these conditions using employment as a standard metric. We assume that the employment process follows a quadratic time trend, where we allow for seasonal employment effects and up to second-order autocorrelation in the residuals. We use BLS state employment and national employment data measured at a quarterly frequency to estimate the parameters. Letting E_{it} denote the employment in state

or industry *i* in period *t* and Q_{jt} denote quarterly seasonal dummy variables, we estimate the following equation:

$$\log(E_{it}) = \beta_{i0} + \beta_{i1}t + \beta_{i2}t^2 + \sum_{j=1}^{3} \delta_{ij}Q_{jt} + \omega_{it}\,,$$

$$\omega_{it} = \rho_1\omega_{it-1} + \rho_2\omega_{it-2} + \epsilon_{it}$$

$$\epsilon_t \sim N(0, \sigma_i^2)$$

We proxy long-run employment trends in the state or industry by the implied employment growth, given by $\hat{\beta}_{i1} + 2\hat{\beta}_{i2}t$. The composite employment residual, $\hat{\omega}_{it}$, provides a proxy for cyclical conditions in the state or industry, with tight labor market conditions represented by positive residuals.

For the specifications, we also include the quarterly growth rate in real GDP as a macro control. To assist in comparing the size of the effects across variables, we standardize all of the continuous control variables to have a zero mean and unit standard deviation.

To allow for the possibility that early renegotiations can be triggered by both positive and negative inflation forecast errors, we include a variable capturing positive inflation forecast errors (and set to zero if the forecast error is negative) and a second variable capturing negative inflation forecast errors (again set to zero if the forecast error is positive) – here measured as the absolute value of the negative forecast error. We can test for symmetric effects of positive and negative shocks by testing for equality of the marginal effects from these pairs of variables. Symmetry would be one indication of efficient renegotiation.[22] Following Danziger (1995), we can also differentiate between large and small shocks, as well as contemporaneous shocks and shocks that have accumulated to date over the course of the contract.

[22] With efficient renegotiations the sign of the shock would only impact the terms of the new contract between the union and the firm as a result of the renegotiation and not the likelihood that the contract is renegotiated.

V. Determinants of Early Renegotiation

The impact of inflation forecast errors on the likelihood of an early contract renegotiation for our full sample of data are given in Table 2. Descriptive statistics are provided in Appendix Table A1. Three specifications are provided in Table 2. Specification (1) controls for positive and negative inflation forecast errors for the prior quarter. In specification (2) we focus on only large values of positive and negative inflation forecast errors. In this specification, we zero out any errors that fall between the 10^{th} and the 90^{th} percentiles of the sample distribution of these inflation forecast errors. Specification (2) is designed to test the prediction from Danziger (1995) that large shocks should trigger renegotiations. Finally, specification (3) adds the positive and negative lag cumulative inflation forecast errors. When calculating the cumulative inflation forecast errors, we zero out the large errors that exceed the 90^{th} percentile or fall below the 10^{th} percentile. Specification (3) is a further test of Danziger (1995) that absent a large contemporaneous price shock, cumulative small price shocks over the course of the contract should not lead to renegotiation.

Before turning to the results from the inflation forecast errors, we review the effects of the other control variables. The data indicates that the propensity to renegotiate is not affected by the size of the bargaining unit as measured by the number of workers covered by the contract. The likelihood of an early renegotiation increases with the number of quarters since the contract was effective, and decreases with the number of quarters left in the planned duration of the contract. The relative absolute magnitudes of these two different duration effects are similar implying that the two duration effects tend to offset each other.[23] As reported by Estache *et al* (2008) for concession contracts, we find that renegotiation is countercyclical with respect to overall conditions in the economy as measured by real GDP growth. Controlling for overall aggregate economic conditions, the likelihood that a contract will be renegotiated is declining for industries that have higher trend employment growth, and when the industry employment is

[23] If we drop the variable measuring the quarters left in the contract and allow the duration dependence to vary by the ex-ante contract duration, then we find that the marginal effect of each additional quarter into the contract is to increase the likelihood of a renegotiation by 0.205 percent of the average probability for contracts less than 30 months in duration, 0.163 for contracts between 30 and 42 months in duration, and 0.144 for contracts in excess of 42 months in duration. All three duration effects are statistically significant.

currently above trend. While trend employment growth in the state where the bargaining unit is located does not impact renegotiation rates, we find that when current employment in the state is above trend a contract is less likely to renegotiate. The magnitude of this effect, though, is almost half the magnitude associated with the industry employment residual.

We now turn now to the role that inflation forecast errors may play as a determinant of early contract renegotiations. In specification (1) we find that both positive and negative inflation forecast errors lead to a higher incidence of early renegotiation. A one standard deviation change in the positive (negative) inflation forecast errors increases the probability of early renegotiation by 20 percent (16 percent) of the observed quarterly average (respectively). The data do not reject the restriction that these marginal effects are equal in magnitude. This symmetry is consistent with efficient bargaining between the union and the firm over the decision to renegotiate the contract.

Turning to specification (2) we can investigate if this result is driven primarily by large inflation forecast errors. We take the inflation forecast errors used in specification (1) and separate them into large and small forecast errors. As previously discussed, we classify a positive/negative forecast error as large if it is in the top/bottom 10^{th} percentile of the sample distribution of inflation forecast errors.

The results from specification (2) indicate that the overall impact of these inflation forecast errors on the likelihood that a contract is renegotiated is driven by large forecast errors. The marginal effects for these large errors are similar to those that we reported for the overall forecast errors. Not shown in the table is that the small forecast errors have an insignificant effect on the likelihood of a renegotiation. The data also can not reject the symmetry hypothesis for these large inflation forecast errors. The findings in specification (2) provide support for Danziger's prediction that renegotiation will be triggered by large and infrequent price shocks. The final specification in Table 2 examines the role of cumulative inflation forecasts over the course of a contract in helping to explain renegotiation. Controlling for any large current inflation forecast errors, cumulative small inflation forecast errors over the life of the contract do not

provide any additional impetus to renegotiate the contract.[24] This supports Danziger (1988) that non-reopenable contracts would be optimal in an environment of only small but frequent price shocks.

We carried out a number of robustness checks on the specification estimated in Table 2. First, we used a more restrictive version of an early renegotiation where we required that the negotiation data was at least 3 months prior to the planned expiration date. Second, using our original indicator for an early renegotiation, we censored all observations beyond the fourth quarter of 1995. Third, we recalculated our inflation forecast errors fixing the lag structure of the AR model for all time periods. In particular, we considered an AR(1) model and an AR(4) model which represented the two most frequently occurring specifications in the unrestricted case. In all three of these cases, the qualitative results reported in Table 2 remain.

VI. Conclusion

While labor contracts are associated with the notion or fixity or rigidity, their features can and do change over time in response to economic conditions. With regard to contract duration, theoretical and empirical studies have focused exclusively on the ex ante duration of labor contracts and its relationship to movements in real uncertainty, nominal uncertainty, and inflation uncertainty. This study complements previous work by using data on U.S. union labor contracts over the period 1970 to 1995 to analyze the ex post duration of labor contracts. In particular, we examine the roles of inflation forecast errors on the decision to renegotiate a labor contract prior to its planned expiration date.

For the analysis, we construct multi-period inflation forecasts that are consistent with the information sets available to bargaining units when the contract was signed based on the negotiation date. The results indicate the realization of large inflation forecast errors is associated with a greater likelihood that a contract will be renegotiated. Moreover, we find this result holds for large inflation forecast errors of either sign, which is consistent with efficient renegotiation.

[24] The cumulative small inflation forecast errors are both economically insignificant as well as jointly statistically insignificant as indicated by the Chi-square test reported in the last row of the table.

The evidence from this study and others documents variability in the duration of U.S. labor contracts on both an ex ante basis as well as ex post basis. This finding has several important implications. As previously discussed, greater flexibility in ex ante and ex post contract duration would lessen the ability of Central Banks to leverage nominal rigidities in contracts for stabilization policy. Given the secular decline in union coverage, however, this would argue for an even more limited capability for Central Banks. In addition, changes in ex ante and ex post flexibility in contract duration would be expected to alter the wage-price dynamics in an economy. Consequently, this would raise concerns about the stability of estimated relationships in macroeconomic models and the reliability and usefulness of their predictions.

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Table 1. Incidence of Early Renegotiation – by ex ante contract duration

	0 − 18 months	19 − 30 months	31 − 42 months	43 − 54 months	55+ months
Renegotiation rate	3.8	3.9	8.4	21.8	28.2
Number of contracts	341	1,142	3,749	188	39

Notes: BLS major collective bargaining agreements where we observe the complete history from negotiation to expiration.

Table 2. Early Renegotiation – inflation forecast errors

Variable	(1)	(2)	(3)
Size of bargaining unit (100,000)	0.129	0.127	0.130
	(0.080)	(0.080)	(0.080)
Quarters into contract	0.099**	0.102**	0.100**
	(0.014)	(0.014)	(0.014)
Quarters left in contract	–0.074**	–0.071**	–0.073**
	(0.014)	(0.014)	(0.014)
Real GDP growth	–0.068**	–0.055**	–0.055**
	(0.025)	(0.026)	(0.027)
Industry employment trend	–0.224**	–0.222**	–0.221**
	(0.036)	(0.035)	(0.035)
Industry employment residual	–0.100**	–0.098**	–0.096**
	(0.026)	(0.026)	(0.025)
State employment trend	–0.007	–0.009	–0.007
	(0.029)	(0.028)	(0.029)
State employment residual	–0.054*	–0.054*	–0.056*
	(0.028)	(0.028)	(0.028)
Positive inflation forecast error	0.199**		
	(0.042)		
Negative inflation forecast error	0.159**		
	(0.057)		
Large positive inflation forecast error[1]		0.182**	0.195**
		(0.034)	(0.036)
Large negative inflation forecast error[1]		0.165**	0.159**
		(0.052)	(0.053)
Positive cumulative small forecast error[2]			–0.020
			(0.044)
Negative cumulative small forecast error[2]			0.028
			(0.050)
Chi^2 test for equality of positive and	0.67	0.10	0.37
negative inflation forecast error [p-value]	[0.413]	[0.753]	[0.542]
Chi^2 test for equality of large and			14.68
cumulative small forecast errors			[0.001]

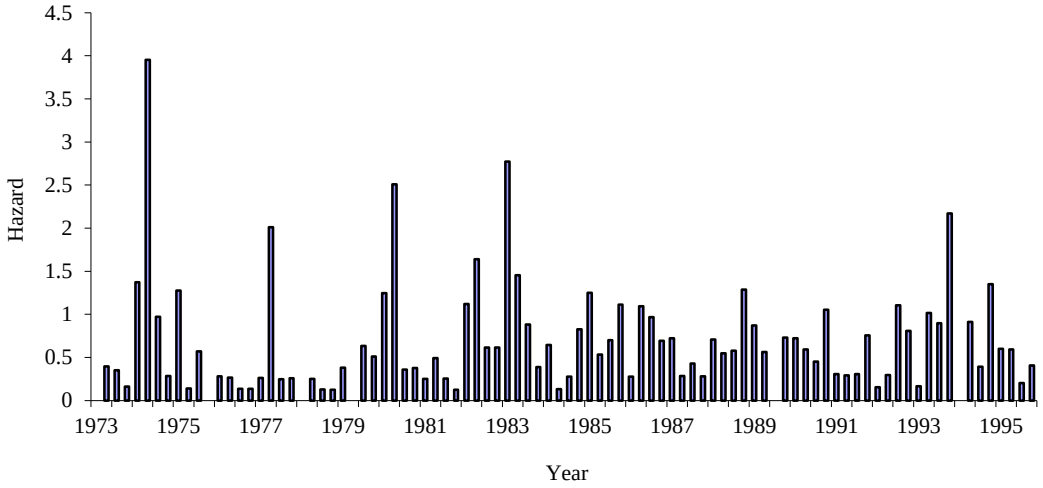
Note: Number of observations is 59,612. Probit marginal effects scaled by the average probability of a renegotiation in a quarter (0.007) with standard errors given in parentheses. Standard errors are calculated clustering at the bargaining unit. Real GDP growth, industry & state employment trends and residuals, and inflation forecast errors are standardized to have mean zero and unit standard deviation. Includes three quarterly fixed effects.

[1] Top/bottom 10 percent of distribution of forecast errors

[2] Excludes large forecast errors

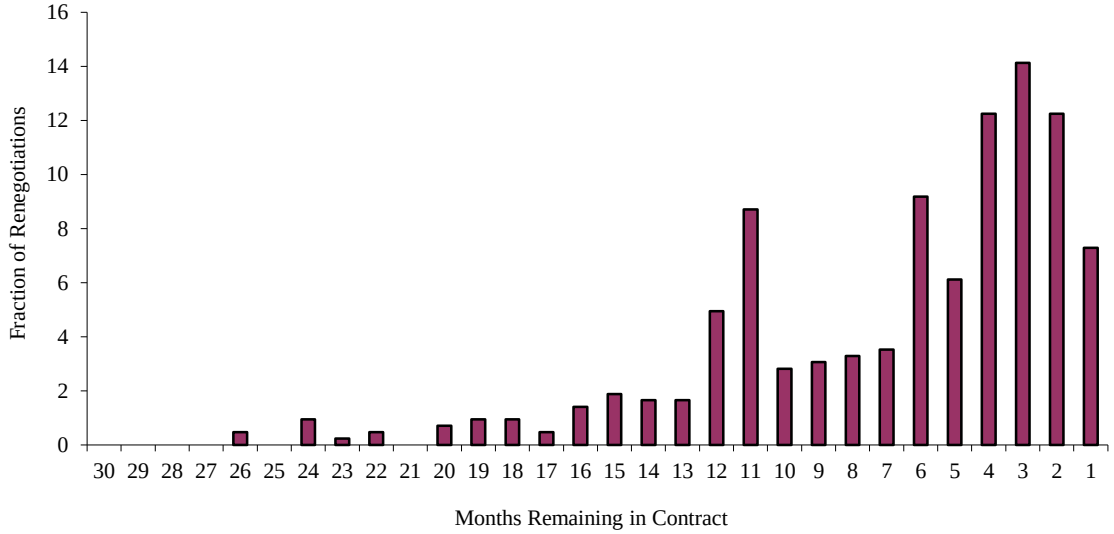
** significant at the 5 percent level; * significant at the 10 percent level

F**igure 1.** Hazard Rate for Early Renegotiation − by calendar quarter



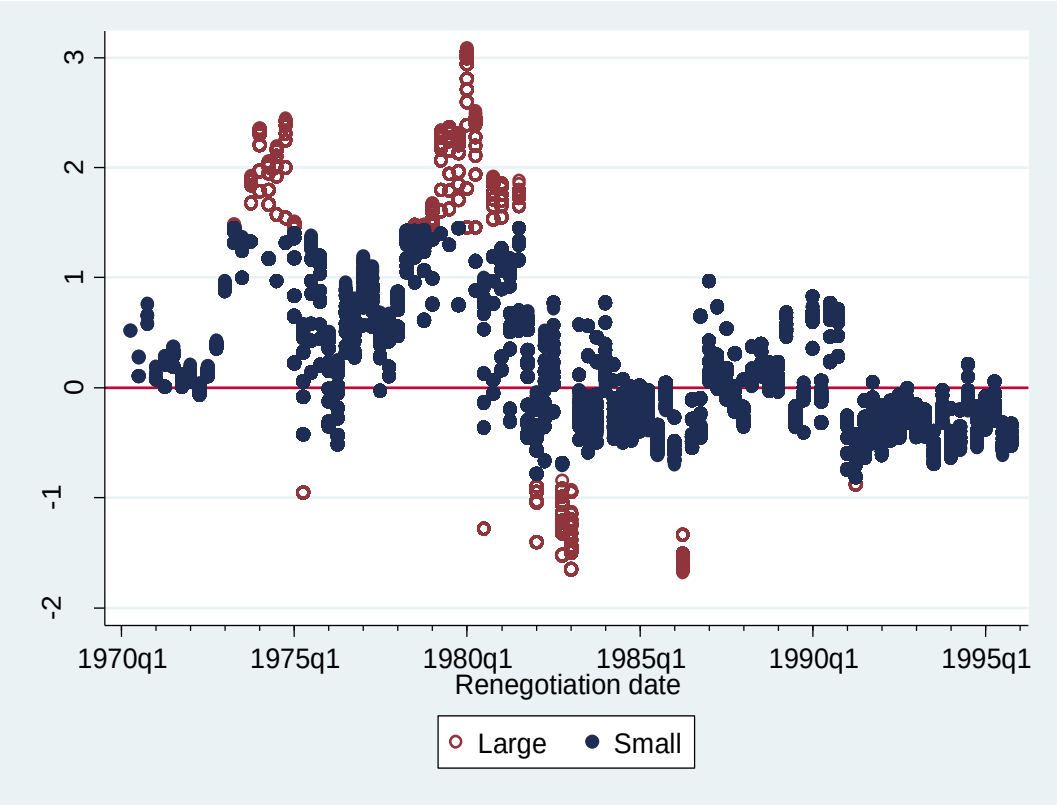
Source: Bureau of Labor Statistics major collective bargaining agreements. Authors' calculations.

Figure 2. Hazard Rate for Early Renegotiation − by months remaining in current contract



Source: Bureau of Labor Statistics major collective bargaining agreements. Authors' calculations.

Figure 3. Inflation Forecast Errors



Source: Bureau of Labor Statistics major collective bargaining agreements. Authors' calculations

Table A1. Descriptive Statistics

Variables	Mean	Standard deviation	Min	Max
Early renegotiation	0.007	0.084	0	1
Size of bargaining unit (100,000)	0.619	2.384	0.090	5.250
Quarters into contract	7.044	3.483	2	20
Quarters left in contract	5.465	3.717	0	29
Real GDP	0.315	0.878	–1.674	3.080
Industry employment trend	0.001	0.005	–0.017	0.018
Industry employment residual	–0.000	0.056	–0.473	0.357
State employment trend	0.004	0.002	0.001	0.017
State employment residual	–0.004	0.035	–0.143	0.172
Inflation forecast error	0.311	0.876	–1.674	3.080