Abstract: Pattern bargaining is a negotiating strategy that is often employed by industry-wide unions in oligopolistic industries to set wages. The conventional wisdom is that pattern bargaining “takes labor out of competition” and therefore softens bargaining between the union and firms, resulting in higher industry wide wages. However, this does not explain why firms agree to pattern bargaining. We analyze a model in which the agents negotiate over the bargaining mechanism, the order of the negotiations and the wages when faced with uncertainty. We show that whether pattern bargaining arises in equilibrium depends on the source of the uncertainty. Finally, we show that when equilibrium is characterized by pattern bargaining, it may harm consumers. This provides an explanation as to how pattern bargaining can arise in equilibrium and why there is often strong political opposition to it.

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Pattern bargaining is a widely-used, sometimes controversial negotiating strategy that is often employed by industry-wide unions to set wages. If implemented perfectly, the union picks one firm to bargain with first (the target) and negotiates a wage. It then uses this outcome as a precedent, and makes take-or-leave-it demands to the remaining firms for similar concessions. Assuming that the firms agree, and they usually do, this practice results in a uniform wage rate across firms. Conventional wisdom is that this practice, often attributed in the United States to the United Auto Workers and the Teamsters, provides the union with countervailing power in its relationship with the powerful firms that employ their members. It is argued that by “taking labor out of competition” pattern bargaining helps the union secure higher wages than they would obtain otherwise. Controversy over its impact on wages recently led the Howard Government in Australia to outlaw this practice under the WorkChoices legislation (which became effective on March 27, 2006). It is the contention of union leaders that the government’s objective in doing so was to “irrevocably shift bargaining power in industrial relations to employers.”

Explanations of why pattern bargaining works and how it comes to be adopted are rare. This is surprising given that this strategy clearly plays an important role in wage determination in most OECD countries, often in important industries. The “taking labor out of competition” explanation is the one most commonly given, although, as far as we know, it has never been formalized. The basic idea is simple. Ordinarily, unionized oligopolistic firms have an incentive to bargain tough since any wage concessions that they can pry from the union will provide them with a competitive edge over their product

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1 What we have in mind is an industry in which several unionized oligopolistic firms negotiate wages with the same industry-wide union and then compete with each other in the product market. Thus, the wages that are being negotiated are paid to workers with similar skills in similar occupations. The U.S. automobile industry in which the United Auto Workers negotiates wages with Ford, Chrysler and General Motors or the U.S. airlines industry in which the Air Lines Pilot Association (ALPA) negotiates terms with the major airlines both fit into this framework nicely. Pattern bargaining is also used in other settings by employers to tie-down the wages of workers with different skill sets and occupations. For example, in the U.S. Airline industry pattern bargaining links the wages of pilots, maintenance workers, and workers in other crafts. Pattern bargaining is also used widely in state and local government negotiations with public sector employees with different skill sets (e.g., firefighters and police). In this paper, we restrict attention to pattern bargaining of the former type.

2 Related to pattern bargaining is the “me too” agreement in which some firms agree to accept the terms negotiated by other firms. For example, workers employed by Las Vegas casinos have their wages set through negotiations between their union and a multi-employer bargaining group. Casinos that are not members of the multi-employer group often sign “me too” agreements that bind them to accept those terms without additional negotiations.

3 See the discussion of pattern bargaining and the recent changes in Australian Labor Law on the Construction Forestry Mining Energy Union web site: www.cfmeu.asn.au/construction/research/secondwave/pattern.html.
market rivals. Pattern bargaining assures such firms that if they give in to the union’s wage demands, they will not have to worry that their will rivals will gain an advantage by being tougher during negotiations – after all, all firms wind up paying the same wage rate. Thus, pattern bargaining is viewed as one way to soften negotiations with oligopolistic firms. The problem with this rationale is that it does not explain why the firms are willing to accept such an arrangement.

In recent work, Marshall and Merlo (2004) provide a formal resolution to the first piece of this puzzle by showing in a model with heterogeneous unionized firms that an industry-wide union prefers pattern bargaining. In their model, the two firms produce substitute products and negotiate wages with the union. The firms face constant costs, but differ in labor productivity. Four different bargaining mechanisms are considered, with the Nash Bargaining Solution applied in each case. The union can bargain simultaneously over wages with both firms; they can bargain sequentially; they can use pattern bargaining that results in both firms paying the same wage; or they can use “pattern bargaining in labor costs” which results in wage rates that equalize marginal costs across the firms. In the latter three cases, the order of bargaining is important, so both possible orderings are considered. Marshall and Merlo derive two major results. First, they find that when firm-heterogeneity is weak, the union prefers pattern bargaining in wages; whereas when firm-heterogeneity is strong, the union prefers pattern bargaining in labor costs – thus, the union always prefers some type of pattern bargaining. Second, the union always chooses to use the efficient firm as the target. The first result is consistent with the perceived wisdom that pattern bargaining benefits union members. Marshall and Merlo argue that the second result is consistent with a stylized fact that unions almost never select the relatively unproductive firm as the target.

Though Marshall and Merlo show formally that the union prefers pattern bargaining, in their setting the firms always prefer an alternative bargaining mechanism. This is particularly true of the non-target firm. This firm should surely view the union’s take-it-or-leave it wage demand as non-credible. If the firm rejects the union’s wage demand, it will always be in the union’s interest to reopen negotiations, effectively resulting in the same outcome that would be generated by sequential bargaining. Thus, it is
hard to understand why the firms would ever agree to pattern bargaining.⁴

In this paper, we argue that the bargaining mechanism cannot simply be imposed upon the firms and that for pattern bargaining to survive as a long-run feature of the negotiation process it must be agreed upon by all agents on both sides of the labor market. It follows that if we are to truly understand pattern bargaining, we must examine conditions under which it emerges endogenously from a setting in which the agents negotiate not only over the wage rates but the bargaining mechanism as well. In order to do so, we develop a model that captures many of the essential features of the markets in which pattern bargaining has been so important (the US auto market serves as our primary motivator). In particular, we assume that the market is characterized by oligopolistic firms that produce substitute goods and that the firms’ production costs are subject to random shocks so that their relative competitive positions may change over time.⁵

Once the bargaining mechanism has been determined and productivity realized, our model then follows Marshall and Merlo (2004) in that there are two firms that face a linear demand curve, costs are constant, the firms differ in terms of labor productivity, the union’s goal is to maximize the wage bill and wages are determined by the Nash Bargaining Solution. However, our model differs from theirs in three key ways. First, the dynamic nature of the model and existence of the random shocks implies that the firms will prefer the bargaining mechanism that maximizes their expected profits over time. This implies that they will prefer a mechanism that rewards them when they are relatively efficient without penalizing

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⁴ Marshall and Merlo do recognize this issue and examine it in one of the latter sections of the paper. Building on an insight originally due to Williamson (1968), they extend their analysis to allow for a potential entrant that must use union labor if it enters the market. They then show that in such a setting there are entry costs such that the third firm would enter under sequential bargaining but stay out under pattern bargaining. Consequently, they argue that both the firms and the union may prefer pattern bargaining because it serves as a barrier to entry. To make this point, they show that there exists a wage that would result in higher payoffs for both the union and the firms under duopoly than they would earn with sequential bargaining under triopoly. However, it is unclear whether or not this wage is an equilibrium wage with pattern bargaining since the union ignores the effect on entry deterrence. We conjecture that it is not and that if we restrict attention to equilibrium wages it is likely to be the case that the firms prefer pattern bargaining while the union prefers some other bargaining mechanism. We return to this issue and discuss it a bit further in footnote 23.

⁵ The assumption that costs are subject to random shocks that alter the competitive positions of firms is becoming increasingly common in many applied areas. For example, this assumption is a crucial component of the Mortensen and Pissarides (1994) model of search generated unemployment in macroeconomics, the Hopenhayn (1992) model of industry dynamics in industrial organization and the Melitz (2003) model of monopolistic competition in international economics.
them too much when they are at a competitive disadvantage. Second, although we follow Marshall and Merlo in assuming that the firms differ in labor productivity, we also consider the case in which firm heterogeneity is driven by differences in non-labor costs. Finally, as noted above, we expand the bargaining environment by allowing the agents to negotiate over the bargaining mechanism.

Our dynamic game consists of three stages. In the first stage, the agents negotiate over the bargaining mechanism; whereas the identity of the target firm is determined in second stage. Finally, in the third stage the agents participate in a repeated game of quantity competition in which each period’s wage rate is negotiated after the firms’ costs have been determined and publicly revealed. We find that in this setting there are important instances in which both the union and the firms prefer pattern bargaining over sequential bargaining, but that they always disagree about the order of negotiations. As a result, the extent to which the union can influence the identity of the target firm plays a crucial role in determining conditions under which pattern bargaining arises in equilibrium. However, contrary to the perceived wisdom, we find that this is most likely to occur when pattern bargaining is the preferred mechanism of the firms, not the union. We also find that the source of firm-heterogeneity plays a crucial role in determining conditions under which pattern bargaining can be supported in equilibrium without side payments. Finally, we consider the impact of bargaining structure on consumers and find that pattern bargaining can reduce consumer surplus. This last issue, which has (to the best of our knowledge) received no attention at all in the literature, is important in light of the recent Australian legislation outlawing pattern bargaining.

The remainder of the paper divides into five sections. In Section 2, in order to gain some insight into the forces driving our results, we consider, as a baseline model, an extreme version of the Marshall-
Merlo model in which the union has complete wage setting power. That is, rather than allow for negotiations, we start out by assuming that the union selects the wage paid by each firm and then the firms choose employment. In such a setting, pattern bargaining is equivalent to the union demanding the same wage from each firm; whereas we interpret a decision by the union to demand different wages as a preference for sequential bargaining. In this setting, contrary to both conventional wisdom and Marshall and Merlo (2004), the union prefers firm-specific wages rather than a uniform wage – after all, when the union has the ability to choose the price at which it supplies labor to the firms and the firms have the power to choose the number of workers to employ, the union is in exactly the same position as a monopolist in a product market that must choose whether to charge the same price to all consumers. As we know from the literature on price discrimination, the supplier always prefers to price discriminate when possible. As for the firms that demand labor, their total profits can be higher or lower with a uniform wage: they prefer the uniform wage when they are the more efficient firm but wage discrimination when they are the less efficient firm. Thus, it is clear that there are instances in which the firms will prefer a uniform wage structure.

The problem with the model analyzed in Section 2 is that, since it does not allow for wage negotiations, it does not capture the firms’ strategic considerations that are inherent in the “taking labor out of competition” argument. We therefore turn to the general model (outlined above) in Sections 3-5 which uses the Nash Bargaining Solution to determine wage rates. In Sections 3 and 4 we consider the model when side payments are not possible. We relax this assumption in Section 5.

The main result is Section 3 is that in the Marshall-Merlo set-up, pattern bargaining can never emerge as an equilibrium outcome. We provide intuition for our results by isolating two attributes of the bargaining mechanisms that influence the agents’ preferences. We argue that both the ability to tailor wages to the firms inherent in sequential bargaining and the ability to “take labor out of competition” under pattern bargaining benefit the union at the expense of the firms. When firm-heterogeneity is weak, the impact of the wage discrimination aspect is small and thus the union prefers to take labor out of competition through pattern bargaining while the firms prefer sequential bargaining. But, when firm-
heterogeneity is sufficiently strong, the price discrimination aspect is strong enough to reverse the agents’ preferences. These trade-offs are, of course, key in determining the equilibrium outcome of the negotiations over the bargaining mechanism. When the firms differ only in labor productivity, we find that the trade-offs are such that pattern bargaining cannot emerge in equilibrium (Proposition 1).

In Section 4 we extend the model to allow the firms to differ in non-labor costs and show that this alters the trade-offs such that pattern bargaining can be an equilibrium outcome (Proposition 2). We also consider an issue that has received surprisingly little attention in the literature – the impact of bargaining mechanism on consumer welfare – and show that when the firms differ in non-labor costs, consumer surplus is maximized by sequential bargaining (Proposition 3). Since the consumers could be interpreted as downstream firms that use the upstream firms’ output as an input, this provides us with an explanation for why pattern bargaining might be preferred all the agents negotiating wages while consumers and downstream firms lobby the government to ban its use.

In Section 5 we allow the agents to use side payments in order to influence the selection of the bargaining mechanism. This allows us to get a better sense as to whether pattern bargaining serves the interests of the unions, the firms, or both. We begin by reconsidering our benchmark model where the union unilaterally sets the wage. In this case, the total surplus to be split between the union and the firms is higher with a uniform wage. Since the firms prefer a uniform wage structure, they would bribe the union to accept this arrangement, which runs contrary to conventional wisdom. We then show that side payments make it possible for pattern bargaining to emerge as an equilibrium outcome in the Marshall-Merlo model. The ability to make side payments also expands the set of parameters under which pattern bargaining occurs when the firms differ in non-labor costs. We also find that, as the benchmark model suggests, if the firms differ in labor productivity, pattern bargaining only emerges as an equilibrium outcome when it is the firms’ preferred mechanism. If instead, we find that when the firms differ in non-labor costs, pattern bargaining can arise as an equilibrium outcome when it is the union’s’ preferred mechanism. We conclude the paper in Section 6 by summarizing our results.
2. Wage Setting by the Union

In this section we introduce the basic model and, to provide a benchmark for later comparisons, examine the outcome when the union is allowed to set the wages. To facilitate comparisons with Marshall and Merlo (2004), we adopt many of their assumptions concerning functional forms and use much of their notation.

There are two firms (a and b) that produce a homogeneous good and face the following linear demand curve: \( P = 1 - x_a - x_b \), where \( x_i \) denotes the output of firm \( i \).\(^8\) We assume that the workers at each firm are represented by the same industry-wide union. As for production, labor is the only input (we relax this assumption in the Section 4) but labor productivity at each firm is initially unknown and may change from one period to the next. It is common knowledge that in each period one firm (a) will be able to produce one unit of output with each worker hired; whereas the other firm (b) will get only \( t \leq 1 \) units of output from each worker. Thus, if we use \( \ell_j \) to denote employment for firm \( j \), then we have \( x_a = \ell_a \) and \( x_b = t \ell_b \). Note that firm a is the efficient firm whereas firm b is relatively inefficient. The identity of the more efficient firm is determined by nature at the beginning of each period, with each outcome equally likely. To ensure that both firms produce in equilibrium, we assume that \( t \) is sufficiently close to one (to be made precise below).

In this section of the paper we assume that in each period the union sets the wages to be paid by each firm. Following Marshall and Merlo, we assume that the union’s goal is to maximize its expected wage bill. After the wages are set, the firms compete in the product market in quantities. Thus, the two firms are engaged in a repeated game in which, in each period, nature determines the firms’ productivities; these values are revealed to all players; wages are set by the union; and then the firms

\(^8\) We normalize the demand intercept in Marshall and Merlo (2004) to 1, and assume that the goods are perfect substitutes. The degree of substitutability plays no role in the results here or in Marshall and Merlo (2004).
choose output to maximize profits. Since a new, independent draw on firm productivities occurs in each period, the competitive positions of the firms change over time.

It is important to note that wages are chosen after each period’s productivity measures have been determined and revealed to all parties. Thus, wage setting takes place under complete information about the current period. In addition, note that since the firms compete in output after the wages have been set, the firms effectively determine employment (as is the case in almost all labor negotiations).

Straightforward calculations yield the Cournot output, employment, profit levels and wage bill as:

(1) \[ x_a(w_a, w_b) = \ell_a(w_a, w_b) = (1/3)\{t(1 - 2w_a) + w_b \} \]

(2) \[ x_b(w_b, w_a) = t\ell_b(w_b, w_a) = (1/3)\{t(1 + w_a) - 2w_b \} \]

(3) \[ \pi_j(w_j, w_i) = x_j(w_j, w_i) \quad \text{for } j = a, b; \ i \neq j \]

(4) \[ \theta(w_a, w_b) \equiv w_a\ell_a(w_a, w_b) + w_b\ell_b(w_b, w_a) \]

With \( \pi_j \) denoting the profits earned by firm \( j \) and \( \theta \) denoting the wage bill. Following Marshall and Merlo, we restrict attention to the case in which \( t \geq .5 \).  

As noted above, in any given period each firm is equally likely to be the efficient firm or the inefficient firm. Thus, ex ante, each firm’s expected profit in any given period is \( .5(\pi_a + \pi_b) \). It follows that the firms’ long-term interests are tied to total per period profits. As for the union, since there is always one efficient firm and one inefficient firm, their goal will be to maximize the (certain) wage bill as defined in (4).

Since the union has the power to select the wages paid by each firm, there are two possibilities: the union can demand the same wage from each firm, or, the union can select firm-specific wages. With the union having all of the wage-setting power, the order in which the wages are chosen is not relevant.

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9 Based on the logic of Kreps and Scheinkman (1983), we can think of quantity competition as a reduced form way of capturing the notion that prices are easier to adjust than quantities in this market. Thus, since production takes place far in advance and then prices are negotiated at the time of purchase in the auto industry, quantity competition seems like a reasonable assumption for the auto industry.

10 This restriction is not needed for this section of the paper. We discuss the appropriate restriction on \( t \) in footnote 11 below.
Maximizing (4) over $w_a$ and $w_b$ subject to (1)-(2) yields the union’s optimal firm-specific wages. We obtain $w_a = 1/2$ and $w_b = t/2$. Maximizing (4) subject to (1)-(2) and $w_a = w_b$ yields the union’s optimal common wage. We obtain $w_u = \frac{t(1+t)}{4(t^2 - t + 1)}$, where the $u$ subscript denotes that this is the uniform wage. For $t \in [0.5,1]$, we have $w_b \leq w_u \leq w_a$; thus, since each firm’s profit is decreasing in its own wage and increasing in its rival’s wage, the efficient firm prefers the uniform wage while the inefficient firm prefers the firm-specific wage structure. And, substituting these wages back into (1), (2) and (4) and comparing we find that the union is always better-off with the firm-specific wages.

None of these results should be surprising – they mimic standard results from the literature on price discrimination under monopoly (and do not depend upon the assumed functional forms). When the union selects a common wage, it settles on one that is between the two firm-specific wages. This benefits the efficient firm and harms the inefficient firm. And, a standard revealed preference argument is enough to ensure that the union cannot be worse off when the wages are firm-specific. Thus, viewed from this perspective, one would never expect the union to prefer a uniform wage.

As for the firms, they know that, over time, they are likely to be the efficient firm half the time and the inefficient firm the remainder of the time. Thus, they would prefer the wage structure that leads to the largest per period total profit. It is straightforward to show that a uniform wage leads to higher total profit. It follows that it will be the firms, not the union, that favor a uniform wage structure.

Since wages are not negotiated, this simple framework does not capture the forces that drive the “taking wages out of competition” argument. However, this framework does provide us with some basic intuition as to why, contrary to prevailing wisdom, an industry-wide union might prefer sequential bargaining (in which firm-specific wages are negotiated). Thus, the “taking wages out of competition” effect, which we expect leads the union to favor pattern bargaining, is not going to be the only force that determines the union’s preferences with respect to bargaining structure.
3. Using Pattern Bargaining to Take Labor Out of Competition

In this section we extend the model so that wages are negotiated. We then examine the agents’ preferences over bargaining mechanisms under the assumption that wages are determined by the Nash Bargaining Solution (NBS). The non-cooperative foundations for the NBS are well known – it is the outcome of negotiations in which the agents trade offers until an offer is accepted (Rubinstein 1982).

There are now three stages to the game. In the first two stages, the union and the firms negotiate over the wage setting mechanism (pattern versus sequential) and, if the order matters, the identity of the target firm is determined (the efficient or the inefficient firm). The last stage consists of a repeated game in which, in each period, nature determines the firms’ productivities; these values are revealed to all players; the union and firms then apply the bargaining mechanism to determine wages; and then, finally, the firms engage in quantity competition in the product market. As in section 2, because a new, independent draw on firm productivities occurs in each period, the competitive positions of the firms change over time. The firms will keep this in mind when selecting a bargaining mechanism and thus, their goal will be to find the bargaining mechanism that maximizes their expected profits.

It is worth noting that we are assuming that there is a single point in the game at which the bargaining mechanism is determined. That is, agents do not renegotiate the bargaining mechanism in each period. The basic idea that we are trying to capture is that negotiating over the bargaining mechanism is likely to be difficult and costly since the agents are likely to have very different preferences (e.g., the firms versus the union; the efficient firm versus the inefficient firm). Thus, the agents will not want to have to re-visit this issue in each period. Instead, since the firms and the union realize that they are in a long term relationship in which the relative competitive positions of the firms change over time, they are likely to take a long-run view and try and select up front a bargaining mechanism that works well for all of them over time. For example, a firm may be willing to put up with a bargaining mechanism which is not ideal for them when they are the efficient firm if they know that this same mechanism will work far better for them when they are at a competitive disadvantage.

When wages are negotiated, the order of bargaining may matter, so we have (potentially) four
cases to consider. Since all four cases are algebra intensive, we sketch the solution method in the text and relegate the details to Appendix A where all analytic solutions are provided. We begin with pattern bargaining with firm \( j \) as the target, which we denote by \( P(j) \). As is standard, we use backwards induction. If the union fails to reach an agreement with firm \( j \), firm \( i \) becomes a monopolist in the product market. Let \( w_i^m \) denote the wage negotiated by firm \( i \) when it is a monopolist and let \( \ell_i^m(w_i^m) \) and \( x_i^m(w_i^m) \) denote this firm’s labor demand and output at this wage. Then, according to the NBS, \( w_i^m \) maximizes the product of the union’s wage bill and the firm’s profit; that is \( w_i^m \) maximizes \( 2\omega(m_i w_i^m, w_i^m) \) over \( w \). Turn next to the original negotiations between the union and firm \( j \). The wage bill evaluated at \( w_i^m \) serves as the union’s threat point during these negotiations, whereas firm \( j \)’s threat point is zero (since it does not produce if no agreement is reached). Since under pattern bargaining it is understood that both firms will end up paying the same wage, then using (3)-(4) and a straight-forward application of the NBS, the wage that the union settles on when using firm \( j \) as the target solves

\[
(5) \quad \max_w \{ \theta(w, w) - w_i^m \ell_i^m(w_i^m) \} x_j(w, w)^2
\]

We use \( w^{p(j)} \) to denote this wage, with the super-script denoting that this wage emerges under pattern bargaining with firm \( j \) as the target. The solutions for \( w_i^m \) and \( w^{p(j)} \) are provided in the Appendix A.

Turn next to sequential bargaining under the assumption that the union negotiates with firm \( j \) first, which we denote by \( S(j) \). Let \( w^{s(j)}_j \) denote the wage that comes out of these initial negotiations – note that the super-script refers to the bargaining structure (sequential bargaining with firm \( j \) as the target) while the sub-script signifies that this is the wage paid by firm \( j \). Then, when firm \( i \) negotiates with the union, the NBS solution wage that emerges solves

\[
(6) \quad \max_w \{ w^{s(j)}_j \ell_j(w^{s(j)}_j, w) + w_i \ell_i(w, w^{s(j)}_j) - w^{s(j)}_j \ell_j(w^{s(j)}_j) \} x_i(w, w^{s(j)}_j)^2
\]

Note that if the union fails to reach an agreement with firm \( i \), firm \( j \) becomes a monopolist in the product
market, but must still pay the (already) negotiated wage of \( w_j^{a(j)} \). This explains why the union’s threat point is given by \( w_j^{a(j)} \ell_j^m (w_j^{a(j)}) \). Let \( w_i^{a(j)} (w_j^{a(j)}) \) denote the solution to (6). As before, the super-script refers to the bargaining structure; whereas the sub-script signifies that this is the wage to be paid by firm \( i \).

It is important to note that \( w_i^{a(j)} \) is increasing in \( w_j^{a(j)} \) with a slope less than one. The reason for this is straight-forward: an increase in firm \( j \)’s wage increases the surplus to be split by firm \( i \) and the union which triggers an increase in firm \( i \)’s wage. However, \( w_i \) does not increase by the full increase in \( w_j \) since this would completely undo the competitive advantage just gained by firm \( i \) (there is also a stability argument that restricts the slope to be below one).

Finally, we turn the initial negotiations between firm \( j \) and the union in order to describe how \( w_j^{a(j)} \) is determined. If the union and firm \( j \) fail to reach an agreement, firm \( j \) does not produce (and therefore earns nothing) while firm \( i \) becomes a monopolist and the union and firm \( i \) settle on a wage of \( w_i^m \). This implies that the union’s threat point is given by \( w_i^m \ell_i^m (w_i^m) \) and \( w_j^{a(j)} \) solves

\[
(7) \quad \max_w \{ \ell_j^m (w, w_j^{a(j)} (w)) + w_j^{a(j)} (w) \ell_j^m (w_j^{a(j)} (w), w) - w_i^m \ell_i^m (w_i^m) \} \geq x_j (w, w_j^{a(j)} (w))^2
\]

Note that in negotiating over its own wage, firm \( j \) takes into account how the outcome will affect the bargaining between firm \( i \) and the union. This is the aspect of wage bargaining in oligopolistic industries that pattern bargaining is meant to eliminate. The analytic solutions for \( w_j^{a(j)} \) and \( w_i^{a(j)} (w_j^{a(j)}) \) are provided in Appendix A.

With the wages determined, we can use (3) and (4) to calculate the union’s wage bill and the firms’ profits. In addition, summing these values allows us to determine the surplus to be split between the agents (producer surplus). To assess the preferences over the different bargaining mechanisms for the agents, we restrict attention to the case in which \( 0.5 \leq t \leq 1 \).\(^{11}\) This leaves us with the same model
analyzed by Marshall and Merlo and allows for a direct comparison of our results. As they demonstrate, with the firms differing only in labor productivity, the order of bargaining does not matter when sequential bargaining is used. Thus, we have three bargaining mechanisms to consider, $P(j)$ with $j = a, b$ and $S \equiv S(a) = S(b)$: pattern with the efficient firm (a) as the target, pattern with the inefficient firm (b) as the target and sequential bargaining.

We start with the union’s preferences, which follow from Figure 1a. The first result is not surprising: under pattern bargaining, the union always prefers to bargain with the more efficient firm first: $\theta(w^{p(a)}, w^{p(a)}) \geq \theta(w^{p(b)}, w^{p(b)})$ for $t \in [0.5, 1]$. This follows from the fact that the efficient firm generates a larger surplus and can therefore afford to pay a higher wage than its counterpart. As we show in the next section, this result generalizes to situations in which the firms differ in non-labor costs as well – it is always in the interest of the union to use the more efficient firm as the target. The second result that is evident from Figure 1a is that when the degree of firm-heterogeneity is weak ($0.7338 \leq t \leq 1$), the union prefers pattern over sequential bargaining regardless of which firm is used as the target. When firm-heterogeneity is moderate ($0.5785 \leq t \leq 0.7338$), the union still prefers pattern bargaining to sequential, as long as the target is the efficient firm. It is only when the firms differ dramatically in labor productivity ($0.5 \leq t \leq 0.5785$) that the union prefers to bargain sequentially.

Marshal and Merlo (2004) provide intuition for the union’s preference ordering and it is the main result of their paper. However, we offer a somewhat different explanation for these results. As we showed in the previous section, the ability to tailor wages to the firms, which is a characteristic of sequential bargaining, benefits the union at the expense of the firms. However, the “taking labor out of competition” aspect of pattern bargaining results in higher average wages in the industry. This follows from the fact that firms are more willing to agree to a wage increase when they know that their rival’s wage will rise by the same amount that their wage will rise (and, as we saw above, with sequential

but it is straightforward to verify that at $t = 1/2$ there exists a $w$ that satisfies the first order condition ($w = 1/4$). This wage is the explicit solution to the first order condition when the limit is taken as $t$ approaches $1/2$. It is not difficult to check that the equilibrium is well behaved (i.e., stability conditions are satisfied) for $t \in (1/3, 1/2]$. Intuitively, we want to restrict $t$ such that the union would prefer to have both firms produce. The qualitatively nature of our results do not change by expanding the range of $t$ – in fact, pattern bargaining becomes more likely for low $t$. 

bargaining any increase in \( w_j \) leads to an increase in \( w_i \) of smaller magnitude). Thus, sequential bargaining benefits the union by allowing for a firm-specific wage structure but harms the union by generating lower average wages. The benefit from wage discrimination is not particularly important when the firms are similar, so that with weak heterogeneity the latter force dominates and the union prefers pattern bargaining. The advantages from a firm-specific wage structure grow as the firms become less alike, and this effect dominates when firm-heterogeneity is strong. As a result, when the firms are quite dissimilar, the union prefers sequential bargaining.

The problem with the Marshall-Merlo result is evident from Figure 1b where the firms’ aggregate profits \( \Pi \) are depicted for each of the bargaining mechanisms. As we noted above, the firms’ goal is to select the bargaining mechanism that maximizes its expected profits, which, given our set-up, is equivalent to maximizing total industry profits. To begin, it is clear that with pattern bargaining, the firms always prefer the inefficient firm to be the target. So, even if we restrict our attention to pattern-bargaining, there is disagreement between the union and the firms over the nature of the bargaining process. When we include sequential bargaining, the possibility of agreement seems even more remote.

Figure 1b indicates that when firm-heterogeneity is weak \((.7267 \leq t \leq 1)\), the firms prefer sequential bargaining over any form of pattern bargaining. Note, however, that when firm-heterogeneity is moderate or dramatic \((.5 \leq t \leq .7267)\), the firms prefer pattern bargaining. More specifically, their first choice is always pattern bargaining with the inefficient firm as the target – that is, \( P(b) \). The fact that the firms prefer that the weak firm serves as the target should not be surprising – since the inefficient firm generates a smaller surplus, using it as the target results in a lower wage and higher profits.\(^\text{12}\)

The explanation for the firms’ preferences is similar to that given above for the union. The firm-specific wage structure, which is inherent in sequential bargaining, harms the firms; whereas the ability to take labor out of competition through pattern bargaining also harms the firm (due to the higher average wages). When the negative aspects from sequential bargaining are dominate, the firms prefer pattern bargaining.

\(^{12}\) Note that with sufficient heterogeneity \((.5 \leq t \leq .529)\) the firms will prefer any sort of pattern bargaining over sequential bargaining.
bargaining; otherwise, they prefer sequential bargaining. If the firms are similar, the impact of wage discrimination is small and the firms prefer sequential bargaining. As the difference between the firms grows, the impact of price discrimination increases so that the firms eventually switch and prefer pattern bargaining.

It is clear from Figures 1a and 1b that no common bargaining mechanism is the first choice for both sides. For \( t < 0.5785 \), the union prefers S while the firms prefer P(b). For \( t > 0.7267 \) the firms prefer sequential bargaining but the union prefers P(a). Finally for \( t \in (0.5785, 0.7267) \), both sides prefer pattern bargaining, however they disagree as to the identity of the target.

To characterize equilibrium, we must now describe the first-two stages of the game that the agents face in a bit more detail. We begin with the second stage, in which the order of the negotiations is determined (after the bargaining mechanism has been selected). If pattern bargaining has been selected, then we assume that with probability \( q \in [0,1] \) nature assigns the union the power to determine the identity of target firm. We therefore use \( q \) as a measure of the union’s ability to influence the selection of the target. For example, if \( q = 1 \), then the union always chooses the target whereas if \( q = 0 \), then the firms always choose the target. By varying \( q \) we can consider all possible stage two outcomes and investigate the manner in which the union’s ability to influence the selection of the target affects the likelihood of pattern bargaining arising in equilibrium.\(^{13} \)

Turn next to the first stage, in which the agents select the bargaining mechanism. We assume that in this stage, knowing how the target will be selected in stage two, the agents simultaneously announce their choice as sequential (S) or pattern (P). However, it is impossible to implement pattern bargaining if all agents do not agree to adopt it. Thus, we assume that if \( \text{all agents} \) select P, then pattern bargaining is adopted; otherwise, sequential bargaining is the outcome.

We begin our analysis by considering the two extreme cases: the union always chooses the target \((q = 1)\) or the firms always choose the target \((q = 0)\). When the union chooses the target, sub-game

\(^{13}\) We note that values of \( q \in (0,1) \) are consistent with a commonly observed phenomenon associated with pattern bargaining in that the target firm and its characteristics change over time (i.e., sometimes the union will select the most efficient firm as the target while at other times it will select a mid-level firm as the target).
perfection dictates that the efficient firm is always selected. Figure 1a indicates that the union prefers $S$ to $P(a)$ for all $t < .5786$; whereas Figure 1b indicates that the firms prefer $S$ to $P(a)$ for all $t > .5291$. For all $t$, $S$ is announced by at least one side, and so $S$ is always the outcome. When the firms choose the target, sub-game perfection dictates that the inefficient firm is always selected. Figure 1a indicates that the union prefers $S$ to $P(b)$ as long as $t < .7338$; whereas Figure 1b indicates that the firms prefer $S$ to $P(b)$ for all $t > .7267$. Again, for all $t$, $S$ is announced by at least one side. Thus, in these two extreme cases, sequential bargaining is the only possible equilibrium outcome.

We now consider intermediate values for $q$. In the first stage, the agents know that if pattern bargaining is chosen the efficient firm will be selected as the target with probability $q$. As a result, the payoff to the union when $P$ is the outcome is $q \theta^{p(a)} + (1-q) \theta^{p(b)}$ (recall that the super-script $P(j)$ indicates that pattern bargaining has been adopted with firm $j$ as the target). On the other hand, under sequential bargaining the union earns $\theta^S$ (since the order of bargaining does not matter). The payoff for the firms is calculated in an analogous fashion. It should be clear that for $t \geq .7267$ and $t \leq .5785$, $S$ will be the outcome. In the former case, the firms prefer (and so announce) $S$ even when they get to choose target firm with probability one; whereas in the latter case it is the union that insists on $S$ regardless of $q$.

For $.5785 \leq t \leq .7267$, the union will only announce $P$ if $q$ is sufficiently high; whereas the firms will announce $P$ only when $q$ is sufficiently low. Let $q_U$ denote the value of $q$ that equates the expected wage bill with pattern bargaining to the expected wage bill with sequential bargaining, and define $q_F$ as the value of $q$ that equates expected total profit with pattern bargaining to expected total profits with sequential bargaining. Clearly, a value of $q$ such that both the union and the firms prefer $P$ over $S$ exists iff $q_U \leq q_F$. However, for all $t$ in this range $q_U > q_F$, so that there is no value for $q$ such that both the union and the firms prefer pattern bargaining! Thus, when side payments are not possible, we conclude that in the Marshall-Merlo framework we would always expect sequential bargaining to be chosen in equilibrium. It follows that the fact that the union may prefer pattern bargaining is not sufficient to explain how it emerges as an equilibrium outcome.
**Proposition 1:** When the firms differ in labor productivity, then equilibrium is characterized by sequential bargaining for all productivity differences ($t$).

Proposition 1 may be somewhat surprising given the preference orderings of the agents. After all, there are parameter values such that all agents prefer pattern bargaining to sequential bargaining (this occurs when $t$ is moderate; i.e., $0.5785 \leq t \leq 1$). The problem is that the agents disagree about the target. When the firms differ only in labor productivity, this disagreement over the target is strong enough that it becomes impossible to get pattern bargaining in equilibrium without side payments. As we show below, this is no longer the case when the firms differ in non-labor costs.

### 4. Differences in Non-Labor Costs

We now extend the model to allow the firms to differ in non-labor costs. We do so by assuming that each time that firm $b$ (the inefficient firm) produces a unit of output it must incur a non-labor cost of $c$. Firm $a$, on the other hand, faces no additional per unit costs. In order to highlight the importance of this extension, we set $t = 1$ so that this is the only difference across firms. This implies that firm $a$’s marginal cost of production is $w_a$; whereas firm $b$’s marginal cost is $w_b + c$. As we show, this assumption alters the trade-offs faced by the firms and the unions and makes it possible for pattern bargaining to emerge as an equilibrium outcome.

With this set-up, Cournot competition in the product market leads to the following equilibrium outcomes (both firms are active in equilibrium under all relevant bargaining mechanisms provided that $c$ is sufficiently low – that is, $c \leq 0.342$).\(^{14}\)

\[ x_a(w_a, w_b) = \ell_a(w_a, w_b) = (1/3)[1 - 2w_a + (w_b + c)] \]  
\[ x_b(w_b, w_a) = \ell_b(w_b, w_a) = (1/3)[1 + w_a - 2(w_b + c)] \]

with the firms’ profits and the union’s wage bill still given by (3) and (4), respectively. Furthermore, the NBS wages under the different bargaining mechanisms are still defined by (5)-(7), with the analytic

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\(^{14}\) The condition binds for when there is pattern bargaining with the efficient firm.
solutions provided in the Appendix A.

With $c > 0$, the outcome from sequential bargaining now depends on which firm is used as the target. Thus, we now have four different mechanisms to consider. Since the outcome does not depend on the ordering in the Marshall-Merlo framework, this is the first indication that the source of firm-heterogeneity may be important. Moreover, the outcome with non-labor costs seems more intuitive, as one would normally expect the order of negotiations to matter.

Turning to the union’s preferences, it is easier to follow the ensuing discussion by referring to a description of the agents’ preference orderings (provided in Appendix B), since with four cases now the analogs of Figures 1a and 1b are excessively complex to be useful. As is clear from the orderings of the wage bills, the union prefers pattern bargaining over sequential bargaining for all $c$. Thus, when the firms differ only in non-labor costs, the “taking labor out of competition” effect associated with pattern bargaining always dominates the advantages from the firm-specific wage structure associated with sequential bargaining. This result is consistent with the conventional wisdom about pattern bargaining as well as the basic message of Marshal and Merlo – the union prefers pattern bargaining. The orderings also indicates that, as in the Marshall-Merlo framework (and for the same reasons), the union always prefers to bargain with the efficient firm first (regardless of the bargaining mechanism).

Turning to the firms, we find that their preferences are consistent with the case of productivity differences discussed in Section 3 (see Appendix B). That is, they prefer sequential bargaining when firm heterogeneity is weak ($c \leq .263$) but prefer pattern bargaining when firm heterogeneity is strong ($c \geq .263$). The intuition follows that in previous sections – for the firms there are both positive and negative aspects of sequential bargaining. The positive aspect is that it results in lower average wages. The negative aspect, which dominates when the firms are sufficiently heterogeneous, is that they are harmed

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15 This result is partly the artifact of examining interior solutions in all cases, which requires that $c < .342$ (this restriction is required under pattern bargaining with the efficient firm as the target). If we allow for corner solutions, then there exists a small region of the parameter space when firms are sufficiently heterogeneous in which sequential bargaining with the efficient firm as the target is preferred by the union to pattern bargaining with the efficient firm as the target.
by the price discrimination inherent in sequential bargaining. We also see that, as before and for the same reasons, the firms always prefer that the inefficient firm carry out their negotiations first.

We are now in position to solve for equilibrium. As in Section 3, we begin with the two extreme cases. Suppose first that the union has complete control over the target \((q = 1)\). Then, by sub-game perfection the efficient firm will be selected as the target and from Appendix B we know that the union will opt for pattern bargaining. Turning to the firm, we see that for strong heterogeneity \((c > .2646)\) the firms would also prefer pattern bargaining. Thus, pattern bargaining can emerge as an equilibrium outcome if there is heterogeneity in non-labor costs.

Turning to the case in which the firms can select the target \((q = 0)\), we know that they will always select the inefficient firm. In this case (from Appendix B), the union would select pattern bargaining as long as the firms are not too different \((c < .3127)\). The firms, on the other hand, prefer pattern bargaining whenever \(c > .2630\); otherwise, they prefer sequential bargaining. This implies that pattern bargaining will be the equilibrium outcome for all \(c \in [.2630, .3127]\).16

Extending the analysis to allow for all possible \(q\), it follows for \(c \in [.2646, .3127]\) pattern bargaining arises regardless of the target firm. That is, for all \(q\), pattern bargaining is the equilibrium outcome. Further, for all \(c \geq .2630\), there exists a range of values for \(q\) such that equilibrium is characterized by pattern bargaining. For \(c < .2630\), sequential bargaining is always the equilibrium outcome. We summarize these results in Proposition 2:

**Proposition 2:** Suppose that the firms differ in non-labor costs, then if firms are sufficiently homogeneous \((c < .2630)\), equilibrium is characterized by sequential bargaining.

For \(c \in [.2630, .2646]\), there exists a \(q^*\) such that we get pattern bargaining if \(q < q^*\);

16 It is worth noting that the equilibrium wage solutions provided in Appendix A are sufficient to allow for consideration of the general model in which the firms differ in both labor productivity and non-labor costs. We have examined this model and the results are qualitatively identical to those described in this section. The key result remains: for a significant portion of the parameter space the trade-offs are such that all agents prefer pattern bargaining to sequential bargaining. Thus, as long as the firms differ in non-labor costs, pattern bargaining can emerge in equilibrium even when side payments are not possible.
otherwise we get sequential bargaining. For \( c \in [.2646,.3127] \), equilibrium is always characterized by pattern bargaining for all \( q \). Finally, for \( c \geq .3127 \), there exists a \( q^{**} \) such that pattern bargaining is the equilibrium outcome for all \( q > q^{**} \); otherwise equilibrium is characterized by sequential bargaining.

The contrast between the cases in which \( c \in [.2630,.2646] \) and \( c \geq .3127 \) is worth highlighting. In the former case, we get pattern bargaining only if \( q \) is sufficiently low. This is due to the fact that for these values of \( c \), the union always prefers pattern bargaining (regardless of the target) while the firms prefer pattern bargaining only if they have sufficient control over the target. In contrast, in the latter case, we only get pattern bargaining if \( q \) is sufficiently high. This follows from the fact that when the firms are sufficiently heterogeneous the firms always prefer pattern bargaining but the union will only agree to pattern bargaining when it has sufficient control over the target.

Proposition 2 is our most important result in that this is the first example (that we are aware of) in which pattern bargaining emerges as an equilibrium outcome in a model in which all agents play a role in determining the bargaining structure.

We close this section by turning to an issue that has received surprisingly little attention in the literature – the impact of bargaining structure on consumer welfare.\(^{17}\) Since the good is homogenous, consumers prefer the bargaining structure that leads to the lowest output price. This means that all they are interested in is aggregate output – the distribution of output is not important. We have argued above that sequential bargaining always leads to lower average wages. Thus, this is also the bargaining structure that results in higher total output. Thus, consumers always prefer sequential bargaining over pattern bargaining regardless of the order of the negotiations (for the precise preference ordering, see Appendix B).\(^{18}\) We summarize this result in Proposition 3.\(^{19}\)

\(^{17}\) In our working paper, Creane and Davidson (2007), we also examine the relationship between bargaining structure and total welfare.

\(^{18}\) For the same reason consumers prefer that the inefficient firm be the target firm.
Proposition 3: When the firms differ in non-labor costs, consumer surplus is maximized by sequential bargaining.

In the introduction we noted that the Howard Government in Australia recently adopted legislation aimed at outlawing pattern bargaining and that union leaders argued that the main goal of this legislation was to shift bargaining power towards firms. However, the fact that we find that sequential bargaining generates greater consumer welfare than pattern bargaining provides an intriguing alternative explanation for the Howard Government’s actions – the Workchoices legislation could have been an attempt to protect consumer’s interests. In addition, since consumers can be interpreted as downstream firms, our analysis also offers an explanation as to why some firms would voluntarily agree to pattern bargaining while downstream firms in other industries would lobby against it. We also note that, regardless of the government’s motivation in outlawing pattern bargaining, Proposition 3 suggests that this action may have benefited Australian consumers.

5. Side Payments

For completeness, we now consider the case in which side payments can be used to influence the bargaining mechanism. One reason for doing so is to examine which agents’ interest are most invested in the implementation of pattern bargaining. After all, given the structure of our three-stage game, in the absence of side payments all agents must agree to pattern bargaining for it to be adopted. When side payments are possible, one side may be willing to bribe the other to accept this bargaining structure. Another reason to consider this case is that there appear to be instances in which lump sum transfers are included as part of a newly negotiated contract.

With side payments possible, we would expect the wage structure that maximizes the joint surplus of the union and the firms to emerge in equilibrium. The type of side payments that we have in

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19 The relationship between bargaining structure and consumer surplus is slightly more complicated in the Marshall-Merlo framework. In particular, if firms are sufficiently heterogeneous, then in the Marshall-Merlo setting consumers may prefer pattern bargaining. See the discussion preceding Proposition 24 below (along with footnote 23) and our working paper (Creane and Davidson 2007) for details.
mind would be any payment made by the firms to the union (or vice versa) that would not affect the firms’ marginal costs of production. So, for example, any contribution made by the firms in the auto industry to the UAW’s “job fund” would qualify; as would a signing bonus paid to all union members who vote “yes” on a new proposed contract. Another example would be an agreement to change the pension formula that results in a more favorable retirement package for workers.20

We begin with our benchmark model of Section 2 where the union sets the wages and chooses either a uniform wage or separate wages for each firm. With linear demand, constant costs and both firms active in equilibrium, it is straightforward to show that the total surplus to be split by the union and the firms (i.e., $\pi_e + \pi_i + \theta$) is always larger with a uniform wage (although this need not be true for other functional forms). Thus, in the first period, before productivities are revealed, the firms should be able to bribe the union to commit to setting a uniform wage in each period. Note that in this case the outcome is consistent with pattern bargaining in that the firms wind up paying the same wage. However, this outcome emerges because the common wage is in the firms’ best interest and because a uniform wage generates more value to the agents than firm-specific wages. Since this runs counter to conventional wisdom, we next examine this issue when wages are bargained.

As we saw in Sections 3 and 4, when side payments are not possible the Marshall-Merlo framework yields very different results from the model in which the firms differ in non-labor costs. In the Marshall-Merlo framework, pattern bargaining is never an equilibrium outcome; whereas with differences in non-labor costs, we get pattern bargaining as long as the firms are sufficiently heterogeneous. In contrast, the two models yield qualitatively similar predictions when side payments are possible. Therefore, for concreteness, we focus attention one model. Since it yields cleaner results, we work with the Marshall-Merlo framework. At the end of the section, we describe how the results must be modified when firms differ in non-labor costs. Interested readers are referred to our working paper, Creane and Davidson (2007), in which a complete characterization for both models is provided.

20 We thank Paula Voos for suggesting these examples.
There are two cases to consider since there are two potential sources of disagreement between the union and the firms. In the first case, we assume that side payments can be used to influence both the bargaining mechanism and the selection of the target. In the second case, we assume that the agents are unable to contract on the target. In the first case, we expect that negotiations will result in the mechanism that maximizes the joint surplus of the union and the firms. Figure 1c shows how this producer surplus (PS) varies with the bargaining mechanism when the firms differ in labor productivity. When firm-heterogeneity is weak to moderate \((0.6502 \leq t \leq 1)\), Figure 1c indicates that the PS is largest with sequential bargaining. Thus, in this case, even with side payments, pattern bargaining cannot arise in equilibrium. Figure 1c also indicates that when firm-heterogeneity is strong \((0.5 \leq t \leq 0.6502)\) producer surplus is largest when the firms get their preferred outcome: \(P(b)\). This suggests that pattern bargaining is likely to emerge when it is the outcome desired by the firms, not the unions. These results are entirely consistent with the benchmark model where the union selects the wage.

The explanation for the relationship between bargaining structure and producer surplus can be explained as follows. As with the firms and the union, there are two forces at work. Since sequential bargaining leads to lower average wages, one should expect sequential bargaining to generate a greater surplus – lower wages imply greater output and a larger surplus to be shared. However, with sequential bargaining the inefficient firm winds up paying a lower wage rate than it would under pattern bargaining. This implies that under sequential bargaining, the inefficient firm has a greater market share and thus, a greater fraction of total output is produced inefficiently. Consequently, even though sequential

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21 Marshall and Merlo (2004) do not examine producer surplus. However, the issue does come up implicitly in the final section of their article when they discuss potential entry by a third firm. As discussed in footnote 4, Marshall and Merlo show that in the presence of potential entry, there is a common wage that would make both the union and the two incumbents better-off than they would be with sequential bargaining (this common wage blocks entry while sequential bargaining allows the third firm to enter). They then argue that pattern bargaining would therefore be in the interest of the union and the two incumbents. The fact that such a wage exists merely shows that producer surplus would be higher with a common wage than with sequential bargaining. What needs to be shown is that this common wage is also an equilibrium wage with pattern bargaining.

22 The efficient wage (the one which maximizes producer surplus) is always less than either the pattern or sequential bargaining wages due to double marginalization.
bargaining leads to lower average wages, total output can be lower with sequential bargaining.\textsuperscript{23} When the firms are similar, the first effect dominates and producer surplus is higher with sequential bargaining. As firm-heterogeneity become more pronounced, the loss in output from inefficient production grows, so that producer surplus eventually becomes larger with pattern bargaining.\textsuperscript{24} Summarizing, we have:

**Proposition 4:** Suppose that the firms differ in labor productivity and that side payments can be used to influence both the bargaining mechanism and the target firm, then if the firms are sufficiently homogenous (\(0.6502 \leq t \leq 1\)), sequential bargaining is the equilibrium outcome. Otherwise, equilibrium is characterized by pattern bargaining with the inefficient firm as the target.

If side payments cannot be used to influence the selection of the target, then the value of \(q\) becomes important. To see this, consider what occurs in the two extreme cases. First, assume that the union always has the power to select the target (i.e., \(q = 1\)). Given the union’s preference, sub-game perfection dictates that if pattern bargaining is selected in stage one, then the union always selects the efficient firm as the target. However, Figure 1c indicates that producer surplus with sequential bargaining always exceeds its value under pattern bargaining when the efficient firm is the target. Thus, when \(q = 1\) and side payments can only be used to determine the mechanism, sequential bargaining is the only outcome now. That is, for pattern bargaining to arise in this case, side payments must be able to influence both the mechanism and the target. Note that in this case, if \(t > .5786\), then since the union prefers P(a), we would expect side payments to flow from the firm to the union. That is, if they could, the firms would bribe the union in order to obtain sequential bargaining.

Now turn to the other extreme in which firms select the target (i.e., \(q = 0\)). In the second stage of

\textsuperscript{23} This is precisely why the relationship between the bargaining mechanism and consumer surplus is slightly more complicated in the Marshall-Merlo framework.

\textsuperscript{24} As we discussed in footnote 7, we do not consider pattern bargaining in costs since it leads to a smaller joint surplus than sequential bargaining and/or pattern bargaining in wages. The reason for this is that pattern bargaining in costs combines the worst aspects of the other two mechanisms (in terms of generating a large joint surplus) – by softening negotiations it leads to higher average wages than sequential bargaining and by equalizing marginal costs across firms it results in a less efficient distribution of production than pattern bargaining in wages.
the game, the firms always select the inefficient firm as the target. Given this, the relative values of producer surplus in Figure 1c indicate that if \( t \in (.6502, 1) \), \( S \) is the equilibrium outcome. Moreover, the side-payments go from the union to the firm whenever \( t > .7267 \). Thus, when \( q = 0 \) and \( t \) is sufficiently high, \textit{the union would be willing to bribe the firms in order to obtain sequential bargaining.} Finally, if \( t \in (.5, .6502) \), \( P(b) \) is the equilibrium outcome. It is worth noting that by Proposition 4, assigning the firms the power of selecting the target firm raises producer surplus.

Extending the analysis to the intermediate cases in which \( q \in (0,1) \) is straightforward, since we simply take a weighted average of the payoffs. For \( t \in (.6502,1) \), both sides prefer sequential bargaining regardless of \( q \). If \( t \in (.5,.6502) \), then the outcome depends on whether, given \( t \), producer surplus with sequential bargaining exceeds \( q \cdot PS^{P(a)} + (1 - q) \cdot PS^{P(b)} \) where the super-script \( P(j) \) indicates that pattern bargaining has been adopted with firm \( j \) as the target. Since for any \( t < .6502 \), producer surplus with the efficient firm as the target is strictly greater than producer surplus with sequential bargaining, there always exists a \( q \) arbitrarily close to 0 such that producer surplus with pattern bargaining is greater than with sequential bargaining.\(^{25}\)

\textbf{Proposition 5:} Suppose that the firms differ in labor productivity and that side payments can be used to influence the bargaining mechanism but not the target, then if the firms are sufficiently homogenous \( (.6502 \leq t < 1) \), sequential bargaining is the equilibrium outcome. In addition, when the firms are sufficiently heterogeneous, \((.5 \leq t \leq .6502) \) there exists a \( q^* \in (0, 1) \) such that for \( q > q^* \) there is sequential bargaining; otherwise equilibrium is characterized by pattern bargaining with the inefficient firm as the target.

\(^{25}\) It is worth noting that when the agents cannot contract on the identity of the target, sequential bargaining is the outcome when \( t < .6502 \) and \( q \) is sufficiently large in spite of the fact that producer surplus would be greater under pattern bargaining.
Proposition 5 indicates that pattern bargaining can still arise in equilibrium, but only when the firms have sufficient influence on the selection of the target.

To summarize our results in the Marshall-Merlo framework, Proposition 1 indicates that without side payments, pattern bargaining can never emerge as an equilibrium outcome. Propositions 4 and 5 indicate that when side payments are possible, equilibrium may be characterized by pattern bargaining, but only when the inefficient firm is used as the target. Moreover, from Figures 1a and 1b, pattern bargaining only emerges in equilibrium when it is the preferred bargaining mechanism of the firms.

As we noted at the beginning of this section, results quite similar to those in Propositions 4 and 5 hold when the firms differ in non-labor costs. To begin with, the existence of side payments makes it more likely that equilibrium will be characterized by pattern bargaining -- without side payments pattern bargaining can only arise when \( c > .2630 \), with side payments the condition becomes \( c > .1965 \). In addition, pattern bargaining usually arises when it is the firms’ preferred bargaining mechanism. The one significant difference is that when the firms cannot contract over the identity of the target it is possible to have pattern bargaining emerge when it is in the union’s interest, not the firms’. This is consistent with the conventional wisdom that it the union’s interest that is most served by the adoption of pattern bargaining. Thus, there are at least two reasons to prefer a model in which firms differ in non-labor costs to the Marshall-Merlo framework. First, it provides an explanation of how pattern bargaining can arise in equilibrium without side payments. Second, when side payments are possible, it provides an explanation of how pattern bargaining can arise endogenously when it is support by the union and opposed by the firms.\(^\text{26}\)

\(^{26}\) In our working paper, Creane and Davidson (2007), we highlight a third reason to prefer the model with difference in non-labor costs: it provides an explanation for the controversy that surrounds the use of pattern bargaining. This can be explained as follows. In the Marshall-Merlo set-up, we find that whenever the use of side payments results in the adoption of pattern bargaining, this results in an increase in consumer surplus. Thus, in the Marshall-Merlo set-up, without side payments pattern bargaining will never be adopted, and with side payments all agents will gain by its adoption. When the firms differ in non-labor costs, Proposition 3 makes it clear that consumers (and downstream firms) always prefer sequential bargaining. Thus, there will always be some agents who oppose the adoption of pattern bargaining.
6. Conclusion

Pattern bargaining is a common negotiating strategy that is not well understood. The conventional wisdom is that this strategy is used by industry-wide unions to soften bargaining and secure higher wages. This intuition was confirmed in a recent paper by Marshall and Merlo (2004) in which they show that unions prefer this bargaining mechanism to simultaneous and/or sequential bargaining. However, this does not explain why the firms are willing to accept such an arrangement. Building on the insights of Marshall and Merlo, we have presented a model in which the agents negotiate over wages and the bargaining mechanism. We have shown that when comparing sequential and pattern bargaining, there are competing forces at work for both the union and the firms. For the union, pattern bargaining is advantageous because it softens the negotiations with the firms by “taking labor out of competition,” resulting in higher industry wages. On the other hand, sequential bargaining allows the union to exploit difference across the firms by demanding different wages much in the same way that a monopolist would charge different prices to consumers with different levels of willingness to pay. When firms are similar, the benefits from wage discrimination are small and the union prefers pattern bargaining. The benefits tied to wage discrimination are much more important when the firms are sufficiently different, so that with sufficient firm-heterogeneity, the union prefers sequential bargaining.

In our model the relative competitive positions of the firms change over time due to random shocks to either labor productivity or non-labor costs. The firms may therefore prefer pattern bargaining because it allows the relatively more efficient firm to pay a lower wage than it would with sequential bargaining and this can lead to higher expected lifetime profits. On the other hand, as noted above, pattern bargaining softens negotiations and results in higher average wages. As a result, we find that when firm-heterogeneity is weak (strong), the firms prefer sequential (pattern) bargaining. This is precisely the opposite of the way in which the union’s preferences are linked to the degree of firm-heterogeneity, implying that it may not be possible to find situations in which all agents prefer pattern bargaining to sequential.
Using the Marshall-Merlo framework (linear demand and constant costs), we show that when the firms differ only in labor productivity, the trade-offs are such that without side-payments, pattern bargaining cannot arise in equilibrium (Proposition 1). Moreover, when side payments are possible, pattern bargaining can be an equilibrium outcome, but only when it is the firms’ most preferred mechanism (from Propositions 4 and 5 and Figures 1a and 1b). In contrast, when the firms differ in non-labor costs, the trade-offs are different and pattern bargaining can emerge in equilibrium even when side payments are ruled out (Proposition 2). We also showed that sequential bargaining is the mechanism that maximizes consumer surplus (Proposition 3). Thus, there are cases in which the union and the firms both prefer pattern bargaining while consumers (who could be downstream producers) would oppose it. This provides a new explanation for recent legislation in Australia aimed at eliminating pattern bargaining.
Appendices

A. Analytic Solutions

For concreteness, we provide analytic solutions to the general model in which the firms differ in both labor productivity and non-labor costs. Thus, following the notation in the text we have $x_a = \ell_a$ and $x_b = t\ell_b$, firm $a$’s non-labor costs are zero, and firm $b$ incurs a non-labor cost of $c$ per unit of output. This implies that in the Cournot equilibrium output and employment are given by

(A.1) $x_a = \ell_a = (1/3t)[t(1-2w_a + c) + w_b]$ \\
(A.2) $x_b = t\ell_b = (1/3t)[t(1 + w_a - 2c) - 2w_b]$

Profits and the union’s wage bill are still given by (3) and (4), respectively.

Case 1: Pattern Bargaining with Firm $a$ as the Target

With a common wage, the wage bill becomes

(A.3) $\theta = (w/3t^2)[t^2(1+c) + t(1-2c) - 2w(1-t + t^2)]$

When it bargains with firm $a$, it is straightforward to show that the union’s threat point is $(3/32)(1-c)^2$.

Thus, the wage maximizes

(A.4) $\left\{ \left( \frac{w}{3t^2} \right)[t^2(1+c) + t(1-2c) - 2w(1-t + t^2)] - \frac{3(1-c)^2}{32} \right\}^{1/2} \left\{ \frac{w(1-2t) + t(1+c)}{3t} \right\}^{1/2}$

If we let $H = \left\{ \left( \frac{w}{3t^2} \right)[t^2(1+c) + t(1-2c) - 2w(1-t + t^2)] - \frac{3(1-c)^2}{32} \right\}$, the first-order-condition is

$H^{-1/2} \left\{ \frac{w(1-2t) + t(1+c)}{3t} \right\}[t^2(1+c) + t(1-2c) - 4w(1-t + t^2)] = H^{1/2} \frac{1-2t}{3t}$; which reduces to

(A.5) $A_1w^2 + B_1w + C_1 = 0$

where $A_1 = 4(2t-1)(1-t + t^2)$; $B_1 = -2t(1+c)(t^2-t+1) - (3/2)[t^2(1+c) + t(1-2c)](2t-1)$; and

$C_1 = (t/2)(1+c)[t^2(1+c) + t(1-2c)] + (9/32)t^2(1-c)^2(2t-1)$

We can use the quadratic formula to get the wage, which we denote by $w^{p(a)}$. 

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Case 2: Pattern Bargaining with Firm $b$ as the Target

The wage bill is still given by (A.3) and the union’s threat point is obtained by setting $c = 0$. So, in this case, the wage must maximize

\[
(A.6) \quad \left\{ \frac{w}{3t^2} \left[ t^2(1+c) + t(1-2c) - 2w(1-t + t^2) \right] - \frac{3}{32} \right\}^{1/2} \left\{ \frac{w(t-2) + t(1-2c)}{3t} \right\}
\]

The first-order condition is given by

\[
\frac{H^{1/2}}{6t^2} \left\{ \frac{w(t-2) + t(1-2c)}{3t} \right\} \left[ t(1+c) + t(1-2c) - 4w(1-t + t^2) \right] = H^{1/2} \frac{2-t}{3t}.
\]

After substituting for $H$ we obtain

\[
(A.7) \quad A_2w^2 + B_2w + C_2 = 0
\]

where $A_2 = 4(2-t)(1-t + t^2)$; $B_2 = -2t(1-2c)(t^2 - t + 1) - (3/2)(2-t)t[1+(1+c) + 1-2c]$; and

\[
C_2 = (t^2/2)(1-2c)[(1+c) + 1-2c] + (9/16)(2-t)
\]

We can use the quadratic formula to get the wage, which we denote by $w^{p(b)}$.

Case 3: Sequential Bargaining with Firm $a$ Going First

We start by looking at the bargaining between the union and firm $b$ with $w_a$ fixed. The wage bill is now given by

\[
(A.8) \quad \theta(w_b \mid w_a) = (1/3t^2)[w_at^2(1 - 2w_a + c) + w_b(t(1 - 2c + 2w_a) - 2w_b^2]
\]

If the union fails to reach an agreement with firm $b$, firm $a$ becomes a monopolist and the union’s wage bill is $(w_a^2/2)(1-w_a)$, so, this is the union’s threat point. So, $w_b$ maximizes

\[
\left\{ \left( \frac{1}{3t^2} \right)w_at^2(1 - 2w_a + c) + w_b(t(1 + 2w_a - 2c) - 2w_b^2) - \frac{w_a}{2}(1 - w_a) \right\}^{1/2} \left\{ \frac{t(1 + w_a - 2c) - 2w_b}{3t} \right\}.
\]
If we let $G = \left(\frac{1}{3t^2}\right)[w_a t^2 (1 - 2w_a + c) + w_b t (1 + 2w_a - 2c) - 2w_b^2] - \frac{w_a}{2} (1 - w_a)$, then the first-order condition is given by $G^{-1/2} \left\{ \frac{t (1 + w_a - 2c) - 2w_b}{3t} \right\} \left\{ t (1 + 2w_a - 2c) - 4w_b \right\} = \frac{2G^{1/2}}{3t}$. Simplifying and substituting for $G$ yields $16w_a^2 - 2t[5 + 8w_1 + 8c][2w_2 + t^2[(1 - 2c)^2 + 5w_1 (1 - 2c) + 4w_2^2] = 0$. The quadratic can now be applied to obtain

(A.9) $w_b(w_a) = (t/8)(1 - 2c + 4w_a)$

We can now turn to the union’s negotiations with firm $a$. Plugging (A.9) back into (A.8) yields the wage bill as a function of $w_a$ -- we obtain

(A.10) $\theta(w_a) = (1/32) [(1 - 2c)^2 + 16w_a - 16w_a^2]$

Using (A.9), firm $a$’s profits become

(A.11) $\pi_a(w_a) = \left[ \frac{3 + 2c - 4w_a}{8} \right]^2$

If the union fails to reach an agreement with firm $a$, firm $b$ is a monopolist and so the union’s threat point is (as with pattern bargaining) $(3/32)(1 - c)^2$. This means that $w_a$ maximizes

$\left\{ \left( \frac{1}{32} \right) [(1 - 2c)^2 + 16w_a - 16w_a^2] - \frac{3(1 - c)^2}{32} \right\}^{1/2} \left\{ \frac{3 + 2c - 4w_a}{8} \right\}$.

If we let $Z = \left\{ \left( \frac{1}{32} \right) [(1 - 2c)^2 + 16w_a (1 - w_a)] - \frac{3(1 - c)^2}{32} \right\}$, then the first-order-condition reduces to

$[3 + 2c - 4w_a](1 - 2w_a) = 16Z$; which can be simplified to

(A.12) $A_3w_a^2 + B_3w_a + C_3 = 0$

Where $A_3 \equiv 32$; $B_3 = -4(9 + 2c)$; and $C_3 = 8 + 2c - c^2$. We can use the quadratic formula to get the wage, which we denote by $w^{(a)}$. Substituting this value into (A.9) yields $w_b^{(a)}$. 
Case 4: Sequential Bargaining with Firm b Going First

We start by looking at the bargaining between the union and firm a with \( w_b \) fixed. The wage bill is now given by

\[
\theta(w_a|w_b) = (1/3t^2)\{w_a[t(1-2c) - 2w_b] + w_a[t(1 + c)] - 2t^2w_a^2\}
\]

If the union fails to reach an agreement with firm a, firm b becomes a monopolist and the union’s wage bill is \((w_b / 2t^2)[t(l-c) - w_b]\), so, this is the union’s threat point. Thus, \( w_a \) maximizes

\[
\left\{\left(\frac{1}{3t^2}\right)w_a[t(l-2c) - 2w_b] + w_a[t(1 + c)] - 2t^2w_a^2\right\}^{1/2} - \left\{\frac{w_b}{2t^2}[t(l-c) - w_b]\right\}
\]

If we let \( M = \left\{\left(\frac{1}{3t^2}\right)w_a[t(l-2c) - 2w_b] + w_a[t(1 + c)] - 2t^2w_a^2\right\} - \left\{\frac{w_b}{2t^2}[t(l-c) - w_b]\right\} \), then the first-order condition can be written as \([t(l-2w_a + c) + w_a][2w_a + t(l+c) - 4tw_h] = 12t^2M\). If we now substitute for \( M \) and simplifying we obtain

\[
16t^2w_a^2 - 2t[5t(1+c) + 8w_b]w_a + t^2(1+c)^2 + 5t(1+c)w_b + 4w_b^2 = 0
\]

Applying the quadratic formula yields

\[
w_a(w_b) = \left(1/8t\right)[t(l+c) + 4w_b]
\]

We are now ready to look at the bargaining between firm b and the union. Using (A.14) the union’s wage bill as a function of \( w_b \) is given by

\[
\theta(w_b) = \frac{1}{32t^2}\left(t^2(1+c)^2 + 16w_b[t(l-c) - 16w_b^2]\right)
\]

and firm b’s profits are

\[
\pi(w_b) = \left(\frac{t(3-5c)-4w_b}{8t}\right)^2
\]

So, from (A.15) and (A.16), \( w_b \) maximizes

\[
\left[\frac{1}{32t^2}\left(t^2(1+c)^2 + 16w_b[t(l-c) - w_b]\right) - \frac{3}{32}\right]^{1/2} - \left\{\frac{t(3-5c)-4w_b}{8t}\right\}
\]
If we let \( K = \left( \frac{1}{32r^2} \left( t^2(1 + c)^2 + 16w_b [(t(1 - c) - w_b)] - \frac{3}{32} \right) \right) \), then the first order condition reduces to

\[ (t(1 - c) - 2w_b) [t(3 - 5c) - 4w_b] = 16t^2 K. \]

After substituting for \( K \) and simplifying we get

\[(A.17) \quad A_4 w_b^2 + B_4 w_b + C_4 = 0\]

where \( A_4 = 32; \ B_4 = -4t(9 - 11c); \) and \( C_4 = t^2 \{8 - 18c + 9c^2\} \). We can use the quadratic formula to get the wage, which we denote by \( w_b^{r(b)} \). Substitution of this value into (A.14) then yields \( w_a^{r(b)} \).

With the wages determined, (3), (4), (A.1) and (A.2) can be used to determine profits and the wage bill under each of the bargaining mechanisms.

**B. Preference Orderings when the Firms Differ in Non-Labor Costs**

In all cases, we must have \( c \leq .342 \). With this in mind, for the union we have

\[ \theta^{p(a)} \geq \theta^{p(b)} \geq \theta^{s(a)} \geq \theta^{s(b)} \quad \text{if } c \leq .2702 \]

\[ \theta^{p(a)} \geq \theta^{s(a)} \geq \theta^{p(b)} \geq \theta^{s(b)} \quad \text{if } .2702 \leq c \leq .3127 \]

\[ \theta^{p(a)} \geq \theta^{s(a)} \geq \theta^{s(b)} \geq \theta^{p(b)} \quad \text{if } .3127 \leq c \]

Turn next to the firms. We obtain

\[ \Pi^{s(b)} \geq \Pi^{s(a)} \geq \Pi^{p(b)} \geq \Pi^{p(a)} \quad \text{if } c \leq .2052 \]

\[ \Pi^{s(b)} \geq \Pi^{p(b)} \geq \Pi^{s(a)} \geq \Pi^{p(a)} \quad \text{if } .2052 \leq c \leq .2630 \]

\[ \Pi^{p(b)} \geq \Pi^{s(b)} \geq \Pi^{s(a)} \geq \Pi^{p(a)} \quad \text{if } .2630 \leq c \leq .2646 \]

\[ \Pi^{p(b)} \geq \Pi^{s(b)} \geq \Pi^{p(a)} \geq \Pi^{s(a)} \quad \text{if } .2646 \leq c \]

For Consumer Surplus (CS) we have

\[ C_{S}^{s(b)} \geq C_{S}^{s(a)} \geq C_{S}^{p(b)} \geq C_{S}^{p(a)} \quad \text{for all } c \]
References


