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the political underpinnings of coordinated wage
bargaining**

by

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January 13, 2009



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Building Strategic Capacity: the political underpinnings of coordinated wage bargaining

John S. Ahlquist*

January 13, 2009

Abstract

The coordination of wage bargaining has been used to explain everything from inequality to unemployment in rich democracies. Yet there has been little theoretical work and almost no quantitative empirical work exploring the determinants of bargaining coordination. Others hypothesize that centralized bargaining depends on the ability of peak associations to control the strike activities of their affiliates. I argue formally that more unequally distributed resources across unions should inhibit the centralization of strike powers in union federations. Using membership as a proxy for union resources, I find empirical support for this hypothesis in a panel of 15 OECD democracies, 1955-92. I then show that the centralization of strike powers is a strong predictor of coordinated bargaining. I also find that the influence of other variables purported to explain bargaining coordination (trade, country size, party systems fragmentation, government partisanship, and federalism) flow only through their relationships with centralized strike powers.

The centralization of wage bargaining is the linchpin of theories purporting to explain everything from price levels to inequality to unemployment. The degree of coordination between partial monopolists in the labor market is at the core of current theories of political control of the economy and the New Keynesian macroeconomics (Iversen and Soskice, 2006; Soskice, 2000). Where labor unions represent a large portion of the workforce (and therefore

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the electorate), proportional electoral institutions are more common (Boix, 1999; Cusak, Iversen and Soskice, 2007), Left and Social Democratic parties more frequently in government (Korpi, 1983; Western, 1997), social spending greater, and redistribution more profound (Bradley et al., 2003; Lee and Roemer, 2005). The organization of labor interests—filtered through partisan politics and economic institutions like the central bank—has an influence on economic outcomes from wage compression (Wallerstein, 1990, 1999) to unemployment and inflation (Alvarez, Garrett and Lange, 1991; Calmfors and Driffill, 1988; Garrett, 1998; Iversen, 1999; Nickell and Layard, 1999). Rueda (2008) argues that “corporatism” mediates the effects of partisanship on wage dispersion in the bottom half of the income distribution. While the robustness and magnitude of these relationships as well as the directionality of causation are contested (Flanagan, 1999; Golden and Londregan, 2006), there is broad consensus on the negative relationship between union centralization and wage dispersion. More coordinated bargaining is strongly associated with greater wage and disposable income equality.¹

Given the importance of union coordination, there has been little theoretical work accounting for the variation in labor movements’ institutionalized coordination. None of the existing thinking on union coordination takes seriously the internal politics of union federations as they relate not just to coordinated bargaining but to large scale cooperative union activities more generally. This lack of theoretical progress runs counter to the strong current of endogenous institutions that has been pushing theoretical innovation in political economy over the last decade and a half.

There is shockingly little quantitative empirical work examining the underpinnings of bargaining coordination and union organizational structure. The empirical literature to date has primarily relied on case studies of a handful of northern European nations, most

¹Scheve and Stasavage (2007) challenge to the centralized bargaining-inequality relationship using data for top income shares.

commonly Denmark, Germany, and Sweden.² Rigorous historiography has generated important insights into the role of employers and the dynamics of institutional change (Iversen, 1996; Swenson, 1991; Thelen, 1993, 2004), but these insights have not been examined in a broader spatial-temporal context. Golden, Wallerstein and Lange (2002) and Traxler, Kittel and Blaschke (2001) have invested terrific effort in providing broadly comparable time series data on unions, employers, and government involvement in wage bargaining and economic management for the major OECD economies leading to important work describing the variation in union centralization and bargaining coordination (Ebbinghaus and Visser, 2000; Golden, Wallerstein and Lange, 1999; Traxler, Kittel and Blaschke, 2001; Wallerstein, Golden and Lange, 1997). Kenworthy (2001, 2003) offer surveys of the many datasets floating around purporting to offer empirical measures “corporatism”, bargaining centralization, union structure, and associated concepts. Nevertheless, these measures of centralization and coordination almost always appear on the right hand side of regression equations³. To my knowledge, the only places where something akin to union centralization or wage bargaining coordination have been analyzed in any depth are Marks (1986), Western (1997) and Wallerstein and Western (2000). The first presents only rank correlations while the other two use union and employer centralization to explain the level of wage bargaining (firm-level, industry, or economy-wide). They find that the where employers are more centralized so is wage bargaining while concentration of members in a relatively small number of unions negatively affects the level of wage bargaining.⁴

With union membership coming under pressure in a number of countries and employer

²There is, of course, a large literature examining American “exceptionalism” in labor issues. See Kimeldorf and Stepan-Norris (1992); ? for reviews.

³e.g., Alvarez, Garrett and Lange (1991); Bradley et al. (2003); Garrett (1998); Iversen (1999); Nickell and Layard (1999); Rueda (2008); Traxler (2003); Wallerstein (1999)

⁴The Wallerstein and Western (2000) findings can be criticized on several grounds. First, bargaining coordination rather than level is generally held to be more important, as Wallerstein and Western recognize; I analyze an index of coordination. Second, they do not account for the authority of union peak associations, a central concern of this paper. Third, their measure of concentration is difficult to interpret when the number of affiliates varies over time and across countries.

coordination playing an increasingly important role in theories of economic management (Hall and Soskice, 2001), scholarly attention has shifted away from labor to firms. There has been important recent work examining employer coordination (Mares, 2003; Martin and Swank, 2004, 2008). In all these works, political institutions, especially electoral institutions and federalism are important. The findings here complement this line of inquiry but I seek to refocus attention on the political relations among economic actors and highlight the importance of labor union coordination.

This paper addresses both the theoretical and empirical shortcomings. Taking a cue from the fiscal federalism literature, I provide a theoretical model of confederal organizations focusing on the conditions under which affiliates will cede resources and authority to the confederation. To briefly summarize the results, given some set of unions and some activity over which they can combine resources for mutual gain, there generally exists some subset that will be willing to work together. The size of this subset and the amount affiliates contribute to the cooperative enterprise depends on the returns to cooperation, the heterogeneity of endowments, and the manner in which they take their decision, i.e., the identity of the pivotal voter. Unions better able to achieve their goals on their own are the most difficult to entice into the cooperative arrangement. To induce these more productive agents to contribute to the cooperative project, the group will need to allocate decision rights such that these more powerful agents have a disproportionate influence over group decision-making. The model predicts that where unions vary widely in their resources, confederations will be weaker and/or more unions will remain outside the confederal organization.

In evaluating (some) of the model's predictions, I operationalize union resources with membership levels. Using a panel of 15 OECD countries, 1955-92, I find that centralized control over strike funds is less likely where membership is more unequally distributed across affiliated unions once we account for other plausible relationships. I then follow Wallerstein and Western (2000) and evaluate the importance of centralized union federations in under-

pinning coordinated wage bargaining. I find that countries with more powerful union and employer federations are, in turn, more likely to have more highly coordinated wage bargaining. Furthermore, I show that variables others claim affect bargaining levels only influence coordinated wage bargaining via their relationships with union centralization. Once the degree of centralized union strike powers are accounted for, these other variables show no discernable independent relationship with bargaining coordination.

The findings imply that industrial structure and laws governing union recognition play a strong role in laying the foundation for more or less powerful union federations. While I apply the theoretical model to confederations of labor unions, the theoretical logic can be extended to any situation where the incentives for heterogenous agents to collaborate live in the shadow of potential distributive conflict. The model's heritage in the fiscal federalism literature belies its relevance for nation-states and international organizations like the EU. Less obvious applications could include not just employer federations, but political parties, sports leagues, or religious denominations.

The next section briefly reviews work on the origins of centralized wage bargaining. Section 2 presents the basic theoretical model. Readers preferring a non-technical discussion of the model should skip directly to 2.1. Section 3 presents empirical findings and section 4 summarizes and concludes with observations about future research directions. I collect proofs and details about the data in the appendices.

1 Centralization of labor movements & the coordination of wage bargaining

1.1 Theoretical traditions

Nowhere is the organizational structure of federations of labor unions of more explicit importance than in models of wage/price bargaining and political control of the macroeconomy. Building on arguments about encompassing groups (Olson, 1971, 1982), the well-developed literature on the *consequences* of bargaining centralization attempts to link the ability of unions and employers to coordinate wage bargaining at the national level with unemployment and inflation outcomes (Adolph, 2006; Alvarez, Garrett and Lange, 1991; Calmfors and Driffill, 1988; Cameron, 1984; Franzese, 2001; Iversen, 1999; Lange, 1984; Lehmbruch, 1979; Schmitter, 1979). The argument goes more-or-less as follows: In densely unionized economies, unions in aggregate can affect the evolution of nominal wages economywide. In making its wage settlements with employers, each union considers the unemployment costs of its wage demands on its members, disregarding the spillovers that its wage-employment settlement might have for other workers in other unions.⁵ Furthermore, since each union's wage demands affect producer and, ultimately, consumer prices, nominal wage gains will be inflated away, yielding unchanged real wages but imposing higher inflation and unemployment. Centralization, it is argued, will generate the "public good" of wage restraint, with the attendant benefits of low unemployment and inflation with the same (average) real wages as under decentralized bargaining.⁶

Real wage restraint in centralized bargaining often focuses on the highest-wage unions

⁵These spillovers could take the form of higher product prices in the first unions' industry, reducing the purchasing power of other unions (Calmfors and Driffill, 1988), general price inflation (Iversen, 1999), or unemployment insurance costs borne by those outside the given union's bargaining area.

⁶Note that this argument linking wage bargaining and economic outcomes has been expanded to include an important role for the monetary authority. See Adolph (2006); Franzese (2001); Iversen (1999).

through an explicit policy of “solidaristic bargaining.” Even in the absence of official solidaristic bargaining stance, however, centralized bargaining generates a distributive tension. Specifically, centralized bargaining flattens the wage distribution, both by increasing wages for those at the bottom and restraining wage growth for those at the top (Wallerstein, 1990, 1999).⁷ This then poses a puzzle: what induces high-wage workers to go along with a centralized arrangement in the first place?

Early attempts to answer the question viewed centralized bargaining as a standard collective action problem (Cameron, 1984; Lange, 1984; Olson, 1982). To overcome this problem, the neo-corporatist literature of the 1970-80s claims argued that centralized unions must be compulsory and union leaders must be “insulated” from rank-and-file wage demands. In this traditional view of the labor peak associations (at least in highly unionized economies), the role of the federation is explicitly antidemocratic in the sense that leaders are meant to be a conservatizing influence on the presumably more radical, strike-prone rank-and-file.⁸

Nevertheless, few countries, even among the most centralized, have mandatory union membership; government-granted bargaining monopolies only exist in a handful of cases. Noting this, current theories of wage bargaining have looked away from the state-imposed arrangements explicitly or implicitly driving the earlier arguments. In a fascinating paper, Agell and Lommerud (1992) argue that wage compression might actually provide a justification for centralized bargaining. They provide a model in which centralized wage bargaining provides income insurance to workers who are *ex ante* uncertain as to whether they will be “skilled” or “unskilled” once the labor market opens under the (very plausible) assumption that insurance markets for human capital are missing. This model, however, fails to account for all but the most extreme levels of union coordination. Freeman and Gibbons (1995)

⁷The mechanism inducing this is frequently a wage bargaining posture that demands nominal (rather than percentage) wage increases for all workers. These nominal gains are a bigger percentage wage increase for lower wage workers.

⁸But see Baccaro (2000) for a re-evaluation of this thesis in the Italian case.

provide a different model of centralized bargaining. They rely on informational asymmetries between local bargaining agents and the central confederations to highlight the reasons for wage drift and the restrictions on lower-level bargaining that may cause centralized bargaining to break down. When the bargaining groups become more heterogeneous or the value of wage restraint declines, centralized bargaining becomes less likely. Separately, other theorists have relied on the active support—indeed, insistence via coordinated lockouts—of employers in the tradeables sector (Iversen, 1999; Katzenstein, 1985; Swenson, 1989, 1991; Wallerstein, 1985). These authors argue that export-oriented employers cannot pass along increased wage costs to consumers; they support centralized bargaining so as to rein in the wage demands of workers in the non-tradable sectors. But this just kicks the can a little further down the road; it begs the question of why employers were able to coordinate. What’s more, the employers’ lock out weapon was so potent in Sweden and Denmark because the union federations had already acquired an obligation to support locked out affiliates by raising or dipping into their central strike funds. The AFL-CIO, in contrast, has never been able to develop a strike fund.

In general, then, there has been relatively little work attempting to explain how unions might (endogenously) develop the capacity to coordinate and make strategic group decisions. That said, there are several insights I take from prior work. First, even if there exists some mechanism to solve the free rider problem, the distributional conflict between unions can be even more serious. Second, information and uncertainty can provide a fundamental justification for the existence of a multi-tiered organization. Third, the role of external actors like employers and governments can affect the willingness and/or ability of union federations to centralize decisions in certain policy domains.

2 The basic model

I look to insights from contract economics and, more specifically, the fiscal federalism literature to gain theoretical traction. Authors in this literature have developed several models attempting to explain the existence, allocations of authority, policy outcomes, and welfare implications of federally organized states. The model I propose here is similar to that analyzed by Alesina, Angeloni and Etro (2005) and Hafer and Landa (2007).

There is a set of N agents-independent unions in this application. Each union i has a fixed endowment, $r_i \geq 1$, that it can allocate to two different tasks. The first generates purely local returns whereas the second has positive returns to scale, i.e., there are spillovers across unions and possible gains from cooperation.⁹ I refer to the first activity as the *local activity* and the second as the *confederal activity*. Cooperative union activities can include sympathy strikes, boycotts, political lobbying, organizing drives, get-out-the-vote campaigns, and coordinated wage bargaining.

Unions can join a confederation in which their contributions to the confederal activity are pooled; I refer to these unions as *affiliates*. Those remaining outside the confederation do not receive any of the scale benefits of group production.¹⁰ Each union's utility is given by¹¹

$$u_i = (1 - t_i)r_i + \gamma \log\left(\sum_{i \in C} r_i t_i\right) \quad (1)$$

⁹I assume spillovers to be positive. Results are easily extended to incorporate negative spillovers from the actions of other unions. While the case of negative spillovers might better resemble the wage bargaining problem, for simplicity I speak of all spillovers as if they were positive.

¹⁰On its face this assumption may seem extreme and counter to the notion of spillovers, but allowing all contributions to the confederal activity to spill over to all unions only serves to weaken the incentive to join a federation, especially for those with a lower relative valuation on the confederal good—the best endowed unions. The interpretation of the major propositions is therefore unchanged. From an applied perspective, the outputs of some confederal activities (e.g., coordination in organizing workers) are clearly excludable. Others like political lobbying might have benefits that spill over outside the federation but outsiders are excluded from formulating the actual policy demanded or implemented. I retain this assumption here to draw a brighter line between those in the confederation and those outside.

¹¹The separable preferences and logarithmic confederal production function make exposition simpler but are not strictly necessary. Alesina, Angeloni and Etro (2005) and Hafer and Landa (2007) work with more general versions of a similar model and derive similar results.

where $t_i \in [0, 1]$ is i 's allocation to the confederal activity and γ is a known productivity¹² factor and C denotes the set of unions (along with i) in the confederation C . We can interpret γ as summarizing how valuable or productive confederal cooperation is.

The basic game is played as follows:

1. Each union decides if it wants to affiliate with a confederation.
2. Affiliated unions then decide on the common contribution level, i.e., $t_i = t \quad \forall \quad i \in C$, according to some decision rule.¹³ For the moment, the decision rule is taken to be exogenous.
3. Contributions are made and outcomes realized.

To focus on the distributive tension engendered by this set up, I assume that decisions on the common contribution level for affiliates are binding and enforceable, i.e., there is no collective action problem. The set up here is similar to an N -player Stag Hunt game with endogenously determined N .

I begin by defining each union's outside option. On its own, each union picks t_i to maximize (1). The first-order condition necessary and sufficient for a maximum defines the union's optimal t_i as

$$t_i^* \equiv \min \left(1, \frac{\gamma}{r_i} \right) \quad (2)$$

It is clear that t_i^* is (weakly) increasing in γ and (weakly) decreasing in r_i , implying that, for fixed C , 1) unions' preferences are single-peaked around t_i^* and 2) unions can be ordered

¹²Or, alternatively, a commonly held valuation for confederally-produced goods relative to locally produced ones. Elsewhere (Ahlquist, 2008) I relax the assumption of known γ to provide a justification for an ongoing confederal organization as opposed to simply a static contract.

¹³A confederation of this sort is "rigid" in the language of Alesina, Angeloni and Etro (2005). The welfare benefits of relaxing this rule by, e.g., having the confederation set some minimum contribution to the group effort and allowing unions to allocate more to public goods provision if they prefer to do so (mandates), is the subject of several papers (Alesina, Angeloni and Etro, 2005; Cremer and Palfrey, 2000; Hafer and Landa, 2007; Lulfesmann, 2002).

by r_i . This, in turn, implies that the median voter theorem holds for voting games over common t . Substituting t_i^* an agent's utility for remaining outside the federation is

$$u_i^{out} = u_i(t_i^* | i \notin C) = \begin{cases} r_i + \gamma(-1 + \log \gamma), & \gamma < r_i \\ \gamma \log r_i, & \gamma \geq r_i \end{cases}$$

It will also be useful to define the total endowment of unions affiliated to a confederation with membership C as

$$\bar{r}_C \equiv \sum_{j \in C} r_j$$

The game will be solved by backward induction. Since unions can be ordered by r_i we can define the α -*decision rule* to be one in which the α th quantile of the affiliates is the pivotal voter; if $\alpha = 0.5$ then the median affiliate is decisive.¹⁴ At the voting stage, affiliates vote for their most-preferred t . Let t_α denote the winning t under decision rule α and let C_α be the confederation with decision rule α .

Define the utility of an affiliate to confederation C_α as

$$u_i^{in} = u_i(t_\alpha | i \in C_\alpha) = (1 - t_\alpha)r_i + \gamma \log(t_\alpha \bar{r}_{C_\alpha})$$

Thus an agent's net utility of joining a C_α confederation is $\Delta u_i = u_i^{in} - u_i^{out}$. More precisely,

¹⁴Different values of α might be achieved by assigning voting weights to affiliates. Note that it *cannot* be achieved by simply requiring a coalition of size α to decide on a value of t ; all a supermajority requirement will do is bias the confederal decisions toward the status quo, but any policy in $[(2t_m - t_\alpha), t_\alpha]$, where t_m is the median affiliates' t_i^* , is in the core.

letting r_α be the affiliate such that $\text{quantile}(r_i) = \alpha$

$$\Delta u_i(C, t, \alpha, \gamma \mid r_\alpha > \gamma) = \begin{cases} (1 - t_\alpha)r_i + \gamma \log \frac{t_\alpha \bar{r}_{C_\alpha}}{r_i} & \gamma \geq r_i \\ -t_\alpha r_i + \gamma \left[\left(\log \frac{t_\alpha \bar{r}_{C_\alpha}}{\gamma} \right) + 1 \right] & \gamma < r_i \end{cases} \quad (3)$$

$$\Delta u_i(C, t, \alpha, \gamma \mid r_\alpha \leq \gamma) = \begin{cases} \gamma \log \frac{\bar{r}_{C_\alpha}}{r_i} & \gamma \geq r_i \\ -r_i + \gamma \left[\left(\log \frac{\bar{r}_{C_\alpha}}{\gamma} \right) + 1 \right] & \gamma < r_i \end{cases} \quad (4)$$

Lemmata 1 and 2 follow directly from the comparative statics of Δu_i :

Lemma 1 *If $r_\alpha, r_i > \gamma$ and $r_i/r_\alpha > 1 + \log \bar{r}_{C_\alpha} - \log r_\alpha$ then Δu_i is decreasing in γ . Otherwise Δu_i is weakly increasing in γ .*

Proof: see appendix A.

Intuition would suggest that as the returns to the confederal activity increase cooperation would automatically be more likely. Lemma 1 shows that this is not necessarily the case. If difference between an agent's endowment and that of the decisive affiliate is bigger than the difference between the mean and decisive member's endowment, the attractiveness of the confederation is actually *declining* in the productivity of the confederal activity. Put another way, if, for fixed α , an agent (potentially) looms large in confederal production, the likelihood that this richest union will cooperate with the poorest declines as the confederal activity becomes more productive. The intuition here is reminiscent of the logic behind the Meltzer and Richard (1981) inequality and redistribution result. If the median affiliate is pivotal, i.e., $\alpha = 0.5$, then the RHS of the antecedent is the (log) difference between the mean and median endowments. As γ increases (up to the point where $\gamma = r_\alpha$), the relatively poor affiliates want to "tax" more heavily for confederal activity. But the rich union is so big relative to the poorer ones that their contributions matter little to it and the rich union is less inclined to find affiliation profitable.

Lemma 2 For fixed γ and assuming an instantaneous change in r_i does not change the identity of the decisive affiliate, if $\gamma \leq \bar{r}_{C_\alpha}$ then Δu_i is weakly decreasing in r_i for all i .

Proof: see appendix A.

In words, the profitability of being an affiliate of a fixed confederation decreases the bigger the endowment, holding all other endowments fixed. An increase in an agent's endowment has two effects. It increases the amount of overall resources devoted to the confederal activity but it also increases that union's relative contribution. This lemma says that the latter effect outweighs the former. Only when the returns to confederal activity are very high does net utility increase in the endowment.

Unions will join C_α iff $\Delta u_i \geq 0$. If $\gamma < r_\alpha$, then we can substitute γ/r_α for t_α , yielding the following condition:

$$\frac{r_i}{r_\alpha} \leq 1 + \log \frac{\bar{r}_{C_\alpha}}{r_\alpha} \quad (5)$$

Whereas if $\gamma \geq r_\alpha$ then we substitute 1 for t_α and get

$$r_i \leq \gamma \left[1 + \log \frac{\bar{r}_{C_\alpha}}{\gamma} \right] \quad (6)$$

Note that both conditions always hold for all i such that $r_i \leq r_\alpha$. This follows directly from the insights of lemma 2: all unions with endowments smaller than the decisive affiliate's endowment will find joining the confederation increasingly attractive, once again reinforcing the redistributive aspect of confederal organization.

Define an *equilibrium confederation under decision rule α* as one in which 1) $\Delta u_i \geq 0 \forall i \in C_\alpha$ and 2) $\Delta u_i < 0 \forall i \notin C_\alpha$. We can also say that unions i and j have *weakly contiguous endowments* and hence *weakly contiguous preferences* if either 1) $r_i = r_j$ or 2) $r_i \leq r_j$ and \nexists an agent k such that $r_i \leq r_k \leq r_j$. I can now state the following proposition:

Proposition 1 For fixed α, γ there exists a unique equilibrium confederation composed of

affiliates with contiguous preferences. The size of the confederation is weakly increasing in γ .

Proof: see appendix A.

Corollary 1 *If $\gamma > r_{max}$ then all unions belong to the confederation and allocate all resources to the confederal activity.*

There are two immediate implications. First, as the returns to the confederal activity increase (decrease), the size of the federation will increase (decrease). Combining proposition 1 with lemma 2 we have a second substantive claim: the more an agent's endowment exceeds that of the pivotal union, the less "likely" that richer union will find it in its interest to join the confederation. Put differently, the more skewed the distribution of endowments, the less likely the best endowed or most productive unions will join a confederation. By submitting to the collective choice procedure inherent in a confederation, the weaker affiliates borrow strength from the stronger. If these differences in endowments are sufficiently large, the weaker unions will demand a contribution by the stronger beyond what the stronger finds profitable. The strongest unions foresee this and will refuse to join.

Whenever the equilibrium confederation falls short of full integration there is a tension between the t_α and the fact that the poorer affiliates would generally prefer that the better endowed unions outside the confederation join. Those remaining outside the federation see t_α as too high a price to pay. Is there some lower contribution rate that would make confederal membership worthwhile for an agent outside the federation while not making any of the current members worse off? Formally, for some $i \in N$, $\Delta u_i(t_\alpha; C) < 0$, but $\Delta u_i(t_{\alpha'}; C) \geq 0$ for some $t_{\alpha'} < t_\alpha$ where C is the confederation including i . It must also be the case that for all $j \in C_{-i}$, $u_j(t_{\alpha'}; C) \geq u_j(t_\alpha; C_{-i})$, where C_{-i} is the confederation excluding i .

Proposition 2 *Assuming $\gamma < r_{max}$, given some i such that $\Delta u_i(t_\alpha; C) < 0$ then there exists some $\alpha' > \alpha$ such that $\Delta u_i(t_{\alpha'}; C) \geq 0$ and $u_j(t_{\alpha'}; C) \geq u_j(t_\alpha; C_{-i}) \quad \forall j \in C_{-i}$ if and only if the following condition holds:*

$$r_j(\bar{t}_{\alpha'} - t_\alpha) \geq \gamma \left(\log \frac{\bar{r}_{C_{-i}}}{r_C} - \log \frac{t_\alpha}{\bar{t}_{\alpha'}} \right) \quad \forall j \in C_{-i} \quad (7)$$

where $\bar{t}_{\alpha'}$ solves $t_{\alpha'} r_i = \gamma(1 + \log t_{\alpha'} \bar{r}_C / \gamma)$.

Proof: see appendix A.

Condition 7 describes the rationality constraint for those already in the confederation. If it were not met then even if i were made exactly indifferent between joining and not ($t_\alpha - t_{\alpha'}$ is as small as possible), j would still be better off in the α -rule confederation without i . The inequality of endowments and the relative returns to the confederal activity describe the extent to which these conditions are met for different i .

To make this easier to see, table 1 presents a numerical example. In column 1 we have the set of unions ($|N| = 3$) indexed by their endowments, r_i . Column 2 displays the value of γ . Column 3 presents each union's net payoffs for being in the grand confederation where the median affiliate sets t and column 4 presents the same information when $t = \bar{t}_{\alpha'}$, i.e., when t is set so that the best endowed union is just indifferent between joining and not. Column 5 displays unions 1 and 2's net payoffs to being in the grand confederation where $t = \bar{t}_{\alpha'}$ compared to a confederation by themselves with t set by the median. In row 1, union 3 will not join a confederation made up of all three unions when union 2 sets t . It is possible, however, for unions 1 and 2 to offer a $t_{\alpha'}$ that makes union 3 indifferent about joining. Unions 1 and 2 benefit from this arrangement relative to what they could achieve in a confederation without union 3. The situation described in row 2 is different. Even if union 3's maximum acceptable contribution level is set, union 1 is still better off

Table 1: Numerical simulation exploring when it is possible for weaker unions to induce stronger unions to join a confederation by letting the stronger determine confederal contribution levels.

N	γ	$\Delta u_i(t_m)$	$\Delta u_i(\bar{t}_{\alpha'})$	1 & 2's gain
{1, 2, 9}	1.5	{3.0, 2.5, -0.6}	{2.7, 2.3, 0.0}	{1.1, 1.7}
{1, 5, 40}	1.0	{3.0, 2.2, -4.8}	{1.6, 1.4, 0.0}	{-0.1, 2.1}

in the confederation with just union 2.¹⁵ The difference between unions 1 and 3's preferred confederal contributions is so large that no mutually acceptable t exists that would induce union 3 to join while making union 1 at least as well off as it is with just union 2. What's more, a confederation of unions 2 and 3 (not shown), with t set as the average between the two's t^* s would be unacceptable to union 2; union 2 could do better in the confederation with union 1. Only when the confederal contribution level is biased toward union 2's preferred t will it join into confederation of unions 2 and 3.¹⁶

2.1 Summary and implications

In the model, unions are heterogeneous in the amount of resources they control. All, however, can benefit from cooperating with one another on some projects. Tension arises because the amount each union wants to contribute to the cooperative enterprise depends negatively on the union's resources; because of spillovers to some activities (like organizing, political contributions, or wage bargaining), weaker unions prefer higher contribution levels and stronger unions prefer less. The greater the difference between the preferred contribution of the pivotal affiliate and that of the strongest unions the more this tension complicates interunion

¹⁵Note that this example points to the possibility that if admittance to the confederation were determined by majority vote then union 3 would not gain admittance. Alesina, Angeloni and Etro (2005) addresses this exact situation. They prove that only other unions with preferences close to the median affiliate will be admitted under majority rule.

¹⁶Also note that such a confederation would be attractive to union 1. While union 1 prefers the confederation of just 1 and 2 to the one including 3, it prefers the one with all three to being on its own.

cooperation and the less likely we are to observe confederations engaging in highly redistributive activities on a large scale. Propositions 1 shows that even in the absence of collective action problems, there is no guarantee that all unions will join together for cooperative activity. Distributional concerns can get in the way to such a degree that confederal cooperation is difficult and negotiation costs potentially high. Furthermore, when some unions do not affiliate with the confederation, it is the best endowed ones that remain alone. This has implications for the strategic capacity of “bottom up” federations. Where unions are unable to coalesce into one federation, it is likely that the most powerful ones will be the ones standing alone. Proposition 2 highlights the importance of the internal decision process in determining which unions will be part of the confederation and the extent of resource centralization. Whether a confederation can include all its potential members is largely driven by how internal organizational rules determine the pivotal affiliate. Where union resources are more unequally distributed, there is an increasingly stark trade off between choosing a high level of contributions to the confederation (centralization) and a governance structure that induces the best-endowed unions to affiliate in the first place.¹⁷

If we assume membership to be the fundamental union resource¹⁸, i.e., r_i represents i 's membership, then where unionists are more unequally distributed across unions it will be more difficult to entice the most powerful unions to join the confederation. If they do it is unlikely that highly redistributive powers will be ceded to the central organization. A centralized control of strikes is possibly the most redistributive of confederal activities. Arguably the key function of a union is collective bargaining. A union's bargaining power is driven by its ability to effectively impose costs on employers, ultimately through strikes. Confederal-level strike powers can prevent unions capable of winning more immediate concessions on

¹⁷This implication is investigated more fully in Ahlquist (2008:ch. 2-3)

¹⁸While membership is not a perfect proxy for union strength, it is the only one for which reliable data is available. From an empirical standpoint, inequality in mean income across unions clearly cannot be used to measure of union resources since it is a function of the degree of wage bargaining coordination.

their own from doing so, usually in the name of price stability. Possessing centralized strike funds makes the confederation's strike veto power more meaningful, raises the costs of confederal secession for any one union, and gives the federal leadership leverage over affiliates that is most effective precisely when affiliates are most vulnerable. Smaller unions are correspondingly able to engage in more aggressive bargaining than they otherwise would be able to on their own. Yielding strike powers to a confederal organization is a key extension of the confederation's scope of activity. The core empirical hypothesis is that more a more unequal distribution of unionists across affiliated unions will decrease the likelihood that the union confederation controls strike funds.

The model does not directly address centralized bargaining, only the extent to which an equilibrium federation will engage in activities that redistribute resources across affiliates. Centralized bargaining depends on other factors, most obviously the existence of a counterpart. Nevertheless, whether emphasizing unions (Lange, 1984; Olson, 1982; Schmitter, 1979; Windmuller, 1975) or employers (Swenson, 1989, 1991; Wallerstein and Western, 2000), it has long been held that centralized bargaining depends on the ability of peak associations to enforce discipline on their affiliates (i.e., there is a collective action problem). By initially ignoring issues of collective action, the model demonstrates that distributional concerns affect the extent to which confederal organizations will have the capacity to subsequently solve free rider problems. The centralization of union strike funds should, by all accounts improve the prospects for more coordinated wage bargaining.

3 Empirical analysis

The empirical analysis will proceed in two steps. First I examine the determinants of centralized strike powers; the dependent variable is the Golden-Wallerstein-Lange indicator of whether a country's largest union federation controls strike fund. I then turn to the coor-

dination of wage bargaining. Many have argued that peak association control over strike activity is key to centralized bargaining, but this assertion has not been established empirically. I evaluate the extent to which central control over strike funds is important to the coordination of wage bargaining once we account for other political/institutional and structural factors. The outcome variable is the Kenworthy scale of wage bargaining coordination (Kenworthy, 2001).

3.1 Data

I have pieced together an (unbalanced) panel time series of annual observations covering 1955-1992 for 15 OECD countries: Australia, Austria, Belgium, Canada, Denmark, Finland, Germany, Italy, Japan, the Netherlands, Norway, Sweden, Switzerland, UK, and the USA. Data definitions and sources are collected in appendix B. I draw heavily on the dataset constructed by Golden, Wallerstein and Lange (2002), henceforth GWL. A key feature of these data, particularly the indicator variables for whether unions and employer federations have centralized decision making over strikes and lockouts, is that cross-country variation swamps within-country fluctuations over time. This will present some computational and modeling issues discussed at length below. Furthermore, some of the variables used here are measured only intermittently, typically at five-year intervals. To maximize the number of country-years available, I linearly interpolate the intervening years but do not extrapolate past a country's last observed value¹⁹ or before its first. While the low levels of temporal variation suggests that extrapolation may not be such a problem here, the economic structure and wage bargaining institutions of several rich democracies under went significant changes through the 1990s, so I restrict analysis to the period for which the data were originally gathered. Most of the missingness in these data are for variables pertaining to union federations and wage

¹⁹typically 1992 for union federation variables

bargaining and are generally missing for entire countries.²⁰ Since cross-sectional variation dominates the temporal, I do not impute missing values (either country means or multiple imputation). I am more comfortable excluding these cases rather than attempt an heroic imputation exercise.

From a theoretical standpoint, the key covariate is the degree of inequality of union membership across unions affiliated to the largest union confederation. Ideally a measure of skewness is most congruent with the theoretical argument. Unfortunately, cross-nationally comparable union-level membership data do not currently exist, preventing recovery of the higher moments of the union membership distributions. Nevertheless, the GWL dataset reports the number of affiliated unions in the largest confederation and the Herfindahl index of member concentration in those confederations.²¹ Neither of these measures alone captures inequality (Davies, 1979, 1980). A completely equal distribution of membership would give a Herfindahl value of $1/a$, where a is the number of affiliated unions, telling us nothing about inequality when the number of affiliates varies across countries and over time, as it does here. If we are willing to assume that union members are distributed log-normally across unions, Hart (1975) shows that $H = a^{-1} \exp \eta^2$, where H is the Herfindahl index of membership concentration and η^2 is the variance in log membership. Given H and a from the GWL dataset we can calculate η^2 . I use η^2 to measure membership inequality.

The literature also suggests that other covariates should be included. On the union side, centralized bargaining is argued to be more important the greater the role of unions in setting wages. For this reason, I include union density as a covariate. A larger number of confederations may also be related to whether the largest federation controls strike funds, so I include the total number of union confederations. As already noted, several scholars argue that both union centralization and more coordinated wage bargaining are a function more

²⁰i.e., Ireland, New Zealand, Portugal, and Spain

²¹A Herfindahl index is given by $\sum_i s_i^2$ where s_i is the share of total confederal membership belonging to the i th affiliate.

coordinated employers. To measure employer coordination I use the predicted probability that the employer federation has authority to veto affiliates wage agreements, as derived from a GEE logit (not reported here) with (log) population, trade, Left government, and the effective number of political parties as predictors. I use the predicted probability rather than GWL's actual dummy variable to avoid problems of perfect separation between the dummy variable and the outcomes of interest, a computational problem discussed further below.

Several structural covariates may play a role. As mentioned above, current theories of coordinated wage bargaining argue that countries more exposed to international markets via trade are more likely to have centralized bargaining. While these theories make no direct claim about centralized strike powers, if we believe that centralized strike powers affect bargaining coordination which, in turn, is more valuable in open economies²², then trade exposure could reasonably be believed to affect the likelihood that union federations control central strike funds as well. I include (imports + exports)/GDP in both sets of regressions. Bigger countries are generally more complex, economically diversified, and less reliant on trade. Several arguments have been proffered linking country size and the organization of labor unions. Scholars focusing on the United States have argued that the weak and decentralized character of American unions is due in part to the country's geographic size (Commons, 1926*a,b*; Laslett and Lipset, 1974; Ulman, 1955). Martin and Swank (2008) find that geographically larger countries are less likely to have highly coordinated employers. Wallerstein (1989) argues theoretically and finds empirically that economies with bigger labor forces will be less unionized. I therefore include (log) population as a measure of size, with the expectation that it is associated with lower probability of central strike funds and less coordinated wage bargaining.²³

There are several conflicting arguments linking union peak associations and political par-

²²i.e., in terms of the model, trade exposure could be one determinant of γ , the value of cross-union cooperation.

²³Findings are unchanged if I include log square kilometers of area in place of or in addition to population.

ties. Left parties have their electoral fortunes bound more tightly to the ability of the labor movement to coordinate in both their political *and* economic (i.e., wage bargaining) behavior than those of the center or Right. Where unions can coordinate effectively, Left parties are more likely to hold office and when the Left is more frequently in office, they have both the incentive and ability to use the spoils of office to induce further union centralization. Headey (1970) argues explicitly that frequent Socialist government is required to sustain the confederal authority of union organizations and concomitant incomes policies. Similarly Hartmann and Lau (1980:370) argue that “confederations seem to be ‘sponsored’ by their environment: employers, political parties, and the government lend their support to confederate status by treating confederations as quasi-autonomous and cooperating parties.” Ahlquist (under review) finds that government-union policy pacts are more common when the Left is in power. Korpi (1983) and others following in the power resources tradition claim that causality works the other way around: strong, centralized union movements produced frequent Left governments. Empirically speaking, there is evidence of both occurring: unions founding political parties and parties founding affiliated union organizations (Ebbinghaus and Visser, 2000). I include the proportion of government-controlled seats in the lower house held by parties of the Left to account for this relationship. I expect this variable to show a positive relationship with confederal strike funds.

The role of electoral institutions is less clear. On the one side, more proportional electoral institutions are strongly associated with more frequent Left party governance (Cox, 1997; Cusak, Iversen and Soskice, 2007; Sartori, 1976). Martin and Swank (2008) focus on the role of electoral institutions in engendering coordination among employers, finding coordination increasing in the proportionality of the electoral system. A fragmented party system may also result in less union coordination. Some point to fragmented party systems as explaining the existence of multiple, party-aligned confederations as seen in Italy, Spain, and Portugal (Headey, 1970; Marks, 1989). I will include the (log) effective number of political parties

to measure partisan fragmentation understanding that making statements about causal effects of partisanship and partisan fragmentation will be further hampered by the known endogeneity between the two.²⁴

Separate from the wage bargaining literature, there is a venerable series of arguments from political science and sociology that explicitly link the organization of interest groups and other “voluntary associations” with political institutions, specifically the centralization or dispersion of political authority. The existence of multiple venues in which interest groups can make policy demands—state and national legislatures as well as courts and the administrative bureaucracy at both the national and state levels—impedes the development of centralized interest group organizations. With a decentralized political system, there are strong reasons to maintain a decentralized confederal structure for interest groups (Skocpol, Ganz and Munson, 2000; Wilson, 1973). I therefore include an indicator for federalism on the expectation that it takes a negative regression coefficient.

The argument that linguistic, racial, and religious cleavages impede the organization of a unified working class is at least as old as Marx. There are those who trace union fragmentation back to primordial cleavages of religion and language or the historical development of social democratic parties (Agell, 2002; Ebbinghaus and Visser, 2000). There is some direct evidence of this: in the Netherlands and Italy, union federations split along confessional lines. Scholars of the American labor movement have looked to racial divisions and immigration to explain its weakness and fragmentation (Commons, 1926*a*; Laslett and Lipset, 1974; Mink, 1986). I use Fearon’s measure of cultural fractionalization (Fearon, 2003) to account for this hypothesis. I expect cultural fractionalization to impede confederal centralization and coordinated bargaining.

²⁴Including these variables separately or excluding them all together does not alter the fundamental findings of the paper, i.e., the relationship between membership inequality, the centralization of strike funds, and bargaining coordination

3.2 Modeling framework

In political science, the now-standard approach to modeling TSCS data is OLS regression with either a lagged response variable or autoregressive error correction to account for temporal dependence along with so-called “panel corrected standard errors” (Beck and Katz, 1995), to deal with concerns about unit-based heteroscedasticity. The OLS-PCSE approach has not been extended to accommodate discrete response data. A complete solution to the challenges of TSCS data would be to specify a fully hierarchical model, accounting for unit-specific variation and spatio-temporal dependence. Unfortunately, these data create significant computational problems in this regard. Though the data contain repeated measures for each country along several dimensions, the within-country, over-time variation is negligible relative to the cross-country variation. What’s more, for some covariates there is perfect separation; there is no country-year in which the union federation controls a strike fund and bargaining is completely decentralized. In trying to estimate models fully specifying the correlation structure within countries and over time, Gibbs sampling schemes regularly became stuck attempting to sample from posterior distributions with unit-level variances of 0 (i.e., infinite precision in the BUGS parametrization) and values arbitrarily close to unity for autocorrelation parameters.

From a theoretical perspective, my interest is in accounting for cross-country diversity in centralization rather than explaining within-country variation over time. While the strong within-country dependence across observations reduces the amount of information available for estimating quantities of interest, modeling this dependence is not substantively meaningful here. As a result, I take a population-averaged (or marginal) rather than a country-specific (or conditional) approach (Diggle, Liang and Zeger, 2002; Zorn, 2001). I turn to generalized estimating equation (GEE) and non-parametric window subseries empirical variance (WSEV) estimators.²⁵

²⁵All models were fit in \mathcal{R} 2.7.2 for Mac OS X using the `geepack`, `arm`, and `WhatIf` libraries.

The GEE framework is a generalization of the quasi-likelihood approach to the generalized linear model (GLM). The GEE logit regression utilized throughout can be expressed as

$$\mu_{it} = E(y_{it}) \tag{8}$$

$$\text{logit}(\mu_{it}) = \beta' x_{it} \tag{9}$$

$$V(\mu_{it}) = \mu_{it}(1 - \mu_{it}) \tag{10}$$

The GEE estimator for β solves the system of estimating equations

$$\sum_{i=1}^N \frac{\partial \mu_i}{\partial \beta} [V(\hat{\alpha})]^{-1} (y_i - \mu_i) = 0 \tag{11}$$

where N is the number of subjects (countries), the working covariance matrix $V(\alpha) = A_i^{1/2} R_i(\alpha) A_i^{1/2}$, A_i is a diagonal matrix with $V(\mu_i)$ on the main diagonal, and $R_i(\alpha)$ is the “working” correlation matrix, possibly a function of some parameters α . The intuition behind the estimation procedure is to iterate between choosing regression parameters β such that the predicted values are, on average, close to the actual values of the response given a “working” covariance matrix and then to use the residual variance to estimate the correlation parameters of the covariance matrix (Liang and Zeger, 1986).

The WSEV approach is a non-parametric extension of the GEE model.²⁶ Rather than using the empirical correction for the GEE standard errors, WSEV assumes that the dependence across observations decreases as the distance between them in time increases. Taking advantage of the (asymptotic) consistency and normality of the GEE estimates for β , the WSEV estimator accounts for temporal and spatial dependence in the error process by generating “subsamples that are nearly independent between clusters then averaging variances over clusters.” (Heagerty, Ward and Gleditsch, 2002:311). This is achieved by breaking

²⁶See Heagerty, Ward and Gleditsch (2002); Heagerty and Lumley (2000) for details.

the time series into (overlapping) blocks and assigning an observation, y_{it} to cluster k if $t_k \leq t \leq t_{k+1}$. Specifically, in the logit case

$$\text{Var}(\hat{\beta}) = P^{-1}\Sigma P^{-1} \quad (12)$$

$$P = X^T(\hat{\mu}(1 - \hat{\mu})X) \quad (13)$$

$$\Sigma = \frac{1}{\tau} \sum_{j=1}^M \sum_{k,l \in W_m^j} (X_k(y_k - \hat{\mu}_k))(X_l(y_l - \hat{\mu}_l))^T \quad (14)$$

where $\hat{\mu}$ is μ evaluated at $\hat{\beta}$, τ is number of time periods, m is the length of the time window, W_m^j is the j th window and M is the number of windows. The trick is to choose a window length such that observations are nearly independent across clusters. Heagerty and Lumley (2000) argue that windows should be set to length $\approx 4\tau^{1/3}$. I therefore use windows of length 10.

3.3 Confederal strike funds

I model the probability that the largest union federation controls a central strike fund. Results are displayed in table 3.3. I begin in the first column reporting a model with no time-invariant covariates. Model two then adds federalism and cultural fractionalization, but in order to avoid perfect separation, this model excludes union density. The third model includes the predicted probability that the employer federation can veto wage contracts but once again excludes the time-invariant covariates as they are nearly perfectly collinear with the employer variable.²⁷

To evaluate the in-sample predictive power of the models, figure 3.3 displays ROC curves. The ROC curve plots the correctly predicted “successes” (country-years with centrally con-

²⁷Bivariate logit models for the joint probability of centralized union strike funds and centralized employer contract vetoes were exceedingly fragile and showed an odds ratio indistinguishable from unity.

Table 2: GEE logits for the probability the biggest union federation possesses strike funds, reporting WSEV standard errors.

	Model 1	Model 2	Model 3
Population	-3.34 (2.04)	-2.97 (1.09)	-2.50 (2.11)
Trade	0.11 (0.02)	0.10 (0.06)	0.14 (0.02)
η^2	-1.33 (0.42)	-1.96 (0.35)	-1.66 (1.01)
Left government	0.03 (0.01)	0.01 (0.01)	0.02 (0.01)
No. parties	-4.44 (1.74)	-7.89 (2.59)	-4.55 (2.41)
No. labor confed	0.05 (0.22)	-0.25 (1.24)	-0.56 (0.36)
Density	-0.00 (0.02)		-0.07 (0.06)
Cultural frac.		-4.95 (6.10)	
Federal		-5.66 (2.82)	
Employer contract veto			4.33 (1.61)
N (no. countries)=	562(15)		

Note: Constant estimated but not reported. See appendix B for details on the variables.

trolled strike funds) against the incorrectly predicted successes for different cut-off thresholds. The further the curve from the 45° line, the better the model performs. In the figure, the heavy lines represent models 1-3. Model 2 is clearly the best performing. To emphasize the importance of interunion membership variance (η^2), the broken lines represent each model's performance with η^2 excluded. Omitting this variable negatively affects each model; no model excluding η^2 perform as well model one.

I present a graphical depiction of first differences to interpret the model's substantive implications.²⁸ Figure 2 displays changes in the expected probability of a strike fund for

²⁸All hypothetical data points for the simulations are inside the convex hull of the data.

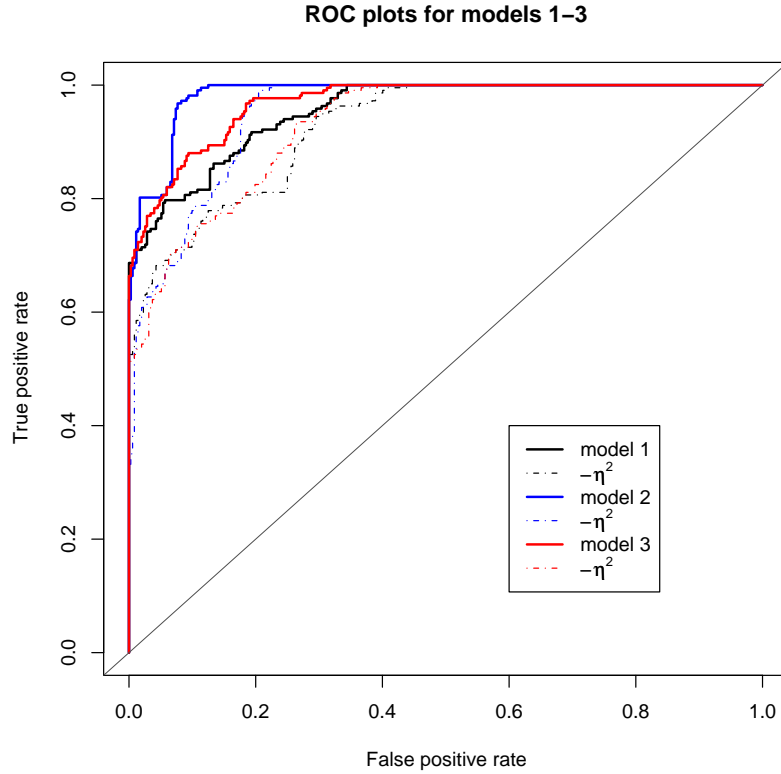


Figure 1: Evaluating the in-sample predictive power of models 1-3. For each model, excluding η^2 (broken lines) substantially impairs the models' predictive performance.

changes in each of the covariates, holding all others at their mean levels (for interval scaled covariates) or modal values (for categorical variables). Interval-scaled variables move across their interquartile ranges and indicators are toggled. All predictions use estimates from model two save the density and employer variables, which are taken from model 3. The directionality of findings is largely in line with expectations. More unequal distribution of membership resources across unions is clearly negatively associated with centralized strike powers; the probability of centralizing conflict funds is lower by 0.5, on average, for countries with third quartile levels of membership variance compared to those in the first. Also, contrary to findings about employer coordination in the pre-World War II era (Martin and Swank, 2008), more fragmented political party systems impede the development of central-

ized strike funds. Bigger, more diverse economies and countries with federal governments are substantially less likely to have union federations with centralized strike powers whereas trade exposure, Left governments, and centralized employers are associated with modest and more uncertain increases in this probability.

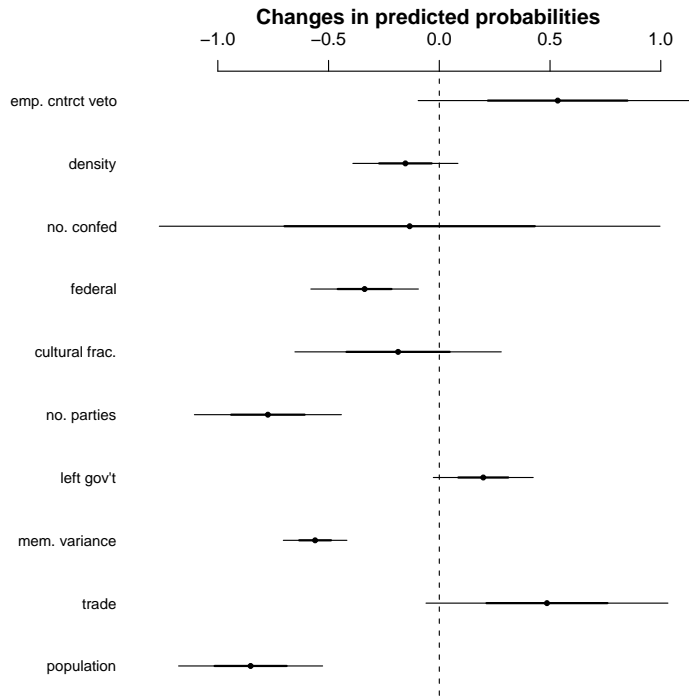


Figure 2: Predicted change in the probability of the biggest confederation controlling a strike fund. Indicator variables are toggled and continuous variables move across their interquartile ranges. Thicker bars represent ± 1 WSEV SEs and thinner bars are ± 2 WSEV SEs. Values taken from model 2 except for density and employer contract veto, which are taken from model 3.

3.4 Bargaining coordination

We next turn toward the determinants of bargaining coordination.²⁹ The response variable here is Kenworthy’s scale of bargaining coordination (Kenworthy, 2001).³⁰ As an ordered categorical variable, it is most common to model these data using ordered logit or probit regression. These models have been difficult to extend to panel time series data (Jackman, 1998), but GEE models for ordered categorical responses do exist (Heagerty and Zeger, 1996; Parsons, Edmondson and Gilmour, 2006). But even in the GEE world these models rely on the strong and frequently untested assumption of “proportional odds”, i.e. $\log\left(\frac{\Pr(y_{it} \leq c_j)}{\Pr(y_{it} > c_j)}\right) = \beta' X_{it}$ where the c_j are the cutpoints between categories. Substantively, this amounts to assuming that the effects of covariates are the same across different levels of the response variable. For the data here, both the Brant (1990) test for conventional MLE ordered logit and the Wald test for GEE logit (Stiger, Barnhart and Williamson, 1999) show this assumption to be unsustainable. Ignoring this and fitting an ordered model anyway can induce inconsistent estimates of the slope parameters across levels of the response.³¹ I therefore break the response variable into a sequence of binary variables, \tilde{y}_{ijt} , $j = 1, 2, 3$, which takes on a value of 1 if $y_{it} > j$ and 0 otherwise. Results for these models describe the (log odds) of exceeding a certain level of bargaining centralization. Breaking the variable apart in this way retains the ordering information and avoids imposing the strong interval assumptions of a Gaussian linear model while also enabling the use of the WSEV estimator.

There is an efficiency cost to not estimating the models simultaneously. I defer this extension

²⁹Golden (1993); Soskice (1990) argue convincingly that the degree of cross-union coordination in wage setting is more important than the actual level at which wages are bargained (plant, firm, industry, sector, or economy-wide).

³⁰I collapse Kenworthy’s 5-point scale into a four-point scale by combining categories one and two. If I retain the five-point scale, I cannot estimate the model for \tilde{Y}_{i2} in the sequential logit models discussed below due to perfect separation with the employer contract veto and confederal strike fund dummies. Results for the other categories are identical to what I report below, however.

³¹For example, if a variable increases the probability of being in at least category two but decreases the probability of being in three or higher, a proportional odds model could end up reporting a parameter estimate near 0.

for later work.

In these models I include (log) population, trade, and cultural fractionalization as structural covariates; (log) parliamentary parties, Left government, and the federalism dummy for political/institutional regressors. It appears that there has been a secular decline in bargaining coordination across countries, at least since the 1980s (Wallerstein and Western, 2000), so I include a linear time trend. To examine the importance of union and employer organizational factors, I include the interunion membership variance, predicted probability that the largest union federation controls a central strike fund (taken from model 1) and the predicted probability of an employer federation with contract veto power.³² Including these latter two variables implies that coefficients on the structural and institutional variables are interpreted as their additional direct associations with bargaining coordination above and beyond their relationship through union and employer organizational centralization. Table 3 reports parameter estimates.

I interpret these findings using a plot of first differences in predicted probabilities, as displayed in figure 4. For each variable, j increases from top to bottom. For $j = 1$, we use solid dots/black lines. Open triangles/red lines represent $j = 2$. Vertical dashes/blue lines represent $j = 3$. As before, indicator variables are toggled and continuous variables move across their interquartile ranges.

The first thing to note is that the model does poorly at predicting the probability that bargaining coordination will rate at least a “3” on Kenworthy’s scale. Most parameter estimates are effectively near 0 with exceedingly wide confidence intervals. This uncertainty is directly traceable to the case of Denmark, a country in which the major labor federation lacks centralized strike fund but notable for its highly coordinated wage bargaining. Unlike Sweden or Norway, Danish unions have a long craft union tradition. There are a few larger

³²I use model 1 as it excludes employer contract veto as a covariate. The model for predicting employer veto power here is the same as above, only excluding population due to perfect separation.

Table 3: Sequentially ordered binary GEE logit results for bargaining coordination. Organizational centralization of union federations and more coordinated bargaining are positively related.

	Coordination >		
	1	2	3
Population	-0.75 (0.53)	0.48 (6.62)	0.12 (0.41)
Trade	0.02 (0.07)	-0.04 (0.41)	0.00 (0.03)
Left government	-0.00 (0.02)	0.02 (0.06)	-0.00 (0.01)
No. Parties	1.55 (2.05)	5.01 (17.74)	0.09 (2.31)
Federal	3.66 (1.54)	1.01 (11.76)	0.08 (0.69)
Cultural fractionalization	-19.90 (9.28)	-2.42 (31.16)	-8.72 (4.13)
Density	-0.08 (0.11)	0.02 (0.94)	0.02 (0.02)
Strike fund	9.86 (5.77)	3.75 (36.33)	2.76 (1.44)
Employer contract veto	6.50 (7.42)	-2.01 (57.13)	-0.20 (1.94)
η^2	0.70 (0.46)	0.53 (1.43)	0.49 (0.21)
year trend	-3.36 (5.06)	-1.87 (41.00)	-4.18 (1.99)
N (no. countries)=	457(15)		

Note: Constant estimated but not reported. WSEV standard errors in parentheses. See appendix B for details on the data.

industrial unions but most Danish unions tend to be small; interunion membership variance for Denmark averages 5.3 compared to the sample average of 2.9. Cross-union cooperation and enforcement of coordinated bargaining is achieved not through centralized strike funds but rather through the process of state-sponsored contract concatenation. Where unions and employers have difficulty coming to an agreement, binding arbitration can attach the terms from other industries' contracts onto the contract in question. Swenson argues that

“Compulsory arbitration...probably did more to freeze the existing craft-based divisions of the Danish (as compared to the Swedish unions) than to further consolidate or centralize them.” (Swenson, 1991:529). In this way, the Danish case is the exception that proves the rule: the balkanized, craft-based Danish unions with unequally distributed members had difficulty creating a strong central organization³³. It also emphasizes that there are other institutional paths to bargaining coordination.³⁴ Re-estimating the model excluding Denmark (plot of predicted probabilities and confidence intervals reported in appendix C) drastically shrinks the degree of uncertainty.

Second, the centralization of union authority, as proxied by the predicted probability of centrally controlled strike funds, has a consistent positive association across levels of the response variable, indeed it is the *only* theoretically interesting covariate that has any meaningful effect in these models. Countries in the third quartile of predicted central strike funds are nearly 50% more likely to have bargaining coordinated at level 2 or higher and over 30% more likely to be in the highest category than those in the first quartile, though only this latter relationship attains traditional significance levels. This is not to say that other covariates are not meaningful—cultural fractionalization in the third quartile decreases by roughly 0.25 the probability of being in the most centralized category relative to the first quartile and an increase in interunion member variance seems to have a slight *positive* influence on the probability of being in the most coordinated category. Rather the other variables do not show a consistent relationship with bargaining coordination independently of their influence on the centralization of union confederal authority.³⁵ The findings here provide

³³Swenson also claims that “[The Danish DSF] was to remain the least centralized of Scandinavian labor confederations.” (Swenson, 1991:518)

³⁴The arbitration institutions in Australia and New Zealand are notable in this regard. See Ahlquist (under review^a) for a discussion of how these institutions enabled the Australians to centralize bargaining in the 1980s.

³⁵In the model excluding Denmark (appendix C), both the number of parties and government partisanship show significant and non-trivial increases in the probability that $j > 2$. Union density is also positive and marginally significant.

strong evidence that organizational factors, especially pertaining to unions, are critical for sustaining coordinated wage bargaining.

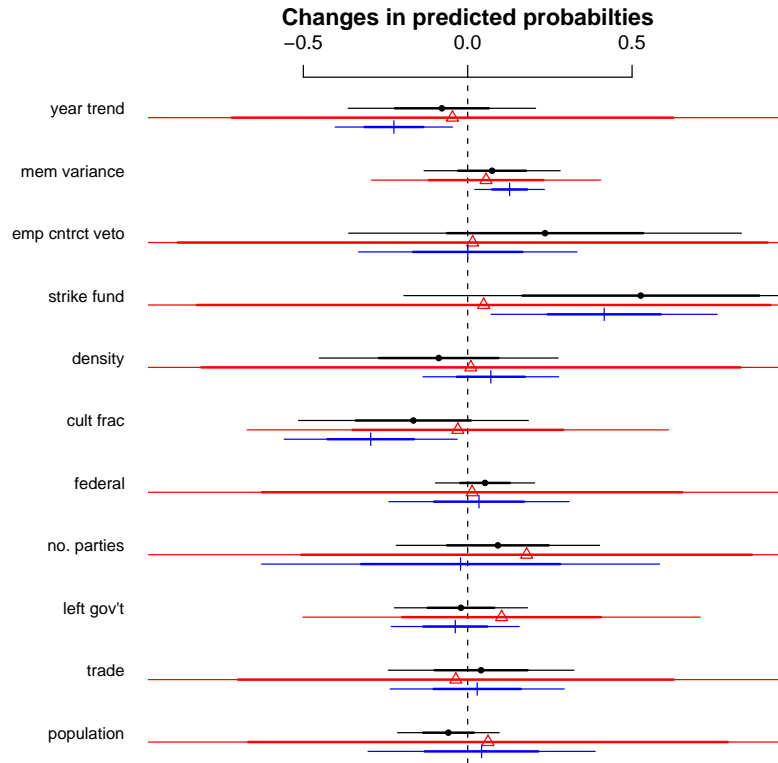


Figure 3: Predicted change in the probability that the level of bargaining coordination is $> j$, where $j = 1, 2, 3$, the values of Kenworthy's coordination scale. For each variable, j increases from top to bottom. For $j = 1$, we use solid dots/black lines. Open triangles/red lines represent $j = 2$. Vertical dashes/blue lines represent $j = 3$. Indicator variables are toggled and continuous variables move across their interquartile ranges. Thicker bars represent ± 1 WSEV SE and thinner bars are ± 2 WSEV SEs.

3.5 Summary of empirical findings

Consistent with expectations generated from the model, I find that the likelihood of union confederations controlling the strike decisions of their affiliates is decreasing in the inequality of membership across affiliated unions. I also find a strong role for political/institutional

factors. Larger countries, federalism and fragmented parties systems are associated with less centralized confederal organizations while Left government, trade exposure, and organized employers are associated with more centralized strike powers. When we turn to bargaining centralization, findings here imply that most of the influence of the covariates considered here flow through their effects on the organizational capacity of peak associations, particularly labor. Central control of strike funds appears as the most consistent predictor of bargaining coordination.

4 Conclusion

The analysis above represents what is, to my knowledge, the first formal theory of the internal politics of confederally structured union organizations as well as the first systematic, quantitative description of labor movement centralization and wage bargaining coordination in rich democracies. The model emphasizes how the distributional effects of cross-union cooperation can work to undermine union centralization. Effective cooperation depends on a relatively egalitarian distribution of the key union resource—members. The basic modeling framework can be extended in a number of ways, most notably increasing the number of possible confederal activities and the introduction of uncertainty around the value of cooperation.

The empirical findings are generally in line with the model’s predictions: centralized union control of strikes is more likely where unionists are equally distributed across affiliates. I also find evidence congruent with other assertions in the literature surrounding coordinated bargaining. Trade exposure tends to improve chances while larger economies tend to be more decentralized. On the political side, partisanship, electoral institutions, and federalism all appear to affect bargaining coordination. Taken together, it seems clear that political structure and the actions of politicians “matter” for the organization of labor interests. But

a noteworthy caveat is in order: All these variables' relationships to bargaining coordination appear to flow through their effects on the organizational capacity of peak associations, especially for unions. This latter observation coupled with the model imply that the determinants of union fragmentation is an important area for continued research. We know that labor law recognizing bargaining units is important; indeed, when Australia tried to implement centralized wage bargaining in the 1980s the Labor government and the Australian Council of Trade Unions simultaneously implemented a policy aimed at forcing smaller unions to merge or fold themselves into larger ones. Others have pointed to the timing of industrialization in determining whether unions are craft-based or industry-based (Ingham, 1974; Iversen and Soskice, 2007). Craft unionism tends to be particularly balkanized.

While I have made some progress, there are several limitations both in the analysis itself and in its relationship to theory. It is easy to point to several of the covariates as being endogenous, violating the standard regression assumption that the covariates be independent of the disturbance. On technical grounds, in the GEE framework, consistent parameter estimation only requires a properly specified model for the mean; residuals remain correlated (Diggle, Liang and Zeger, 2002; Zeger, Liang and Albert, 1988). Bias in variance estimation is accounted for via the iterated GEE fitting. Similarly, the WSEV approach, as non-parametric extension of the GEE logic, requires only a properly specified mean model. Given the known problem of strong temporal dependence, possible linkages between the other variables, several of which have yet to be discovered, is of second order importance. That said, to the extent these dynamic, structural processes are present, it is preferable to model them in the fullness of time.

The work here points to significant additional data collection projects needed to better evaluate the utility of this model or others. First, there are no data that describe the *scale* of confederal activity in its various dimensions. The strike fund variable is binary only; it does not provide any information on how much the confederation is extracting. Ideally,

confederal per-capita tax rates and budget relative to affiliates would be available. Third, the composition of membership by sector would be useful. As others have observed (Garrett and Way, 1999; Iversen, 1996, 1999), sheltered public sector workers account for a much larger share of the unionized workforce now than in the 1960-70s, perhaps attenuating the effects of trade dependence on unions' willingness to coordinate in wage bargaining and certainly altering the distribution of membership across an important sectoral cleavage in the labor movement. Currently, however, public sector unionization data are only available for a limited cross-section of countries for the early 1990s, thwarting any attempt to investigate the effects of change. More thorough investigation awaits more complete cross-national longitudinal data on public sector unionism. Fourth, we need to extend the coverage of union and bargaining datasets both longitudinally and spatially. The analysis here stops at 1992; much action on the wage bargaining front has taken place since then. In order to be able to estimate more parametrically demanding models, we also need cases where bargaining is relatively uncoordinated even in the presence of strong de jure confederal powers.

Finally, the model provides a way forward for further endogenizing the major institutional underpinnings of coordinated capitalism. The model's logic can be extended to shed light on the strategic capacity of other organizations that take a confederal form, from political parties to employer federations. It also problematizes the existence of "top down" organizations: what induces one organization (e.g., a firm) to organize collaborative production in a top-down, hierarchical fashion whereas other forms of cooperation occur through confederal means?

A Proofs

Proof of lemma 1

The proof proceeds through each case of Δu_i .

$$r_\alpha > \gamma \geq r_i$$

The derivative with respect to γ of the top half of equation 3 is

$$1 - \frac{r_i}{r_\alpha} + \log \frac{\gamma}{r_i} + \log \frac{\bar{r}_{C_\alpha}}{r_\alpha}$$

$r_\alpha > \gamma \geq r_i \geq 1 \Rightarrow$ the first two terms sum to a non-negative number and the third term is non-negative. Since $r_\alpha \leq \bar{r}_{C_\alpha} \forall C \neq \emptyset$, the last term is nonnegative.

$$r_\alpha > \gamma; \quad r_i > \gamma$$

The derivative with respect to γ of the bottom half of equation 3 is

$$1 - r_i/r_\alpha + \log(\bar{r}_{C_\alpha}/r_\alpha)$$

which is nonnegative if and only if $r_i/r_\alpha \leq \log(\bar{r}_{C_\alpha}/r_\alpha) + 1$.

$$r_\alpha \leq \gamma; \quad r_i \leq \gamma$$

The derivative with respect to γ of the top half of equation 4 is $(\log \bar{r}_{C_\alpha} - \log r_i) \geq 0 \quad \forall \quad i$.

$$r_\alpha \leq \gamma < r_i$$

The derivative with respect to γ of the bottom half of equation 4 is $\log \bar{r}_{C_\alpha} - \log \gamma$. $\bar{r}_{C_\alpha} \geq r_i > \gamma \Rightarrow$ the derivative is positive. ■

Proof of Lemma 2

The proof proceeds through each case of Δu_i .

$$r_\alpha > \gamma \geq r_i$$

The derivative with respect to r_i of the top half of equation 3 is

$$\frac{\partial \Delta u_i}{\partial r_i} = -\frac{\gamma}{r_i} + \frac{\gamma}{\bar{r}_{C_\alpha}} - \frac{\gamma}{r_\alpha} + 1 \leq 0$$

$$r_\alpha > \gamma; \quad r_i > \gamma$$

The derivative with respect to r_i of the bottom half of equation 3 is

$$\frac{\partial \Delta u_i}{\partial r_i} = \frac{\gamma}{\bar{r}_{C_\alpha}} - \frac{\gamma}{r_\alpha} \leq 0$$

$$r_\alpha \leq \gamma; \quad r_i \leq \gamma$$

The derivative with respect to r_i of the top half of equation 4 is

$$\frac{\partial \Delta u_i}{\partial r_i} = \frac{\gamma}{\bar{r}_{C_\alpha}} - \frac{\gamma}{r_i} \leq 0$$

$$r_\alpha \leq \gamma < r_i$$

The derivative with respect to γ of the bottom half of equation 4 is

$$\frac{\partial \Delta u_i}{\partial r_i} = \frac{\gamma}{\bar{r}_{C_\alpha}} - 1 \leq 0 \Leftrightarrow \gamma \leq \bar{r}_{C_\alpha}$$

If i is decisive, i.e., $r_i = r_\alpha$ and a change in r_i changes r_α , then Δu_i simplifies to $\gamma \log(r_{C_\alpha}/r_\alpha)$, the derivative of which is $\gamma(r_\alpha - r_{C_\alpha})/r_\alpha^2$, which is nonpositive since $r_\alpha \leq r_{C_\alpha}$ by construction. Note that all weak inequalities above become strict when $|C| > 1$. ■

Proof of Proposition 1

Fix some α and some membership C . If conditions 5 or 6 holds for r_α then, by lemma 2, they hold $\forall i$ such that $r_i \leq r_\alpha$. Each such i benefits by joining the confederation. Denote by \hat{r} the value of r_i for which either condition 5 or 6 holds with equality. Any union j outside the confederation for which $r_\alpha < r_j \leq \hat{r}$ can do better by joining since doing so moves the decisive member closer to j 's preferred t_j^* and adds resources thereby increasing the returns from the confederal activity. Thus, in equilibrium, there is a (compact) set of unions with contiguous preferences around the α th union satisfying either condition 5 or 6.

To see that the size of the confederation is weakly increasing in γ , it suffices to show that when $\gamma < r_\alpha, r_i$ members with $r_i > r_\alpha(1 + \log \bar{r}_{C_\alpha} - \log r_\alpha)$ will find it unprofitable to join since, by lemma 1, Δu_i is increasing in γ in all other cases implying that the equilibrium confederation will not shrink and may increase in size for any increase in γ . If $\tilde{r} = r_\alpha(1 + \log \bar{r}_{C_\alpha} - \log r_\alpha)$ then, substituting for r_i and γ/r_α for t_α , $\Delta u_i = -\gamma(1 + \log \bar{r}_{C_\alpha}/r_\alpha) + \gamma(1 + \log \bar{r}_{C_\alpha}/r_\alpha) = 0$. Thus any union with $r_i > \tilde{r}$ will have $\Delta u_i < 0$ and will therefore not be a member of C_α . ■

Proof of Proposition 2

For $t_{\alpha'}$ to exist, it must be the case that i would join the confederation at some value of t . Since t_i^* is i 's most preferred contribution level and, by assumption, there is some i for which $\gamma < r_i$, we can substitute γ/r_i for t_i^* into Δu_i , leading to the condition that $\gamma \log \bar{r}_C/r_i \geq 0$, which will always be true for nonnegative γ .

The value of t that makes i indifferent between joining and not solves $\Delta u_i = 0 \Leftrightarrow tr_i = \gamma(1 + \log t\bar{r}_C/\gamma)$. Denote this value of t as $\bar{t}_{\alpha'}$. It must also be the case that all j would prefer that i be in the confederation. For this to be the case, there must exist some value of t that

satisfies i 's participation constraint while making all j at least as well off as they were without i . This value exists if $u_j(t_\alpha; C_{-i}) \leq u_j(\bar{t}_{\alpha'}; C_{-i}) \Leftrightarrow r_j(t_{\alpha'} - t_\alpha) + \gamma(\log \bar{r}_{C_{-i}} t_\alpha - \log \bar{r}_C t_{\alpha'}) \leq 0$. Rearranging terms gives condition 7. ■

B Data

η^2 (**interunion membership variance**) The variance in log union membership across affiliates of the largest union confederation, derived by multiplying the Herfindahl index of membership concentration for the largest federation (interpolated to the annual level) by its number of affiliates (see Hart (1975)). The former is taken from Golden, Wallerstein and Lange (2002) while the latter was provided by Miriam Golden.

bargaining coordination Kenworthy's index of wage coordination. The original index takes on values in $\{1,2,3,4,5\}$ where "1= fragmented wage bargaining, confined largely to individual firms or plants...; 2=mixed industry- and firm-level bargaining, with little or no pattern setting and relatively weak elements of government coordination such as setting of basic pay rate or wage indexation...; 3 = industry-level bargaining with somewhat irregular and uncertain pattern setting and only moderate union concentration...; government wage arbitration; 4 =centralized bargaining by peak confederation(s) or government imposition of a wage schedule/freeze, without a peace obligation...; informal centralization of industry- and firm-level bargaining by peak associations...; extensive, regularized pattern setting coupled with a high degree of union concentration; 5 = Centralized bargaining by peak confederation(s) or government imposition of a wage schedule/freeze, with a peace obligation...; informal centralization of industry-level bargaining by a powerful, monopolistic union confederation...; extensive, regularized pattern setting and highly synchronized bargaining coupled with coordination of bargaining by influential large firms," (Kenworthy, 2003:41). I collapse categories one and two together.

confederal strike fund Indicator of whether the largest union confederation controls a central strike fund (Golden, Wallerstein and Lange, 2002)

cultural fractionalization Cultural-linguistic fractionalization taken from Fearon (2003).

effective number of parliamentary parties Natural log of the effective number of parliamentary parties from Golder (2005)

federal Indicator for federal governmental system taken from Keefer (2002).

Left government Proportion of the total number of legislative seats controlled by the government parties that are due to Left parties taken from Swank (1999)

population Log population in millions from taken from the Penn World Tables (Heston, Summers and Aten, 2006), henceforth PWT.

trade (Exports + Imports)/GDP in current \$US from PWT.

union density Net union density taken from Golden, Wallerstein and Lange (2002) and supplemented with values from Visser (2006).

C Model 4 re-estimated excluding Denmark

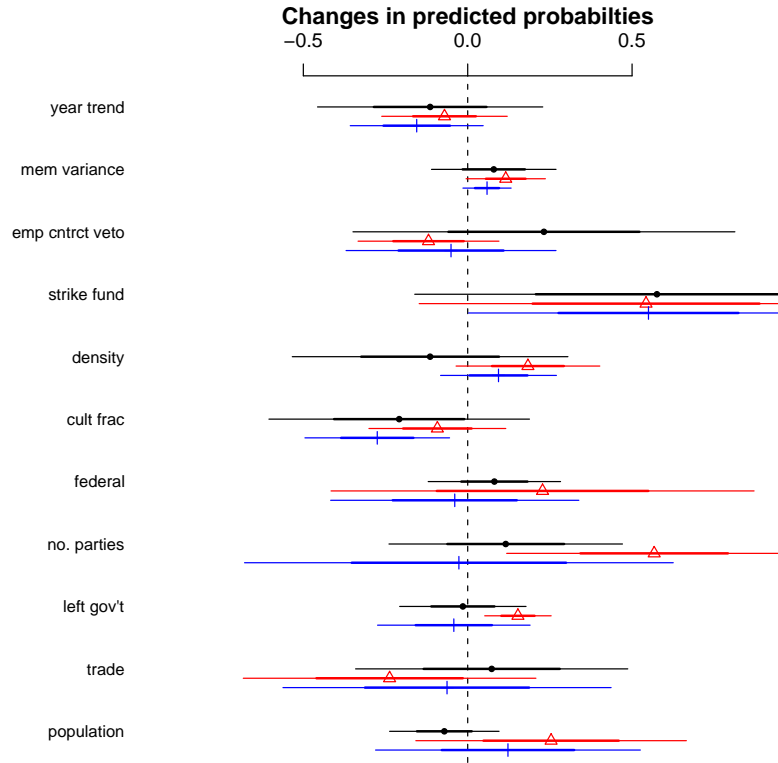


Figure 4: Predicted change in the probability that the level of bargaining coordination is $> j$, where $j = 1, 2, 3$, the values of Kenworthy's coordination scale. This model excludes Denmark. For each variable, j increases from top to bottom. For $j = 1$, we use solid dots/black lines. Open triangles/red lines represent $j = 2$. Vertical dashes/blue lines represent $j = 3$. Indicator variables are toggled and continuous variables move across their interquartile ranges. Thicker bars represent ± 1 WSEV SE and thinner bars are ± 2 WSEV SEs.

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