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Wage-Setting Institutions and Corporate Governance

Matthew Dimick* Neel Rao†

January 24, 2014

Abstract

Why do corporate governance law and practice differ across countries? This paper explains how wage-setting structures influence ownership structures and investor protection laws. In particular, we identify a nonmonotonic relationship between the level of centralization in wage-bargaining institutions and the level of ownership concentration and investor protection laws. As wage setting becomes more centralized, ownership concentration within firms at first becomes more, and then less, concentrated. In addition, the socially optimal level of investor protection laws is decreasing in ownership concentration. Thus, as wage-setting institutions become more centralized, investor protection laws become less and then more protective. This explanation is consistent with the observable pattern of wage-setting structures, ownership concentration, and investor protection legislation across developed countries. While agreeing with recent research that highlights labor as an important corporate stakeholder in shaping corporate governance, a focus on bargaining structures can resolve an important puzzle this research confronts, namely, why Scandinavian countries with higher than average labor strength also have higher than average investor protection legislation.

Keywords: Corporate governance, bargaining centralization, wage-setting structures, legal origin, labor, politics

JEL codes: G34, K22, K42

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1 Introduction

Why do corporate governance law and practice differ across countries? In this paper, we propose a new answer to this question that highlights differences in wage-setting structures across countries. In particular, we argue that the structure of wage-setting institutions influences the ownership structure of firms. Firms' ownership structure, in turn, generates different incentives for dominant shareholders' preferred level of investor protection. The key insight that emerges from our analysis is that there is a nonmonotonic relationship between wage-setting structures and the level of investor protection. The argument runs briefly as follows. Lower firm profits create larger opportunities for reorganization. To capture more of the gains from reorganization, dominant shareholders will increase their ownership stake as these opportunities increase. When dominant shareholders prefer owning a smaller fraction of the firm, they will favor stronger investor protection, to increase the value of the firms' shares. Finally, wage-setting institutions have critical effects for firms' profits and reorganization opportunities. At first, greater centralization of wage-setting institutions increase wages and lower profits. However, at very high levels, centralization favors high-productivity firms and penalizes low-productivity firms, which increases firms profits. Thus, as the centralization of wage-setting institutions increases, ownership concentration at first increases, but then decreases, while investor protections at first decrease and then increase.

Two proposed explanations dominate the literature on the sources of differences in corporate governance and investor protection across countries. The first—the “legal origin” hypothesis—suggests that cross-country differences in investor protections can be explained by each country's distinct and historically-given legal system (La Porta et al., 1997, 1998, 2000). In particular, the legal-origin authors classify legal systems into four different types: the English common-law system and the French, German, and Scandinavian civil-law traditions. Their results show that “common-law countries generally have the strongest, and French civil-law countries the weakest, legal protections of investors, with German- and Scandinavian-civil-law countries located in the middle” (La Porta et al., 1998, 1113).

While our argument is related, importantly, to this cross-country variation identified by the legal-origin authors, the shortcomings of the legal origin hypothesis are by now well recognized. Among other reasons, there is a lack of a convincing causal mechanism: it is not clear exactly how broad legal traditions actual determine the content of corporate law and the level of investor protections (Pagano and Volpin, 2005a, 1006). Furthermore, the legal-origin argument disappoints as a predictive matter: a country's inherited legal system does not always account for actual change of investor-protective laws in the contemporary world (*ibid.*). Indeed, there is evidence that at different periods of history, civil-law countries have offered greater protection to investors than common-law countries (Rajan and Zingales, 2003).

The second main explanation for cross-country differences in corporate governance is a story about politics, where the interests of employees as a crucial stakeholder constituency feature as an important determinant (Gourevitch and Shinn, 2005; Pagano and Volpin, 2005a; Roe, 2000). Given the distinctive interests of managers, shareholders, and employees, the political process serves as a crucial mediating factor that transforms these divergent interests into actual law and policy. Various versions of this theory exist, with one argument emphasizing the level of employment protection legislation and its impact on corporate

governance and the demand for investor protection (Pagano and Volpin, 2005a). Other accounts highlight the role of codetermination, in which employee representatives are allowed to sit on the supervisory boards of corporations (Roe, 2000). More generally, the impact of social democratic politics is seen as injecting the interests of employees at the firm level, in ways that compound already existing conflicts between shareholders and managers (Roe, 2000).

While agreeing with the emphasis on the role of employee interests, as well as the importance of the political process, our approach differs from the previous contributions to the politics of corporate governance in several important ways. To put the matter somewhat crudely, other arguments relating employee interests to investor protection are essentially dichotomous or linear: as labor interests become stronger, the level of investor protection or the quality of corporate governance will decrease. However, this argument inevitably encounters a puzzle. The puzzle is: If strong labor interests are so bad for corporate governance, why is corporate governance so good in Nordic countries? As we discuss more fully below, while Nordic countries have the highest levels of labor representation, measured in terms of rates of union membership or the level of bargaining centralization, they rank as “intermediate” with respect to the degree of investor protection they provide. Thus, Nordic countries offer better legal protection to investors than some countries with weaker labor movements. We argue that the nonlinear effect of a country’s wage-bargaining structure on ownership structure and investor protections that this paper identifies can account for this paradox.

In addition to exploring this puzzle, the role of wage-settings structures has been, so far as we are aware, entirely overlooked in corporate governance research. This is somewhat surprising, given the great deal of attention that both the political economy and political science literatures have given to this institutional variable. For both disciplines, the level of wage-bargaining centralization has important implications for the political economy of inflation, unemployment, and central bank independence (Cukierman and Lippi, 1999; Hall and Franzese, 1998; Iversen, 1998, see, e.g.,). Indeed, the “hump-shaped” expectation of the relationship between wage-bargaining centralization and unemployment that this literature has investigated is an important inspiration for the theory we advance in this paper (Calmfors and Driffill, 1988). The level of bargaining centralization is also a critical variable in the political-science literature on the political economy of inequality and income distribution (Wallerstein, 1999). Finally, a more recent line of economic research has examined the role of wage-bargaining structure on firms’ incentives to innovate (Haucap and Wey, 2004).

Despite the limitations of the existing research on comparative corporate law and governance, we feel compelled at the outset to emphasize how this paper complements this previous research. With respect to the legal-origin hypothesis, our argument could be viewed as proposing an entirely independent explanation for variation in the quality of corporate law across countries. However, it is also possible that there could be some causal relationship between a country’s legal origin and its prevailing (and history-dependent) structure of wage bargaining. In this case, one can interpret our argument as supplying (at least part of) the missing causal thread in the legal-origin argument. As for the labor and politics line of research, we do not believe that our emphasis on wage-bargaining structure either detracts from or contradicts the existing literature. We have no reason to think, for example, that employment protection legislation or codetermination do not have the effects previous

papers purport to them. Rather, our goal in this paper is to highlight the effect of another important, but overlooked, labor institution, as well as to address more completely some of the paradoxes that arise from an investigation of the effects of labor interests on corporate governance and investor protection laws.

The paper proceeds in the following order. In order to further motivate the theory we present, Section 2 provides a brief overview of the empirical data on corporate governance, investor protections, and structures of wage bargaining. Section 3 presents the model assumptions and timing of events. Section 4 analyzes the model, presents the main results we derive from it, and discusses the implications of these results. Finally, Section 5 concludes.

2 Some Empirical Evidence

A brief overview of the existing data motivates our focus on wage-bargaining institutions and underscores the paradox we introduced earlier between the strength of labor and the quality of corporate governance.

The literature on the political economy of labor and corporate governance tends to presume a simple linear or dichotomous relationship between the strength of labor interests and the quality of corporate governance and firm performance. For instance, Pagano and Volpin (2005a) hypothesize and find empirical support for a negative, linear relationship between employee and shareholder protection legislation. Similarly, Pagano and Volpin (2005b) propose a model that argues that when management has high private benefits and a small equity stake, “managers and workers are natural allies against takeover threats.” In addition, Roe (2000) argues that in general “[s]ocial democracies weaken the ties between managers and dispersed shareholders” and highlights in particular the role of German-style codetermination in frustrating good corporate governance. Finally, and most recently, Atanassov and Kim (2009) find empirical evidence for their claim that “strong union laws protect not only workers but also underperforming managers” and that “[w]eak investor protection combined with strong union laws are conducive to worker-management alliances” that weaken corporate performance.

While perhaps true at an aggregate level, the view that labor interests and good corporate governance are always incompatible inevitably encounters the paradox we identified previously: why do Nordic countries, with stronger than average labor movements, have better than average investor protections? Responding directly to Roe’s general argument that labor interests and the social democratic parties they support will undermine the financial performance of firms, Högfeldt (2007, 552) observes that this claim “does not fit the history and politics of corporate ownership in Sweden, perhaps the quintessential Social Democratic society, very well.” Roe (2000, 570–573) himself acknowledges this puzzle, pointing out that Sweden “has been for quite some time the paradigm of the [labor supported] social welfare state . . . ,” but also that “by conventional measures, Swedish institutions protect minority stockholders well” (pp. 570, 571). Finally, Gourevitch and Shinn (2005, 140–41) also recognize this paradox, observing that Sweden “fits many images of labor power in a democratic market economy,” but that the extent of “private benefits of control extracted by blockholders at the expense of minority shareholders appear to be limited.”

To illustrate this puzzle in more detail, Table 1 includes measures of wage bargaining

centralization, labor movement strength (union density), corporate governance (ownership concentration and investor protection as measured by the “anti-self-dealing” index of Djankov et al. (2008)), and financial performance (stock market capitalization and the premium paid for a controlling block of shares). To facilitate comparison with previous research, countries are grouped by their legal origin. Bargaining centralization is defined as the level at which bargaining over employees’ earnings primarily takes place in a given country. For example, in increasing order of centralization, wage bargaining could take place between an individual employee and employer, between a labor union and an employer at the workplace or firm level, or between a union and an employers’ association at the industry or national level. Kenworthy (2001, 70) makes an extended argument for why the two measures developed respectively by Iversen (1998) and Traxler et al. (2001) “are the best existing bargaining centralization measures” among the many measures that are available. Accordingly, we report both of these measures in Table 1. Unfortunately, data on bargaining centralization do not exist for less-developed countries. Union density, employees who are union members as a proportion of wage and salary earners in employment, is a key measure of the “strength” of a country’s labor movement. The other measures are fairly well-defined in the literature.

Averaged over the years , Table 1 shows that the structure of wage bargaining is most centralized in countries with a Scandinavian-civil-law legal origin and is least centralized in countries with a common-law legal origin (with the exception of Australia and Ireland in the Traxler et al. measure), with French and German civil-law countries having an intermediate level of bargaining centralization. Countries with a Scandinavian legal origin are also overwhelmingly those with the highest rates of union membership within the employed workforce.

We also stress that, to a significant extent, wage-bargaining structures are independent of more transitory partisan politics. While it would be straining the argument to contend that wage bargaining structures are entirely exogenous to partisan politics, it is true that wage-bargaining structures have remained relatively constant across both changing parties in government as well as over time more generally, as can be observed in Figure 1. Thus, a causal explanation based on wage-bargaining structures is less susceptible to objections of reverse causation than are distinct, if related, stories linking politics and corporate governance.

Under the prevailing view in the literature on the political economy of corporate governance, one would expect Scandinavian countries, with highly centralized wage bargaining and high rates of union membership, to exhibit high ownership concentration, low levels of investor protection, and more generally poorly performing corporate governance regimes. However, this not the case. As Table 1 and the legal-origin literature, show, Scandinavian countries fall in between common law and French and German civil-law countries in terms of the quality of corporate governance and overall financial performance. In particular, ownership concentration is higher in Scandinavian civil-law countries than in common-law countries, but lower than in French and German civil-law countries; likewise, investor protection is higher than in French and German civil-law countries, but lower than in common-law countries. As for financial performance, market capitalization of firms is higher in Scandinavian countries than in French and German civil-law countries (with the exception of Switzerland), but lower than in English common-law countries. Finally, large shareholders in Scandinavian civil-law countries do not appear to be able to extract significant private benefits, since a controlling block sells for a lower value than in French and German civil-

law countries, and about for the same premium as in common-law countries. In summary, despite the highest levels of bargaining centralization and union membership rates, Scandinavian civil-law countries have intermediate levels of corporate governance and financial performance.

These findings prompt us to ask whether there is some nonlinear relationship between labor market institutions and corporate governance. Some simple empirical investigations reveal just such a relationship between bargaining centralization and our two key measures of corporate governance. As seen in Figure 2, there is a fairly clear nonmonotonic relationship between the level of bargaining centralization and ownership concentration. Ownership concentration is lowest in decentralized bargaining regimes, highest in intermediate levels of centralization, and intermediate at high levels of centralization. A similar pattern emerges when we compare wage-setting centralization and levels of investor protection, using a measure of anti-self-dealing. As Figure 3 shows, protection against self dealing tends to be highest at the lowest levels of wage-bargaining centralization, lowest at intermediate levels of centralization, and assumes an intermediate level at the highest levels of centralization. As explained in our model below, although the proposed causal effect of centralization on investor protection is indirect, and occurs through its effect on ownership structure, we still observe something of a “U”-shaped relationship in this exercise.

3 The Model

With this brief empirical overview serving as a backdrop, the remainder of this paper proposes a model to explain the relationships between wage-bargaining institutions, ownership structure, and investor protection laws. There are a set of n ex-ante identical firms, indexed by i , $i \in \{1, 2, \dots, n\}$, each initially and entirely owned by a single owner-manager, denoted S_i . As explained in more detail below, S_i will become the dominant, controlling shareholder after taking the firm public. Since firms are ex-ante identical, we will suppress the subscripts whenever possible to simplify notation. The initial event is the determination of the level of investor protections, denoted λ . If the level of investor protection is λ , then the government must pay the amount $h(\lambda)$ in law enforcement costs. We assume that a social planner chooses λ to maximize the expected value of a firm less the costs of law enforcement. Since S initially owns the entire firm, this choice largely tracks S 's preferences for investor protection legislation. We think this assumption adequately captures the results, in a more simplified way, of a more involved political-economic model in which the preferences of large, controlling shareholders have heavy influence.

Following the determination of the level of investor protection, the owner-manager S chooses the ownership structure of the firm. In particular, S can sell shares to a competitive fringe of shareholders. That is, S commits to selling a certain fraction of the firm, and the price adjusts to make outside shareholders indifferent between selling and buying.¹ Let α denote the fraction of the firm that the owner-manager S retains. All parties are assumed to be risk neutral. After selling shares in the firm, S then becomes the single, dominant shareholder of the firm. All other investors are assumed to remain atomistic.

¹For a similar assumption, see Bebchuk (1999).

In addition, S enjoys some private benefits of control. If S owns a fraction α of the firm, then S receives $w(\alpha)$ in private benefits. However, the exercise of private benefits reduces the value of the firm due to corruption or mismanagement. If S owns a fraction α of the firm, then the value of the firm decreases by $r(\alpha)$. These assumptions reflect the standard approach in the literature. First, because of the collective action problem among shareholders, a large shareholder that undertakes a costly reorganization must be compensated for doing so. In addition, a greater ownership share also carries its own costs. To simplify matters we assume a loss in value due to corruption or mismanagement, but, at the cost of greater clarity, we could also assume that a higher ownership share entails a loss of liquidity or risk diversification.²

Following a conventional practice in the literature, after the choices of the firm's ownership structure and the level of investor protection, we posit a fundamental problem of corporate control. This problem arises from the fact that after sale of the firm's shares, the firm is run by managers who always prefer continuation to reorganization. As a result, reorganization can only occur through outside intervention, which is costly in terms of both time and resources. Given the single large shareholder and the atomistic nature of the other investors, such interventions will only be undertaken by S .³

Thus, following the sale of the firm's shares, S can make a noncontractible investment in finding an opportunity for reorganization. If S chooses investment level I , then the probability of finding a reorganization opportunity is I . If S chooses investment level I , then S incurs the cost $c(I)$. If S finds a reorganization opportunity, then the profits ψ of the firm with reorganization are distributed according to the density function f . It is assumed that f has full support on the real line and that ψ has a finite expectation. Let F denote the cumulative distribution function of ψ . The firm is reorganized if an opportunity for reorganization is found and the profits are higher with reorganization. Let Π denote the expected profits of the firm without reorganization. We omit the elaboration of a more detailed process by which S acquires some minimum stake α_{\min} necessary to reorganize the firm.⁴ Since we have assumed perfect capital markets, any such transaction would be fully reflected in the market value of the shares. More critically, inclusion in the model of such a process would only obscure the central insights we are trying to establish.⁵ Finally, if a reorganization takes place, the firm is wound up and does not continue into the wage-setting and production stage. Note that because the firm is shut down after a reorganization, the profits from reorganization do not depend on the unionization structure.

²For the idea that owning a larger proportion of the firm is costly because of the lack of diversification, see Admati et al. (1994). Alternatively, for the idea that more concentrated ownership entails liquidity costs, see Bolton and Von Thadden (1998).

³Bolton and Von Thadden (1998) make a similar assumption. Roe (2000) takes the problem of corporate control further, arguing that social democracies will increase the agency problem between shareholders and managers, and that this will encourage owners to maintain large, controlling blocks in order to increase monitoring of managers and counter the increase in agency costs. Although plausible, our argument does not depend on such an assumption. Moreover, following Burkart et al. (1997), it also seems possible that a worsening of the agency problem could induce large shareholders to *reduce* the proportion of the firm they own, in contradiction to Roe's hypothesis.

⁴For a paper that investigates this problem in more detail, see Shleifer and Vishny (1986).

⁵Note also that such a process is unnecessary if the solution of the model is such that the large shareholder selects an ownership share no less than α_{\min} .

In addition to its search for a reorganization opportunity, as the dominant shareholder S is also in a position to divert funds from the firm, and has an incentive to do so following a sale of a portion of the firm. If S chooses diversion level R , then the value of the firm decreases by R , and S receives the amount R as a transfer. However, engaging in financial expropriation is costly. In order to divert money, S must suffer a penalty $d(R, \lambda)$, which depends on the diversion level R as well as the degree of investor protection λ .

If a reorganization does not take place, the firm continues, wages are determined, and firms engage in production. Each firm differs in terms of its unit labor cost, which is given by $1 - \Delta_i$ for $\Delta_i \in [0, 1)$. Prior to wage setting and production, only the distribution of this cost parameter is known; Δ_i is identically distributed across firms. Firms produce a homogeneous good and compete with the other n firms in a Cournot framework. Under these conditions, profits for firm i are given by:

$$\pi_i = [p - (1 - \Delta_i)w_i]q_i \quad (1)$$

where the equilibrium market price for the homogeneous good is given by $p = A - Q$ for $A \geq Q$, q_i is the firm-specific quantity produced, $Q = \sum_{i=1}^n q_i$ is the total quantity produced, and w_i is the firm-specific wage. To simplify matters, we assume that managers choose q_i to maximize the profits of the firm facing given wages. Thus, the only divergence of interests between managers and shareholders is the choice or reorganization or continuation of the firm.

Wages are determined in one of four different wage-bargaining scenarios, which we rank in order of increasing centralization. In the (1) “market” regime, denoted M , firms make take-it-or-leave-it offers to individual workers; in the (2) “decentralized” regime, denoted D , wages are chosen by a monopoly union independently at each firm; in the (3) “coordinated” regime, denoted C an industry union chooses a different wage rate for each firm for all firms in the market; and in the (4) “centralized” regime, denoted U , an industry union chooses a uniform wage for all firms in the market.⁶

Under the market regime, firms hire workers and choose wages matching their outside option; so that, $w_i^M = w_0$. When unions set wages, their objective is to maximize the excess of the wage bill over the outside option of workers. Let $q_i(w_1, \dots, w_n)$ and $L_i(w_1, \dots, w_n)$ respectively denote the quantity of output produced and the amount of labor demanded by firm i when (w_1, \dots, w_n) is the vector of wages facing the firms. Note that $L_i(w_1, \dots, w_n) = (1 - \Delta_i)q_i(w_1, \dots, w_n)$. Unions choose wages taking into account the labor demands of the firms. Unions’ optimal wage-setting strategy, w_i^ρ , regarding firm i under each regime $\rho \in \{D, C, U\}$ can be defined as follows:

$$w_i^D = \arg \max_{w_i \geq w_0} L_i(w_1^D, \dots, w_{i-1}^D, w_i, w_{i+1}^D, \dots, w_n^D) \cdot (w_i - w_0), \quad (2)$$

$$(w_1^C, \dots, w_n^C) = \arg \max_{(w_1, \dots, w_n) \geq (w_0, \dots, w_0)} \sum_{j=1}^n L_j(w_1, \dots, w_n) \cdot (w_j - w_0), \quad (3)$$

$$w_i^U = \arg \max_{w \geq w_0} \sum_{j=1}^n L_j(w, \dots, w) \cdot (w - w_0). \quad (4)$$

⁶Our analysis of bargaining structures is an n -firm generalization of the two-firm case analyzed by Haucap and Wey (2004).

Given all of the above, we can write the expected value of the firm given I , R , α , and Π as:

$$V(I, R, \alpha, \Pi) = (1 - I) \cdot \Pi + I \cdot F(\Pi) \cdot \Pi + I \cdot \int_{\Pi}^{\infty} \psi f(\psi) d\psi - r(\alpha) - R,$$

where the first, second, and third terms represent the cases where a reorganization opportunity is not discovered, is discovered but unprofitable, and is discovered and profitable. The fourth term reflects the loss due to corruption or mismanagement. The fifth term captures the diversion of funds. The function $V(I, R, \alpha, \Pi)$ can be expressed as follows:

$$V(I, R, \alpha, \Pi) = \Pi + I \cdot \int_{\Pi}^{\infty} (\psi - \Pi) f(\psi) d\psi - r(\alpha) - R = \Pi + I \cdot g(\Pi) - r(\alpha) - R,$$

where $g(\Pi) = \int_{\Pi}^{\infty} (\psi - \Pi) f(\psi) d\psi$. Note that $g(\Pi)$ is positive and decreasing in Π .

To summarize the model, the timing of events is as follows:

1. A social planner chooses the level of investor protection λ to maximize total social welfare, which is defined as the expected payoff to S minus law enforcement costs.
2. S sells a fraction $1 - \alpha$ of the firm, while retaining the fraction α .
3. S makes an investment I to search for a reorganization opportunity and diverts funds in amount R from the firm. Private benefits are paid.
4. S decides whether to reorganize the firm; if a reorganization takes place the firm is wound up and the game ends.
5. If a reorganization does not take place, the firm continues to operate and the productivity $1 - \Delta_i$ of each individual firm is revealed.
6. Wages w_i^{ρ} are set, by management in regime M or by unions in regimes D , C , and U .
7. Managers produce output q_i to maximize profits; wages and dividends are paid.

4 Results

In this section we analyze the model through backwards induction.

Wage-Setting Structures and Expected Profits

We begin by deriving a result about average wage costs and average profit levels under each wage-setting regime, M , D , C , and U . We assume that A and w_0 are such that each firm, i , $i \in \{1, 2, \dots, n\}$ under each regime $\rho \in \{M, D, C, U\}$ produces a positive quantity $q_i > 0$. First, we provide a lemma that establishes the equilibrium value of quantities produced by each firm and wages for each firm under each wage-setting regime

Lemma 1. For all regimes $\rho \in \{M, D, C, U\}$, the equilibrium quantity produced by each firm i is given by:

$$q_i = \frac{A + \sum_{j=1}^n (1 - \Delta_j) w_j}{n + 1} - (1 - \Delta_i) w_i. \quad (5)$$

In addition, for each wage-setting regime, the equilibrium wages w_i^ρ for each firm i are given by:

$$w^U = \frac{A \sum_{j=1}^n (1 - \Delta_j)}{2(n + 1) \sum_{j=1}^n (1 - \Delta_j)^2 - 2[\sum_{j=1}^n (1 - \Delta_j)]^2} + \frac{w_0}{2}, \quad (6)$$

$$w_i^C = \frac{A}{2(1 - \Delta_i)} + \frac{w_0}{2}, \quad (7)$$

$$w_i^D = \frac{A}{(n + 1)(1 - \Delta_i)} + \frac{n[(n + 1)(1 - \Delta_i) + \sum_{j=1}^n (1 - \Delta_j)] w_0}{(n + 1)(2n + 1)(1 - \Delta_i)}, \quad (8)$$

$$w^M = w_0. \quad (9)$$

Proof. See Appendix.

Next, the expressions in Lemma 1 allow us to state Proposition 1, which establishes the fundamental result that profits are nonmonotonic in the level of centralization.

Proposition 1. For each wage-setting regime $\rho \in \{M, D, C, U\}$, average profits have the following rankings: $\frac{1}{n} \sum_{i=1}^n \pi_i^M > \frac{1}{n} \sum_{i=1}^n \pi_i^D > \frac{1}{n} \sum_{i=1}^n \pi_i^C$ and $\frac{1}{n} \sum_{i=1}^n \pi_i^U > \frac{1}{n} \sum_{i=1}^n \pi_i^C$.

Proof. See Appendix.

As we move through the different wage-setting regimes in order of increasing centralization, average profits decrease between the market and decentralized regimes and then again between the decentralized and coordinated regimes. However, average firm profits increase as centralization increases by one more step between the coordinated and centralized regimes. As will be shown below, the nonmonotonic relationship between wage-setting centralization and average profits is critical to the similar relationship we derive between bargaining structures and corporate governance characteristics.

Our intuition for this result is driven by Proposition 2, which ranks the impacts of different bargaining regimes on wages.

Proposition 2. For each wage-setting regime $\rho \in \{M, D, C, U\}$, define wage costs per unit of output for firm i as $v_i^\rho = (1 - \Delta_i) w_i^\rho$. Then, average wage costs per unit of output under each wage-setting regime have the following rankings: $\frac{1}{n} \sum_{i=1}^n v_i^C > \frac{1}{n} \sum_{i=1}^n v_i^D > \frac{1}{n} \sum_{i=1}^n v_i^M$ and $\frac{1}{n} \sum_{i=1}^n v_i^C > \frac{1}{n} \sum_{i=1}^n v_i^U > \frac{1}{n} \sum_{i=1}^n v_i^M$.

Proof. See Appendix.

Under the market regime, the wages firms pay are equal to workers' outside option, and this keeps wage costs as low as possible. In contrast, unions raise wages above the outside option but will nevertheless have different impacts on profits under alternative wage-setting

structures. When wage-setting is decentralized and a separate union negotiates wages independently at each firm, a substitution effect in the product market holds wages down. Unable to coordinate across firms, decentralized unions are more sensitive to the effect of wage increases on the quantity produced by the firm and hence the amount of labor demanded. In contrast, the industry union under the coordinated regime fully internalizes this substitution effect. Indeed, the wage under coordinated bargaining, given by equation (7), is identical to what the union's optimal wage would be if the given firm was the only one in the market. Accordingly, wage costs are higher under coordinated bargaining than under decentralized bargaining, and higher under decentralized bargaining than under the market regime.

However, the implication for wage costs under the centralized wage regime is different. Because the wage is uniform across firms in this regime, firms with a high labor cost per unit of output pay the same wage as firms with a low labor cost per unit of output. This wage policy essentially acts as a subsidy to industry leaders and a tax on laggards. This effect raises average profits above those in the coordinated regime. However, because unions maximize the excess of the wage bill over the outside option of workers, wages are in the aggregate still higher under centralized bargaining than under the market regime.

These two propositions demonstrate that wages can be ranked between regimes M , D , and C and between regimes M , U , and C and that profits can be ranked between regimes M , D , and C and between regimes C and U . Nonetheless, we cannot in general rank all regimes together for either attribute. Specifically, we cannot rank wage costs between regimes D and U . Depending on specific parameter values, the average wage cost per unit of output could be higher in regime D or in regime U . A similar conclusion is drawn for firm profits. Comparing regimes D and U , profits could be higher under either depending on specific parameter values. The same holds for comparing regimes M and U . This last conclusion is interesting, since although the centralized regime has a higher wage than the market regime, profits may still be higher under the centralized regime. We conjecture that this is possible because of the effect we described above: a rise in the wage can increase profits in a high productivity firm by more than it decreases profits in a low productivity firm.

Choice of Diversion and Investment

We now turn to S 's choices of diversion and investment. To ensure straightforward interior solutions we make the following additional assumptions for the expected profit level, the penalty-for-diversion function, and the cost-of-investment function.

Assumption 1. *Assume the following conditions for expected profits, the penalty-for-diversion function, and the cost-of-investment function:*

1. *There exists $b_{\Pi} > 0$ such that $\Pi \geq b_{\Pi}$; there exists $b_r < b_{\Pi}$ such that $r(\alpha) \leq b_r$ for all $\alpha \in [0, 1]$.*
2. *The penalty for diversion has the separable form $d(R, \lambda) = x(\lambda) \cdot z(R)$; $x(\lambda)$ is defined for $\lambda \geq 0$, $x(\lambda)$ is increasing on the interval $[0, \infty)$, and there exists $b_x > 0$ such that $x(\lambda) \geq b_x$ for all $\lambda \geq 0$; $z(R)$ is a continuously differentiable function defined for $R \geq 0$, where $z'(0) = 0$, $z'(b_{\Pi} - b_r) > 1/b_x$, and $z'(R)$ is increasing on the interval $[0, \infty)$.*

3. The cost of investment $c(I)$ is a continuously differentiable function defined for $I \in [0, 1]$, where $c'(0) = 0$, $c'(1) > g(b_\Pi)$, and $c'(I)$ is increasing on the interval $[0, 1]$.

The first part of the assumption implies that expected profits Π , as well as expected profits minus the loss from private benefits of control $\Pi - r(\alpha)$, are always positive and bounded away from zero. The second part places some structure on the penalty-for-diversion function. Respectively, it implies that $x(\lambda)$ is positive and bounded away from zero, that x is increasing in the level of investor protection, that there is an interior solution for the diversion level if and only if $\alpha < 1$, that the diversion level is less than the value of the firm, and that the penalty for diversion is a convex function of the amount expropriated, holding constant the level of investor protection. Finally, the third part specifies our assumptions for the cost-of-investment function. These assumptions help ensure an interior solution for the investment decision if and only if $\alpha > 0$ and imply that the investment cost is a convex function.

With the preceding assumptions, we write S 's expected payoff as:

$$\begin{aligned} W(I, R, \alpha, \Pi) &= \alpha V(I, R, \alpha, \Pi) + w(\alpha) + R - c(I) - d(R, \lambda) \\ &= \alpha[\Pi + I \cdot g(\Pi) - r(\alpha) - R] + w(\alpha) + R - c(I) - x(\lambda) \cdot z(R). \end{aligned}$$

For its choice of diversion, S chooses R to maximize its expected payoff, taking as given α and λ . For its choice of reorganization investment, S chooses I to maximize its expected payoff, taking α and Π as given.

Proposition 3. (A) S 's choice of diversion R is decreasing in its ownership share α and in the level of investor protection λ ; (B) S 's choice of investment I is increasing in its ownership share α and decreasing in the level of expected profits Π .

Proof. See Appendix.

The intuition for this proposition is straightforward. Since S receives the entire value of the diversion R , but only bears the cost αR , the gain from a diversion increases as S 's ownership share decreases. Naturally, the size of the diversion will decrease when there is higher investor protection. As for the choice of investment, S stands to secure more of the gains from a reorganization when its ownership stake is higher; hence I increases with α . Finally, when expected profits are higher, there is less to gain from a reorganization, so I decreases with Π .

Ownership Structure

Having solved for S 's choice of diversion and investment, we can determine how S chooses the firm's ownership structure. In order to solve this problem, we make the following assumptions.

Assumption 2. Assume the following conditions for S 's choice of ownership structure:

1. The continuously differentiable functions $w(\alpha)$ and $r(\alpha)$ are defined for $\alpha \in [0, 1]$. Assume that $w'(0) > r'(0)$ and $r'(1) > w'(1)$.

2. Define $C(u)$ and $Z(v)$ as continuously differentiable functions, where $C(u) = c'^{-1}(u)$ for all u such that $0 \leq u \leq c'(1)$, and where $Z(v) = z'^{-1}(v)$ for all v such that $0 \leq v \leq 1/b_x$.
3. The expression $(1 - \alpha) \cdot g(\Pi) \cdot \partial I(\alpha, \Pi)/\partial \alpha - (1 - \alpha) \cdot \partial R(\alpha, \lambda)/\partial \alpha - r'(\alpha) + w'(\alpha)$ is decreasing in α for all $\alpha \in [0, 1]$, $\lambda \in [0, \infty)$, and $\Pi \in [b_\Pi, \infty)$.
4. The term $e^2 \cdot C'(k \cdot e)$ is increasing in e for all k and e such that $0 < k < 1$ and $0 \leq e \leq c'(1)/k$.
5. The term $Z'(k/e)/e$ is decreasing in e for all k and e such that $0 < k < 1$ and $e \geq b_x$.

The first part of this assumption helps imply an interior solution for the choice of ownership share. Collectively, the second two parts of the assumption help ensure that the second order condition for a global maximum for S 's choice of ownership share is satisfied. The last two parts are useful in deriving comparative statics for the effect of the profit level and investor protection on ownership concentration. Sufficient conditions for the last two assumptions are for C' and Z' to be constant on their domains.

Since S at this stage owns the entire firm, S 's expected payoff can be written in the following way. If S retains a fraction α of the firm, then the value of the firm is expected to be $V[I(\alpha, \Pi), R(\alpha, \lambda), \alpha, \Pi]$. Hence, the expected payoff to S given α , λ , and Π is:

$$\begin{aligned} & \alpha V[I(\alpha, \Pi), R(\alpha, \lambda), \alpha, \Pi] + (1 - \alpha)V[I(\alpha, \Pi), R(\alpha, \lambda), \alpha, \Pi] \\ & \quad + w(\alpha) + R(\alpha, \lambda) - c[I(\alpha, \Pi)] - d[R(\alpha, \lambda)], \end{aligned}$$

where the first term is the expected value of the shares retained, the second term is the revenue from the sale of shares, the third term is the private benefits of control, the fourth term is the financial diversion, the fifth term is the investment cost, and the sixth term is the penalty for financial diversion.

Given λ and Π , S chooses α to maximize the expected payoff $W(\alpha, \lambda, \Pi)$. We can now state the following proposition.

Proposition 4. *The choice of ownership share $\alpha(\lambda, \Pi)$ is decreasing in the level of expected profits Π for a given level of investor protection λ . In addition, the choice of ownership share $\alpha(\lambda, \Pi)$ is decreasing in the level of investor protection λ for a given level of expected profits Π .*

Proof. See Appendix.

The reasoning behind this proposition follows from our previous results on S 's choice of investment and diversion. As the expected profits fall, the expected gains from investing in a reorganization opportunity rise. With greater possible gains from a reorganization, S prefers a higher level of investment in searching for such an opportunity. Thus, anticipating the positive impact of a larger ownership share on the size of the investment, S chooses to retain a larger fraction of the firm. Since at the subsequent, investment stage, S will capture a larger share of the gains from reorganization with a larger ownership stake, S will increase her incentive to invest in finding such an opportunity. Thus, S 's ownership share

is decreasing in the level of expected profits, and this effect occurs through S 's incentives to invest in reorganization.

The ownership share is also decreasing in the level of investor protection. Recall from the previous proposition that an increase in investor protection reduces S 's optimal choice of value diversion from the firm, while an increase in the ownership share reduces the optimal diversion. As a result, S does not need to retain a large share of the firm in order to keep the level of diversion low. Consequently, S can sell a larger share of the firm to outside investors without substantially increasing the losses from expropriation. Thus, S 's choice of ownership structure is decreasing in the level of investor protection.

Finally, the existence of private benefits of control $w(\alpha)$ also provide an incentive for S to increase its ownership stake, while the costs of mismanagement $r(\alpha)$ that accompany these private benefits ensure that S does not retain total ownership of the firm. Note that without the assumptions about private benefits and their incident costs to the value of the firm, S would prefer $\alpha = 1$, that is, S would prefer not to sell any portion of the company. The intuition for this is that by keeping the company private, S can capture all of the gains from a reorganization, and will subsequently choose the efficient investment level. Moreover since S initially owns the entire company, it fully internalizes the impact of subsequent choices that affect the value of the firm when choosing the ownership structure. Retaining full ownership then eliminates any losses from diversion, since S has no incentive to steal from itself.

However, with the costs $r(\alpha)$ associated with the exercise of private benefits of control, S will be compelled to sell at least some fraction of the company. By the same token, even if this loss of value is great, the existence of private benefits also implies that S will retain in ownership some fraction of the firm. Despite this particular way of modeling the costs of full ownership, we readily agree that there additional factors that encourage owner-founders to take their companies public. For instance, risk aversion and the benefits from diversification, as well as the loss of liquidity that accompanies private ownership, are two convincing reasons previously identified in the literature. We emphasize again that our choice in this case is driven primarily as a simplifying assumption.

Optimal Investor Protection

We now address the issue of the optimal level of investor protection. In order to solve this problem, we make the following additional assumptions.

Assumption 3. *Assume the following conditions hold on the penalty-for-diversion functions and the cost-of-enforcement functions.*

1. *The two functions $x(\lambda)$ and $h(\lambda)$, defined for $\lambda \geq 0$, are continuously differentiable, and the following conditions are satisfied: $h'(0)/x'(0) = 0$, $\lim_{\lambda \rightarrow \infty} h(\lambda)/x(\lambda) = \infty$, and $h(\lambda)/x(\lambda)$ is increasing on the interval $[0, \infty)$.*
2. *Assume that $-z(Z\{[1-\alpha(0, b_\Pi)]/x(0)\}) + z'(Z\{[1-\alpha(0, b_\Pi)]/x(0)\}) \cdot Z'\{[1-\alpha(0, b_\Pi)]/x(0)\} \cdot \{[1-\alpha(0, b_\Pi)]/x(0)\} > 0$ and that $-z[Z(e)] + z'[Z(e)] \cdot Z'(e) \cdot e$ is increasing in e for all e such that $0 \leq e \leq 1/x(0)$.*
3. *$[1-\alpha(\lambda, \Pi)]/x(\lambda)$ is decreasing in λ for all $\lambda \geq 0$ and $\Pi \geq b_\Pi$.*

All together, the first part of this assumption means that the additional expenditure required to raise the difficulty of diversion by one unit continuously increases from zero to infinity as the level of investor protection rises. The second part of the assumption helps ensure, respectively, an interior solution for the level of investor protection and that the second-order condition for a global maximum for the level of investor protection is satisfied. The final part of the assumption effectively means that greater investor protection lowers the degree of financial diversion.

As we have conceived of the problem, a social planner chooses λ to maximize the total welfare, which is simply the payoff to S minus law enforcement costs $h(\lambda)$. The total welfare given λ is:

$$\Phi(\lambda, \Pi) = W[\alpha(\lambda, \Pi), \lambda, \Pi] - h(\lambda).$$

The optimal level of investor protection is solved by maximizing this expression with respect to λ and taking expected profits Π as given. This leads to the following proposition.

Proposition 5. *Investor protection $\lambda(\Pi)$ is increasing in the level of expected profits, Π . The ownership share $\alpha[\lambda(\Pi), \Pi]$ is decreasing in the level of expected profits, Π .*

Proof. See Appendix.

Driving this result is a trade off between concentrated ownership and investor protection. When expected profits are high, there is less incentive for a controlling shareholder to maintain a large stake in the company or to make large investments in searching for a reorganization opportunity. At the same time, however, a small ownership stake creates a greater temptation for a controlling shareholder to divert funds from the company. Under these conditions, the social value of investor protection is greatest. Since S has stronger interests in selling off the company than in retaining a large stake and investing in reorganization, the value of the firm is maximized by establishing high levels of investor protection.

In contrast, when expected profits are low, S prefers to own a larger share of the company in order to capture the larger potential gains from reorganization. And when S 's ownership share is larger, S prefers to divert a smaller amount from the company. In turn, when the diversion is smaller, higher investor protection contributes less to encouraging greater value in the company. In this case, the social value of high levels of investor protection is lowest. Social costs are reduced by lowering the level of investor protection and hence the costs of law enforcement.

In effect, a concentrated ownership structure acts as a substitute for high level of investor protection. And since the social welfare analysis for choosing the level of investor protection largely reflects the preferences of controlling shareholders, investor protections are a function of controlling shareholders preferences for diversification or concentration. Stated from this perspective, support for investor protections is a way for large shareholders to commit that minority shareholder investments will not be diverted. Making this commitment is particularly critical when the large shareholder has a strong interest in selling off most of the firm, and this occurs when profits are high. Otherwise, large shareholders maintain large ownership stakes when profits are low and there are greater opportunities to gain from reorganizations. Since the incentive to divert is lower when the ownership stake is high, this ownership structure essentially becomes a substitute for robust investor protection laws.

Note that although both La Porta et al. (1998) and Bebchuk (1999) also link ownership concentration to the level of investor protection, the causal mechanisms relating them in our case is different. For La Porta et al. (1998, 1145), ownership concentration becomes a substitute for legal protection either because large shareholders require more capital to exercise control rights to avoid being expropriated by managers or because poor legal protection lowers the demand for corporate shares. In this argument, a low level of investor protection is a cause of ownership concentration. Similarly, for Bebchuk (1999, 1–2), concentrated, controlling ownership structures emerge because dominant shareholders want to maintain access to the private benefits of control that arise from poor investor protection. In the explanation we propose here, causation runs the other direction, with ownership structure determining the level of investor protection.

Wage-Setting Structures and Corporate Governance

Using the preceding results, we can make a final statement that summarizes the main argument of the paper:

Corollary 1. *Across wage-bargaining structures $\rho \in \{M, D, C, U\}$, (A) the equilibrium levels of ownership structure α are ranked as follows: $\alpha^C > \alpha^D > \alpha^M$ and $\alpha^C > \alpha^U$; (B) the equilibrium levels of investor protection λ are ranked as follows: $\lambda^M > \lambda^D > \lambda^C$ and $\lambda^U > \lambda^C$.*

Since from Proposition 5 the ownership share $\alpha[\lambda(\Pi), \Pi]$ is decreasing in the level of expected profits and since from Proposition 1 we obtain rankings for average firm profits, part (A) of Corollary 1 follows. Similarly, Proposition 5 shows that the level of investor protection $\lambda(\Pi)$ is increasing in the level of expected profits; hence, along with Proposition 1, part (B) of Corollary 1 follows.

The basic insight of our paper is that there is a nonmonotonic relationship between the level of bargaining centralization and certain indicators of corporate governance. Corollary 1 establishes this result. The level of ownership concentration is increasing, and then decreasing, in the level of bargaining centralization. Similarly, the level of investor protection is at first decreasing, and then increasing, in the level of bargaining centralization. This finding arises because wage-setting structures and corporate governance are linked through the effects of bargaining centralization on expected profit levels.

We can give a loose empirical interpretation to these results. Again, although our results do not depend on the legal-origin categories, they are a useful way to summarize cross-country differences. The market M and decentralized D regimes largely correspond to English common-law countries, with the exceptions of Australia and New Zealand, which have higher centralization scores. In these countries, wage bargaining is largely firm- or workplace-based and, perhaps partly as a result, the share of workers covered by a collective agreement is low. As a result, wages are determined by a mix of union bargaining and market criteria. The coordinated C regime corresponds to French and German civil-law countries, which have industry-level unions and tools to extend industry agreements to nonsignatory employers. This results in most workers being covered by collective agreements, but these agreements are also narrower and less encompassing than in more centralized bargaining: wages are less uniform, coordination occurs by following a union wage-setting “leader,” and unions in opportune situations attempt to “leapfrog” over other union agreements. Finally,

the centralized U regime is most consistent with Scandinavian civil-law countries, where wage-setting has been most centralized, and where it is known that employers have for at least certain, substantial periods of time, explicitly favored centralization as a way to establish uniform wage rates and contain wage growth in the highest wage sectors. This pattern appears to be largely consistent with the data that we reported in Section 2.

5 Conclusion

In this paper we argue that introducing different wage-setting institutions into study of corporate governance can help explain why patterns of corporate law and governance differ across developed countries. Our main insight is that key measures of corporate law and governance—specifically, ownership concentration and the level of investor protection—change nonmonotonically as the level of bargaining centralization increases. As centralization increases, average profits decrease, except in the most centralized wage-setting regime, where they then increase. The level of profits are in turn related to a large, controlling shareholder’s incentive to search for a profitable reorganization opportunity. Lower profits represent a larger opportunity for reorganization, Furthermore, to increase its incentive to invest in such a reorganization, a large shareholder will retain a larger ownership stake when profits decrease. Finally, a larger ownership stake essentially signals to potential outside investors that the level of expropriation will be low, since a shareholder with a larger ownership stake has no incentive to steal from itself. Thus, large shareholders planning to sell a smaller fraction of the firm will have little incentive to demand a high level of investor protection. Given the relationship between wage-bargaining institutions and profits, we then argue that ownership concentration will at first increase and then decrease, and that the level of investor protection will at first decrease and then increase, as the level of centralization increases.

A Appendix

Proof of Lemma 1

First, to find the equilibrium quantity for each firm i , we choose q_i to maximize firm profits in equation (1), taking the quantities of all other firms as given. The first order condition for this problem gives:

$$-q_i + A - Q - (1 - \Delta_i)w_i = 0 \quad \text{for each } i \in \{1, 2, \dots, n\} \quad (\text{A.10})$$

Summing across all of the q_i ’s and rearranging, we find an expression for the total quantity produced:

$$Q = \frac{An - \sum_{j=1}^n (1 - \Delta_j)w_j}{n + 1}$$

Substituting this expression for total quantity back into the first order condition and solving for q_i , one obtains the result for the equilibrium quantity for each firm stated in equation (5).

Next, to find the equilibrium wage for each firm, we choose w_i^p to maximize the firm’s profit in regime M or to maximize the union’s utility subject to the firm’s optimal quantity

choice in regimes D , C , and U given equations (8), (7), and (6), respectively, recalling that $L_i = (1 - \Delta_i)q_i$. Beginning with the decentralized regime, the first order condition yields:

$$(1 - \Delta_i) \left[\frac{(1 - \Delta_i)}{n + 1} - (1 - \Delta_i) \right] (w_i - w_0) + (1 - \Delta_i) \left[\frac{A + \sum_{j=1}^n (1 - \Delta_j)w_j}{n + 1} - (1 - \Delta_i) \right] = 0 \quad (\text{A.11})$$

After rearranging and some simplification, one obtains

$$-(2n + 1)(1 - \Delta_i)w_i + A + \sum_{j=1}^n (1 - \Delta_j)w_j + n(1 - \Delta_i)w_0 = 0.$$

Summing across all of the w_i 's and rearranging, one finds an expression for total wage costs per unit of output

$$\sum_{j=1}^n (1 - \Delta_j)w_j = \frac{An + n \sum_{j=1}^n (1 - \Delta_j)w_0}{n + 1}.$$

Substituting this result back into the first-order condition and solving for w_i yields the expression for w_i^D given by equation (8).

Next, the first order condition for the coordinated regime results in the following equation:

$$(1 - \Delta_i) \left[\frac{(1 - \Delta_i)}{n + 1} - (1 - \Delta_i) \right] (w_i - w_0) + (1 - \Delta_i) \left[\frac{A + \sum_{j=1}^n (1 - \Delta_j)w_j}{n + 1} - (1 - \Delta_i) \right] + \sum_{j \neq i} (1 - \Delta_j) \left(\frac{1 - \Delta_i}{n + 1} \right) (w_j - w_0) = 0. \quad (\text{A.12})$$

Manipulation of this expression simplifies to

$$-2(n + 1)(1 - \Delta_i)w_i + A + 2 \sum_{j=1}^n (1 - \Delta_j)w_j - \sum_{j=1}^n (1 - \Delta_j)w_0 + (n + 1)(1 - \Delta_i)w_0 = 0.$$

Summing across all of the w_i 's, simplifying, and rearranging, one finds an expression for total wage costs per unit of output:

$$\sum_{j=1}^n (1 - \Delta_j)w_j = \frac{An + \sum_{j=1}^n (1 - \Delta_j)w_0}{2}.$$

After substituting this expression back into the first-order condition, and solving for w_i , one obtains an the expression for w_i^C given by equation (7).

Finally, the first-order condition for the union's objective function in the centralized regime is given by:

$$\sum_{i=1}^n \left\{ (1 - \Delta_i) \left[\frac{\sum_{j=1}^n (1 - \Delta_j)}{n + 1} - (1 - \Delta_i) \right] (w - w_0) + (1 - \Delta_i) \left[\frac{A + \sum_{j=1}^n (1 - \Delta_j)w}{n + 1} - (1 - \Delta_i)w \right] \right\} = 0. \quad (\text{A.13})$$

After some simplifying and rearranging, this condition can be written as

$$\sum_{i=1}^n \left\{ -2w \left[(n + 1)(1 - \Delta_i)^2 - (1 - \Delta_i) \sum_{j=1}^n (1 - \Delta_j) \right] + w_0 \left[(n + 1)(1 - \Delta_i)^2 - (1 - \Delta_i) \sum_{j=1}^n (1 - \Delta_j) \right] + A(1 - \Delta_i) \right\} = 0.$$

After distributing the summation operator, $\sum_{i=1}^n$, we can write:

$$\begin{aligned} & -2w \left[(n + 1) \sum_{j=1}^n (1 - \Delta_j)^2 - \left[\sum_{j=1}^n (1 - \Delta_j) \right]^2 \right] \\ & + w_0 \left[(n + 1) \sum_{j=1}^n (1 - \Delta_j)^2 - \left[\sum_{j=1}^n (1 - \Delta_j) \right]^2 \right] + A \sum_{j=1}^n (1 - \Delta_j) = 0. \end{aligned}$$

Solving for w gives the solution to w^U given by equation (6). \square

Proof of Proposition 1

Substituting equations (6), (7), (8), and (9) into equation (5), the respective quantities produced by firm i in cases U , C , D , and M are as follows after some simplification:

$$q_{i,U} = \frac{A}{n + 1} \left(1 + \frac{[\sum_j (1 - \Delta_j)]^2 - (n + 1)(1 - \Delta_i) \sum_j (1 - \Delta_j)}{2(n + 1) \sum_j (1 - \Delta_j)^2 - 2[\sum_j (1 - \Delta_j)]^2} \right) + \frac{w_0}{2} \left(\frac{\sum_j (1 - \Delta_j)}{n + 1} - (1 - \Delta_i) \right), \quad (\text{A.14})$$

$$q_{i,C} = \frac{A}{2(n + 1)} + \frac{w_0}{2} \left(\frac{\sum_j (1 - \Delta_j)}{n + 1} - (1 - \Delta_i) \right), \quad (\text{A.15})$$

$$q_{i,D} = \frac{nA}{(n + 1)^2} + \frac{nw_0}{2n + 1} \left(\frac{n \sum_j (1 - \Delta_j)}{(n + 1)^2} - (1 - \Delta_i) \right), \quad (\text{A.16})$$

$$q_{i,M} = \frac{A}{n + 1} + w_0 \left(\frac{\sum_j (1 - \Delta_j)}{n + 1} - (1 - \Delta_i) \right). \quad (\text{A.17})$$

The respective profits of each firm i in cases U , C , D , and M are given by:

$$\pi_{i,U} = q_{i,U}^2, \quad \pi_{i,C} = q_{i,C}^2, \quad \pi_{i,D} = q_{i,D}^2, \quad \pi_{i,M} = q_{i,M}^2. \quad (\text{A.18})$$

The result below shows that the average profits of the firms are higher in case U than in case C .

Lemma 2. *If $q_{i,U} > 0$ and $q_{i,C} > 0$ for all i , then $\frac{1}{n} \sum_i \pi_{i,U} > \frac{1}{n} \sum_i \pi_{i,C}$.*

Proof. Assume that $q_{i,U} > 0$ and $q_{i,C} > 0$ for all i . Define a_C , $a_{i,U}$, and b_i as follows:

$$a_C = \frac{A}{2(n+1)}, \quad (\text{A.19})$$

$$a_{i,U} = \frac{A}{n+1} \left(1 + \frac{[\sum_j (1 - \Delta_j)]^2 - (n+1)(1 - \Delta_i) \sum_j (1 - \Delta_j)}{2(n+1) \sum_j (1 - \Delta_j)^2 - 2[\sum_j (1 - \Delta_j)]^2} \right), \quad (\text{A.20})$$

$$b_i = \frac{w_0}{2} \left(\frac{\sum_j (1 - \Delta_j)}{n+1} - (1 - \Delta_i) \right). \quad (\text{A.21})$$

Given these definitions, the quantities produced by firm i in cases U and C can be expressed as:

$$q_{i,U} = a_{i,U} + b_i \quad \text{and} \quad q_{i,C} = a_C + b_i. \quad (\text{A.22})$$

Hence, the average profits of the firms in cases U and C can be written as:

$$\frac{1}{n} \sum_i \pi_{i,U} = \frac{1}{n} \sum_i (a_{i,U} + b_i)^2 = \frac{1}{n} \sum_i a_{i,U}^2 + 2 \frac{1}{n} \sum_i a_{i,U} b_i + \frac{1}{n} \sum_i b_i^2, \quad (\text{A.23})$$

$$\frac{1}{n} \sum_i \pi_{i,C} = \frac{1}{n} \sum_i (a_C + b_i)^2 = a_C^2 + 2a_C \frac{1}{n} \sum_i b_i + \frac{1}{n} \sum_i b_i^2. \quad (\text{A.24})$$

From equations (A.23) and (A.24), it suffices to show that $\frac{1}{n} \sum_i a_{i,U}^2 > a_C^2$ and that $2 \frac{1}{n} \sum_i a_{i,U} b_i \geq 2a_C \frac{1}{n} \sum_i b_i$, in order to prove that $\frac{1}{n} \sum_i \pi_{i,U} > \frac{1}{n} \sum_i \pi_{i,C}$.

We begin by showing that $\frac{1}{n} \sum_i a_{i,U}^2 > a_C^2$. From Jensen's inequality for convex functions, we know that $\frac{1}{n} \sum_i a_{i,U}^2 > (\frac{1}{n} \sum_i a_{i,U})^2$, where the inequality is strict as long as there exist firms p and q with $\Delta_p \neq \Delta_q$ and so $a_{p,U} \neq a_{q,U}$. Noting that $a_C > 0$, it suffices to show that $\frac{1}{n} \sum_i a_{i,U} \geq a_C$, in order to prove that $\frac{1}{n} \sum_i a_{i,U}^2 > a_C^2$. Applying the Cauchy-Schwarz inequality, the terms $\sum_i (1 - \Delta_i)^2$ and $[\sum_i (1 - \Delta_i)]^2$ can be compared as follows:

$$\sum_i (1 - \Delta_i)^2 = \sum_i \left(\frac{1}{\sqrt{n}} \right)^2 \sum_i (1 - \Delta_i)^2 \geq \left(\sum_i \left(\frac{1}{\sqrt{n}} \right) (1 - \Delta_i) \right)^2 = \frac{1}{n} \left(\sum_i (1 - \Delta_i) \right)^2. \quad (\text{A.25})$$

Using equation (A.20) to substitute for $a_{i,U}$ in $\frac{1}{n} \sum_i a_{i,U}$, we obtain the following after some simplification:

$$\begin{aligned} \frac{1}{n} \sum_i a_{i,U} &= \frac{A}{n+1} \left(1 - \frac{[\sum_i (1 - \Delta_i)]^2}{2n(n+1) \sum_i (1 - \Delta_i)^2 - 2n[\sum_i (1 - \Delta_i)]^2} \right) \\ &\geq \frac{A}{n+1} \left(1 - \frac{[\sum_i (1 - \Delta_i)]^2}{2n(n+1) \frac{1}{n} [\sum_i (1 - \Delta_i)]^2 - 2n[\sum_i (1 - \Delta_i)]^2} \right) = \frac{A}{2(n+1)} = a_C \end{aligned} \quad (\text{A.26})$$

where the second step follows from applying the inequality in expression (A.66). Thus, we have $\frac{1}{n} \sum_i a_{i,U}^2 > a_C^2$ as desired.

We end by showing that $2\frac{1}{n} \sum_i a_{i,U} b_i \geq 2a_C \frac{1}{n} \sum_i b_i$. Using equations (A.19) and (A.21) to substitute for a_C and b_i in $2a_C \frac{1}{n} \sum_i b_i$, we obtain the following after some simplification:

$$2a_C \frac{1}{n} \sum_i b_i = -\frac{Aw_0 \sum_i (1 - \Delta_i)}{2n(n+1)^2}. \quad (\text{A.27})$$

Using equations (A.20) and (A.21) to substitute for $a_{i,U}$ and b_i in $2\frac{1}{n} \sum_i a_{i,U} b_i$, we obtain the following after some simplification:

$$\begin{aligned} & 2\frac{1}{n} \sum_i a_{i,U} b_i \\ &= \frac{Aw_0 \sum_i (1 - \Delta_i)}{2n(n+1)} - \frac{Aw_0 \sum_i (1 - \Delta_i)}{n(n+1)^2} - \frac{Aw_0 \sum_i (1 - \Delta_i)}{n(n+1)^2} \frac{[\sum_i (1 - \Delta_i)]^2}{2(n+1) \sum_i (1 - \Delta_i)^2 - 2[\sum_i (1 - \Delta_i)]^2} \\ &\geq \frac{Aw_0 \sum_i (1 - \Delta_i)}{2n(n+1)} - \frac{Aw_0 \sum_i (1 - \Delta_i)}{n(n+1)^2} - \frac{Aw_0 \sum_i (1 - \Delta_i)}{n(n+1)^2} \frac{[\sum_i (1 - \Delta_i)]^2}{2(n+1) \frac{1}{n} [\sum_i (1 - \Delta_i)]^2 - 2[\sum_i (1 - \Delta_i)]^2} \\ &= \frac{Aw_0 \sum_i (1 - \Delta_i)}{2n(n+1)} - \frac{Aw_0 \sum_i (1 - \Delta_i)}{n(n+1)^2} - \frac{Aw_0 \sum_i (1 - \Delta_i)}{2(n+1)^2} = -\frac{Aw_0 \sum_i (1 - \Delta_i)}{2n(n+1)^2} \\ &= 2a_C \frac{1}{n} \sum_i b_i \end{aligned} \quad (\text{A.28})$$

where the second step follows from applying the inequality in expression (A.66). Thus, we have $2\frac{1}{n} \sum_i a_{i,U} b_i \geq 2a_C \frac{1}{n} \sum_i b_i$ as desired. \square

The result below shows that the average profits of the firms are higher in case D than in case C .

Lemma 3. *If $q_{i,C} > 0$ and $q_{i,D} > 0$ for all i , then $\frac{1}{n} \sum_i \pi_{i,D} > \frac{1}{n} \sum_i \pi_{i,C}$.*

Proof. Assume that $q_{i,C} > 0$ and $q_{i,D} > 0$ for all i . Let Δ_{\min} and Δ_{\max} respectively denote the minimum and maximum of the Δ_i . In case C , the quantity $q_{i,C}$ produced by firm i is positive if and only if:

$$\frac{A}{2(n+1)} + \frac{w_0}{2} \left(\frac{\sum_j (1 - \Delta_j)}{n+1} - (1 - \Delta_i) \right) > 0. \quad (\text{A.29})$$

The inequality in expression (A.29) holds for all i if and only if:

$$\frac{A}{2(n+1)} + \frac{w_0}{2} \left(\frac{\sum_j (1 - \Delta_j)}{n+1} - (1 - \Delta_{\min}) \right) > 0, \quad (\text{A.30})$$

which is equivalent to:

$$A > w_0 \left[(n+1)(1 - \Delta_{\min}) - \sum_j (1 - \Delta_j) \right]. \quad (\text{A.31})$$

By definition, $\frac{1}{n} \sum_i \pi_{i,D} = \frac{1}{n} \sum_i q_{i,D}^2$ and $\frac{1}{n} \sum_i \pi_{i,C} = \frac{1}{n} \sum_i q_{i,C}^2$. Given that $q_{i,C} > 0$ and $q_{i,D} > 0$ for all i , it suffices to show that $q_{i,D} > q_{i,C}$ for all i , in order to prove that $\frac{1}{n} \sum_i \pi_{i,D} > \frac{1}{n} \sum_i \pi_{i,C}$. The statement $q_{i,D} > q_{i,C}$ is equivalent to:

$$\frac{nA}{(n+1)^2} + \frac{nw_0}{2n+1} \left(\frac{n \sum_j (1 - \Delta_j)}{(n+1)^2} - (1 - \Delta_i) \right) > \frac{A}{2(n+1)} + \frac{w_0}{2} \left(\frac{\sum_j (1 - \Delta_j)}{n+1} - (1 - \Delta_i) \right). \quad (\text{A.32})$$

Because $n/(2n+1) < 1/2$, the inequality in expression (A.32) is satisfied whenever the following inequality holds:

$$\frac{nA}{(n+1)^2} + \frac{nw_0}{2n+1} \left(\frac{n \sum_j (1 - \Delta_j)}{(n+1)^2} - (1 - \Delta_{\max}) \right) > \frac{A}{2(n+1)} + \frac{w_0}{2} \left(\frac{\sum_j (1 - \Delta_j)}{n+1} - (1 - \Delta_{\max}) \right). \quad (\text{A.33})$$

Given the inequality in expression (A.31) as well as the fact that $n/(n+1)^2 > 1/[2(n+1)]$, the inequality in expression (A.33) is satisfied whenever the following inequality holds:

$$\begin{aligned} & \frac{nw_0}{(n+1)^2} \left[(n+1)(1 - \Delta_{\min}) - \sum_j (1 - \Delta_j) \right] + \frac{nw_0}{2n+1} \left(\frac{n \sum_j (1 - \Delta_j)}{(n+1)^2} - (1 - \Delta_{\max}) \right) \\ & \geq \frac{w_0}{2(n+1)} \left[(n+1)(1 - \Delta_{\min}) - \sum_j (1 - \Delta_j) \right] + \frac{w_0}{2} \left(\frac{\sum_j (1 - \Delta_j)}{n+1} - (1 - \Delta_{\max}) \right), \end{aligned} \quad (\text{A.34})$$

which is equivalent to:

$$w_0 \left\{ 2n \left[n - \sum_j (1 - \Delta_j) \right] - (1+n)\Delta_{\max} + (1+n-2n^2)\Delta_{\min} \right\} \geq 0. \quad (\text{A.35})$$

The inequality in expression (A.35) is satisfied whenever the following inequality holds:

$$2n \{ n - [(n-1)(1 - \Delta_{\min}) + (1 - \Delta_{\max})] \} - (1+n)\Delta_{\max} + (1+n-2n^2)\Delta_{\min} \geq 0, \quad (\text{A.36})$$

which reduces to:

$$(n-1)(\Delta_{\max} - \Delta_{\min}) \geq 0. \quad (\text{A.37})$$

The inequality in expression (A.37) clearly holds. It follows that $q_{i,D} > q_{i,C}$ for all i as desired. \square

The result below shows that the average profits of the firms are higher in case M than in case D .

Lemma 4. *If $q_{i,D} > 0$ and $q_{i,M} > 0$ for all i , then $\frac{1}{n} \sum_i \pi_{i,M} > \frac{1}{n} \sum_i \pi_{i,D}$.*

Proof. Assume that $q_{i,D} > 0$ and $q_{i,M} > 0$ for all i . Let Δ_{\min} denote the minimum of the Δ_j . In case M , the quantity $q_{i,M}$ produced by firm i is positive if and only if:

$$\frac{A}{n+1} + w_0 \left(\frac{\sum_j (1 - \Delta_j)}{n+1} - (1 - \Delta_i) \right) > 0. \quad (\text{A.38})$$

The inequality in expression (A.38) holds for all i if and only if:

$$\frac{A}{n+1} + w_0 \left(\frac{\sum_j (1 - \Delta_j)}{n+1} - (1 - \Delta_{\min}) \right) > 0, \quad (\text{A.39})$$

which is equivalent to:

$$A > w_0 \left[(n+1)(1 - \Delta_{\min}) - \sum_j (1 - \Delta_j) \right]. \quad (\text{A.40})$$

Define f_D , f_M , and g_i as follows:

$$f_D = \frac{nA}{(n+1)^2} - \frac{w_0 \sum_j (1 - \Delta_j)}{(n+1)^2}, \quad (\text{A.41})$$

$$f_M = \frac{A}{n+1} - \frac{w_0(1+n^{-1}) \sum_j (1 - \Delta_j)}{(n+1)^2}, \quad (\text{A.42})$$

$$g_i = \frac{(n+2+n^{-1}) \sum_j (1 - \Delta_j)}{(n+1)^2} - (1 - \Delta_i). \quad (\text{A.43})$$

Given these definitions, the quantities produced by firm i cases D and M can be expressed as:

$$q_{i,D} = f_D + \frac{nw_0}{2n+1} g_i \quad \text{and} \quad q_{i,M} = f_M + w_0 g_i. \quad (\text{A.44})$$

Hence, the average profits of the firms in cases D and M can be written as:

$$\frac{1}{n} \sum_i \pi_{i,D} = \frac{1}{n} \sum_i \left(f_D + \frac{nw_0}{2n+1} g_i \right)^2 = f_D^2 + \frac{2w_0}{2n+1} f_D \sum_i g_i + \frac{nw_0^2}{(2n+1)^2} \sum_i g_i^2, \quad (\text{A.45})$$

$$\frac{1}{n} \sum_i \pi_{i,M} = \frac{1}{n} \sum_i (f_M + w_0 g_i)^2 = f_M^2 + \frac{2w_0}{n} f_M \sum_i g_i + \frac{w_0^2}{n} \sum_i g_i^2. \quad (\text{A.46})$$

Noting that $w_0^2/n \geq nw_0^2/(2n+1)^2$, it must be that:

$$\frac{w_0^2}{n} \sum_i g_i^2 \geq \frac{nw_0^2}{(2n+1)^2} \sum_i g_i^2. \quad (\text{A.47})$$

Moreover, we obtain $\sum_i g_i = 0$ after some simplification. It follows that:

$$\frac{2w_0}{2n+1} f_D \sum_i g_i = \frac{2w_0}{n} f_M \sum_i g_i = 0. \quad (\text{A.48})$$

Therefore, it suffices to show that $f_M > f_D > 0$, in order to prove that $f_M^2 > f_D^2$ and so $\frac{1}{n} \sum_i \pi_{i,M} > \frac{1}{n} \sum_i \pi_{i,D}$.

We begin by showing that $f_D > 0$. The statement $f_D > 0$ is equivalent to:

$$\frac{nA}{(n+1)^2} - \frac{w_0 \sum_j (1 - \Delta_j)}{(n+1)^2} > 0. \quad (\text{A.49})$$

Given the inequality in expression (A.40), the inequality in expression (A.49) is satisfied whenever the following inequality holds:

$$\frac{nw_0}{(n+1)^2} [(n+1)(1 - \Delta_{\min}) - \sum_j (1 - \Delta_j)] - \frac{w_0 \sum_j (1 - \Delta_j)}{(n+1)^2} \geq 0. \quad (\text{A.50})$$

The inequality in expression (A.50) reduces to:

$$w_0(1 - \Delta_{\min}) \geq \frac{w_0}{n} \sum_j (1 - \Delta_j), \quad (\text{A.51})$$

which clearly holds. It follows that $f_D > 0$.

We end by showing that $f_M > f_D$. The statement $f_M > f_D$ is equivalent to:

$$\frac{A}{n+1} - \frac{w_0(1+n^{-1}) \sum_j (1 - \Delta_j)}{(n+1)^2} > \frac{nA}{(n+1)^2} - \frac{w_0 \sum_j (1 - \Delta_j)}{(n+1)^2}. \quad (\text{A.52})$$

Given the inequality in expression (A.40) as well as the fact that $1/(n+1) > n/(n+1)^2$, the inequality in expression (A.52) is satisfied whenever the following inequality holds:

$$\begin{aligned} & \frac{w_0}{n+1} [(n+1)(1 - \Delta_{\min}) - \sum_j (1 - \Delta_j)] - \frac{w_0(1+n^{-1}) \sum_j (1 - \Delta_j)}{(n+1)^2} \\ & \geq \frac{nw_0}{(n+1)^2} [(n+1)(1 - \Delta_{\min}) - \sum_j (1 - \Delta_j)] - \frac{w_0 \sum_j (1 - \Delta_j)}{(n+1)^2}. \end{aligned} \quad (\text{A.53})$$

The inequality in expression (A.53) reduces to:

$$w_0(1 - \Delta_{\min}) \geq \frac{w_0}{n} \sum_j (1 - \Delta_j), \quad (\text{A.54})$$

which clearly holds. It follows that $f_M > f_D$. \square

We next demonstrate that in general average profits between regimes D and U and between regimes M and U cannot be ranked. Two simple examples will suffice to demonstrate this conclusion. The following example shows that average profits for firms under regimes D and U cannot in general be ranked.

Example 1.

We consider the model with two firms. Assume that the parameters are $\Delta_1 = \Delta$, $\Delta_2 = 0$, $A = 1$, and $w_0 = 0$. In case U , the respective quantities $q_{1,U}$ and $q_{2,U}$ produced by firms 1 and 2 are:

$$q_{1,U} = \frac{1}{6} + \frac{\Delta}{4[1 - \Delta(1 - \Delta)]} \quad \text{and} \quad q_{2,U} = \frac{5}{12} - \frac{1}{4[1 - \Delta(1 - \Delta)]}. \quad (\text{A.55})$$

Note that $q_{1,U} > 0$ and $q_{2,U} > 0$ for all $\Delta \in [0, 1]$. In case D , the respective quantities $q_{1,D}$ and $q_{2,D}$ produced by firms 1 and 2 are simply:

$$q_{1,D} = q_{2,D} = \frac{2}{9}. \quad (\text{A.56})$$

The average profits π_U of the two firms in case U can be expressed as:

$$\pi_U = \frac{1}{2}(\pi_{1,U} + \pi_{2,U}) = \frac{1}{2}(q_{1,U}^2 + q_{2,U}^2) = \frac{8 + \Delta\{-16 + \Delta[54 - \Delta(46 - 29\Delta)]\}}{288[1 - \Delta(1 - \Delta)]^2}. \quad (\text{A.57})$$

The average profits π_D of the two firms in case D are simply:

$$\pi_D = \frac{1}{2}(\pi_{1,D} + \pi_{2,D}) = \frac{1}{2}(q_{1,D}^2 + q_{2,D}^2) = \frac{4}{81}. \quad (\text{A.58})$$

The difference between the average profits in cases U and D is given by:

$$\pi_U - \pi_D = \frac{[-2 + \Delta(2 + 7\Delta)][28 - \Delta(28 - 19\Delta)]}{2592[1 - \Delta(1 - \Delta)]^2}. \quad (\text{A.59})$$

Note that $28 - \Delta(28 - 19\Delta)$ is positive for all $\Delta \in [0, 1]$. Observe that $-2 + \Delta(2 + 7\Delta)$ is negative for $\Delta = 0$, positive for $\Delta = 1$, and increasing in Δ . It follows that there exists $\kappa \in (0, 1)$ such that $\pi_U < \pi_D$ for $\Delta < \kappa$, $\pi_U > \pi_D$ for $\Delta > \kappa$, and $\pi_U = \pi_D$ for $\Delta = \kappa$.

The next example shows that average profits under regimes M and U cannot in general be ranked.

Example 2.

We again consider the model with two firms. Assume that the parameters are $\Delta_1 = \frac{2}{3}$, $\Delta_2 = 0$, and $A = 1$. In case U , the respective quantities $q_{1,U}$ and $q_{2,U}$ produced by firms 1 and 2 are:

$$q_{1,U} = \frac{8}{21} + \frac{1}{18}w_0 \quad \text{and} \quad q_{2,U} = \frac{2}{21} - \frac{5}{18}w_0. \quad (\text{A.60})$$

Note that $q_{1,U} > 0$ and $q_{2,U} > 0$ for $w_0 \in [0, \frac{12}{35})$. In case M , the respective quantities $q_{1,M}$ and $q_{2,M}$ produced by firms 1 and 2 are:

$$q_{1,M} = \frac{1}{3} + \frac{1}{9}w_0 \quad \text{and} \quad q_{2,M} = \frac{1}{3} - \frac{5}{9}w_0. \quad (\text{A.61})$$

Note that $q_{1,M} > 0$ and $q_{2,M} > 0$ for $w_0 \in [0, \frac{3}{5})$. The average profits π_U of the two firms in case U are given by:

$$\pi_U = \frac{1}{2}(\pi_{1,U} + \pi_{2,U}) = \frac{1}{2}(q_{1,U}^2 + q_{2,U}^2) = \frac{1224 + 7w_0(-12 + 91w_0)}{15876}. \quad (\text{A.62})$$

The average profits π_M of the two firms in case M are given by:

$$\pi_M = \frac{1}{2}(\pi_{1,M} + \pi_{2,M}) = \frac{1}{2}(q_{1,M}^2 + q_{2,M}^2) = \frac{9 + w_0(-12 + 13w_0)}{81}. \quad (\text{A.63})$$

The difference between the average profits in cases U and M is given by:

$$\pi_U - \pi_M = \frac{(6 - 7w_0)(91w_0 - 30)}{5292}. \quad (\text{A.64})$$

It follows that $\pi_U < \pi_M$ for $w_0 \in [0, \frac{30}{91})$, $\pi_U > \pi_M$ for $w_0 \in (\frac{30}{91}, \frac{12}{35})$, and $\pi_U = \pi_M$ for $w_0 = \frac{30}{91}$.

Proof of Proposition 2

Recall the following quantities determined for each firm and for each regime from equations (A.14), (A.15), (A.16), and (A.17). The respective wage costs per unit of output for firm i in cases U , C , D , and M are given by:

$$v_{i,U} = (1 - \Delta_i)w_U, \quad v_{i,C} = (1 - \Delta_i)w_{i,C}, \quad v_{i,D} = (1 - \Delta_i)w_{i,D}, \quad v_{i,M} = (1 - \Delta_i)w_M. \quad (\text{A.65})$$

The result below shows that the average wage cost per unit of output is lower in case U than in case C .

Lemma 5. *If $q_{i,U} > 0$ and $q_{i,C} > 0$ for all i , then $\frac{1}{n} \sum_i v_{i,U} < \frac{1}{n} \sum_i v_{i,C}$.*

Proof. Applying the Cauchy-Schwarz inequality, the terms $\sum_i (1 - \Delta_i)^2$ and $[\sum_i (1 - \Delta_i)]^2$ can be compared as follows:

$$\sum_i (1 - \Delta_i)^2 = \sum_i \left(\frac{1}{\sqrt{n}} \right)^2 \sum_i (1 - \Delta_i)^2 > \left(\sum_i \left(\frac{1}{\sqrt{n}} \right) (1 - \Delta_i) \right)^2 = \frac{1}{n} \left(\sum_i (1 - \Delta_i) \right)^2, \quad (\text{A.66})$$

where the inequality is strict as long as there exist firms p and q with $\Delta_p \neq \Delta_q$. The statement $\frac{1}{n} \sum_i v_{i,U} < \frac{1}{n} \sum_i v_{i,C}$ is equivalent to:

$$\frac{A[\sum_j (1 - \Delta_j)]^2}{2(n+1)n \sum_j (1 - \Delta_j)^2 - 2n[\sum_j (1 - \Delta_j)]^2} + \frac{w_0 \sum_j (1 - \Delta_j)}{2n} < \frac{A}{2} + \frac{w_0 \sum_j (1 - \Delta_j)}{2n}. \quad (\text{A.67})$$

Using expression (A.66), condition (A.67) is satisfied whenever:

$$\frac{A[\sum_j (1 - \Delta_j)]^2}{2(n+1)n \frac{1}{n} [\sum_j (1 - \Delta_j)]^2 - 2n[\sum_j (1 - \Delta_j)]^2} + \frac{w_0 \sum_j (1 - \Delta_j)}{2n} \leq \frac{A}{2} + \frac{w_0 \sum_j (1 - \Delta_j)}{2n}, \quad (\text{A.68})$$

which reduces to the true statement $1 \leq 1$. \square

The result below shows that the average wage cost per unit of output is lower in case M than in case U .

Lemma 6. *If $q_{i,M} > 0$ and $q_{i,U} > 0$ for all i , then $\frac{1}{n} \sum_i v_{i,M} < \frac{1}{n} \sum_i v_{i,U}$.*

Proof. Let Δ_{\min} denote the minimum of the Δ_i . The condition $q_{i,U} > 0$ is satisfied for all i if and only if:

$$\frac{A}{n+1} \left(1 + \frac{[\sum_j (1 - \Delta_j)]^2 - (n+1)(1 - \Delta_{\min}) \sum_j (1 - \Delta_j)}{2(n+1) \sum_j (1 - \Delta_j)^2 - 2[\sum_j (1 - \Delta_j)]^2} \right) + \frac{w_0}{2} \left(\frac{\sum_j (1 - \Delta_j)}{n+1} - (1 - \Delta_{\min}) \right) > 0, \quad (\text{A.69})$$

which is equivalent to:

$$A \left(\frac{2 \sum_j (1 - \Delta_j)}{(n+1) \sum_j (1 - \Delta_{\min})(1 - \Delta_j) - [\sum_j (1 - \Delta_j)]^2} - \frac{\sum_j (1 - \Delta_j)}{(n+1) \sum_j (1 - \Delta_j)^2 - [\sum_j (1 - \Delta_j)]^2} \right) > w_0. \quad (\text{A.70})$$

Expression (A.70) implies that the following inequality holds:

$$A \left(\frac{2 \sum_j (1 - \Delta_j)}{(n+1) \sum_j (1 - \Delta_j)^2 - [\sum_j (1 - \Delta_j)]^2} - \frac{\sum_j (1 - \Delta_j)}{(n+1) \sum_j (1 - \Delta_j)^2 - [\sum_j (1 - \Delta_j)]^2} \right) > w_0, \quad (\text{A.71})$$

which reduces to:

$$\frac{A \sum_j (1 - \Delta_j)}{(n+1) \sum_j (1 - \Delta_j)^2 - [\sum_j (1 - \Delta_j)]^2} > w_0. \quad (\text{A.72})$$

The statement $\frac{1}{n} \sum_i v_{i,M} < \frac{1}{n} \sum_i v_{i,U}$ is equivalent to:

$$\frac{w_0 \sum_j (1 - \Delta_j)}{n} < \frac{A [\sum_j (1 - \Delta_j)]^2}{2(n+1)n \sum_j (1 - \Delta_j)^2 - 2n [\sum_j (1 - \Delta_j)]^2} + \frac{w_0 \sum_j (1 - \Delta_j)}{2n}, \quad (\text{A.73})$$

which reduces to:

$$w_0 < \frac{A \sum_j (1 - \Delta_j)}{(n+1) \sum_j (1 - \Delta_j)^2 - [\sum_j (1 - \Delta_j)]^2}. \quad (\text{A.74})$$

Expression (A.74) is the same as the true statement (A.72). \square

The result below shows that the average wage cost per unit of output is lower in case D than in case C .

Lemma 7. *If $q_{i,D} > 0$ and $q_{i,C} > 0$ for all i , then $\frac{1}{n} \sum_i v_{i,D} < \frac{1}{n} \sum_i v_{i,C}$.*

Proof. It follows from $q_{i,C} > 0$ for all i that $\frac{1}{n} \sum_i q_{i,C} > 0$. The condition $\frac{1}{n} \sum_i q_{i,C} > 0$ can be expressed as:

$$\frac{A}{2(n+1)} + \frac{w_0}{2} \left(\frac{\sum_j (1 - \Delta_j)}{n+1} - \frac{1}{n} \sum_j (1 - \Delta_j) \right) > 0, \quad (\text{A.75})$$

which reduces to:

$$A > w_0 \frac{1}{n} \sum_j (1 - \Delta_j). \quad (\text{A.76})$$

The statement $\frac{1}{n} \sum_i v_{i,D} < \frac{1}{n} \sum_i v_{i,C}$ is equivalent to:

$$\frac{A}{n+1} + \frac{w_0 \sum_j (1 - \Delta_j)}{n+1} < \frac{A}{2} + \frac{w_0 \sum_j (1 - \Delta_j)}{2n}, \quad (\text{A.77})$$

which reduces to:

$$w_0 \frac{1}{n} \sum_j (1 - \Delta_j) < A. \quad (\text{A.78})$$

Expression (A.78) is the same as the true statement (A.76). \square

The result below shows that the average wage cost per unit of output is lower in case M than in case D .

Lemma 8. *If $q_{i,M} > 0$ and $q_{i,D} > 0$ for all i , then $\frac{1}{n} \sum_i v_{i,M} < \frac{1}{n} \sum_i v_{i,D}$.*

Proof. It follows from $q_{i,M} > 0$ for all i that $\frac{1}{n} \sum_i q_{i,M} > 0$. The condition $\frac{1}{n} \sum_i q_{i,M} > 0$ can be expressed as:

$$\frac{A}{n+1} + w_0 \left(\frac{\sum_j (1 - \Delta_j)}{n+1} - \frac{1}{n} \sum_j (1 - \Delta_j) \right) > 0, \quad (\text{A.79})$$

which reduces to:

$$A > w_0 \frac{1}{n} \sum_j (1 - \Delta_j). \quad (\text{A.80})$$

The statement $\frac{1}{n} \sum_i v_{i,M} < \frac{1}{n} \sum_i v_{i,D}$ is equivalent to:

$$w_0 \frac{1}{n} \sum_j (1 - \Delta_j) < \frac{A}{n+1} + \frac{w_0 \sum_j (1 - \Delta_j)}{n+1}, \quad (\text{A.81})$$

which reduces to:

$$w_0 \frac{1}{n} \sum_j (1 - \Delta_j) < A. \quad (\text{A.82})$$

Expression (A.82) is the same as the true statement (A.80). \square

Finally, the following example shows that in general, the average wage costs per unit of output under regimes D and U cannot be ranked.

Example 3.

We consider the model with two firms. Assume that the parameters are $\Delta_1 = \Delta$, $\Delta_2 = 0$, $A = 1$, and $w_0 = 0$. In case U , the wages $w_{1,U}$ and $w_{2,U}$ faced by firms 1 and 2 are:

$$w_{1,U} = \frac{2 - \Delta}{4[1 - (1 - \Delta)\Delta]} \quad \text{and} \quad w_{2,U} = \frac{2 - \Delta}{4[1 - (1 - \Delta)\Delta]}; \quad (\text{A.83})$$

so that, the respective wage costs $v_{1,U}$ and $v_{2,U}$ per unit of output for firms 1 and 2 are:

$$v_{1,U} = (1 - \Delta)w_{1,U} = \frac{(2 - \Delta)(1 - \Delta)}{4[1 - (1 - \Delta)\Delta]} \quad \text{and} \quad v_{2,U} = w_{2,U} = \frac{2 - \Delta}{4[1 - (1 - \Delta)\Delta]}. \quad (\text{A.84})$$

In case D , the respective wages $w_{1,D}$ and $w_{2,D}$ faced by firms 1 and 2 are:

$$w_{1,D} = \frac{1}{3(1 - \Delta)} \quad \text{and} \quad w_{2,D} = \frac{1}{3}; \quad (\text{A.85})$$

so that, the wage costs $v_{1,D}$ and $v_{2,D}$ per unit of output for firms 1 and 2 are:

$$v_{1,D} = (1 - \Delta)w_{1,D} = \frac{1}{3} \quad \text{and} \quad v_{2,D} = w_{2,D} = \frac{1}{3}. \quad (\text{A.86})$$

Moreover, it can be verified that the quantity produced by each firm in cases U and D is positive for all $\Delta \in [0, 1]$. The average wage cost v_U per unit of output in case U is given by:

$$v_U = \frac{1}{2}(v_{1,U} + v_{2,U}) = \frac{(2 - \Delta)^2}{8[1 - (1 - \Delta)\Delta]}. \quad (\text{A.87})$$

The average wage cost v_D per unit of output in case D is simply:

$$v_D = \frac{1}{2}(v_{1,D} + v_{2,D}) = \frac{1}{3}. \quad (\text{A.88})$$

The difference between the average wage costs per unit of output in cases U and D can be expressed as:

$$v_U - v_D = \frac{4 - \Delta(4 + 5\Delta)}{24[1 - (1 - \Delta)\Delta]}. \quad (\text{A.89})$$

Note that $4 - \Delta(4 + 5\Delta)$ is positive for $\Delta = 0$, negative for $\Delta = 1$, and continuously decreasing in Δ . It follows that there exists $\chi \in (0, 1)$ such that $v_U > v_D$ for $\Delta < \chi$, $v_U < v_D$ for $\Delta > \chi$, and $v_U = v_D$ for $\Delta = \chi$.

Proof of Proposition 3

The proof of Proposition 3 follows straightforwardly from the first-order conditions for, respectively, the choice of diversion R and choice of investment I . For S 's choice of diversion, the first-order condition for a maximum gives $R(\alpha, \lambda) = z'^{-1}[(1 - \alpha)/x(\lambda)]$. The second-order condition for a global maximum is satisfied. As can be observed, R is decreasing in α and $x(\lambda)$. For S 's choice of investment, the first-order condition for a maximum gives $I(\alpha, \Pi) = c'^{-1}[\alpha \cdot g(\Pi)]$. The second-order condition for a global maximum is satisfied. As can be observed, I is increasing in α and decreasing in Π . \square

Proof of Proposition 4

Observe that $C(u)$ is by definition increasing and satisfies $C(0) = 0$ and $C[g(b_\Pi)] < 1$. Further note that $I(\alpha, \Pi) = C[\alpha \cdot g(\Pi)]$ for all $\alpha \in [0, 1]$ and $\Pi \in [b_\Pi, \infty)$. Likewise, $Z(v)$ is by definition increasing with $Z(0) = 0$ and $Z(1/b_x) < b_\Pi - b_r$. Further note that $R(\alpha, \lambda) = Z[(1 - \alpha)/x(\lambda)]$ for all $\alpha \in [0, 1]$ and $\lambda \in [0, \infty)$.

To facilitate the proof, it will be convenient to rearrange S 's expected payoff. After some substitution and simplification, the expected payoff to S given α , λ , and Π can be expressed as:

$$\begin{aligned} W(\alpha, \lambda, \Pi) &= \Pi + I(\alpha, \Pi) \cdot g(\Pi) - r(\alpha) + w(\alpha) - c[I(\alpha, \Pi)] - x(\lambda) \cdot z[R(\alpha, \lambda)] \\ &= W_1(\alpha, \Pi) + W_2(\alpha, \Pi) + W_3(\alpha, \lambda), \end{aligned}$$

where the functions $W_1(\alpha, \Pi)$, $W_2(\alpha, \Pi)$, and $W_3(\alpha, \lambda)$ are defined as follows:

$$\begin{aligned} W_1(\alpha, \Pi) &= \Pi - r(\alpha) + w(\alpha), \\ W_2(\alpha, \Pi) &= I(\alpha, \Pi) \cdot g(\Pi) - c[I(\alpha, \Pi)], \\ W_3(\alpha, \lambda) &= -x(\lambda) \cdot z[R(\alpha, \lambda)]. \end{aligned}$$

We begin by calculating the partial derivative of $W(\alpha, \lambda, \Pi)$ with respect to α . The partial derivative of $W_1(\alpha, \Pi)$ with respect to α is simply:

$$\frac{\partial W_1(\alpha, \Pi)}{\partial \alpha} = w'(\alpha) - r'(\alpha).$$

The partial derivative of $W_2(\alpha, \Pi)$ with respect to α can be calculated as follows:

$$\begin{aligned}\frac{\partial W_2(\alpha, \Pi)}{\partial \alpha} &= \frac{\partial}{\partial \alpha} \{ \alpha \cdot I(\alpha, \Pi) \cdot g(\Pi) - c[I(\alpha, \Pi)] \} + \frac{\partial}{\partial \alpha} [(1 - \alpha) \cdot I(\alpha, \Pi) \cdot g(\Pi)] \\ &= [I(\alpha, \Pi) \cdot g(\Pi)] + [(1 - \alpha) \cdot \frac{\partial I(\alpha, \Pi)}{\partial \alpha} \cdot g(\Pi) - I(\alpha, \Pi) \cdot g(\Pi)] = (1 - \alpha) \cdot \frac{\partial I(\alpha, \Pi)}{\partial \alpha} \cdot g(\Pi),\end{aligned}$$

where the envelope theorem is used to compute the derivative of the expression inside braces after the first equality. The partial derivative of $W_3(\alpha, \lambda)$ with respect to α can be calculated as follows:

$$\begin{aligned}\frac{\partial W_3(\alpha, \lambda)}{\partial \alpha} &= \frac{\partial}{\partial \alpha} \{ (1 - \alpha) \cdot R(\alpha, \lambda) - x(\lambda) \cdot z[R(\alpha, \lambda)] \} + \frac{\partial}{\partial \alpha} [-(1 - \alpha) \cdot R(\alpha, \lambda)] \\ &= [-R(\alpha, \lambda)] + [R(\alpha, \lambda) - (1 - \alpha) \cdot \frac{\partial R(\alpha, \lambda)}{\partial \alpha}] = -(1 - \alpha) \cdot \frac{\partial R(\alpha, \lambda)}{\partial \alpha},\end{aligned}$$

where the envelope theorem is used to compute the derivative of the expression inside braces after the first equality. Hence, the partial derivative of $W(\alpha, \lambda, \Pi)$ with respect to α is given by:

$$\begin{aligned}\frac{\partial W(\alpha, \lambda, \Pi)}{\partial \alpha} &= \frac{\partial W_1(\alpha, \Pi)}{\partial \alpha} + \frac{\partial W_2(\alpha, \Pi)}{\partial \alpha} + \frac{\partial W_3(\alpha, \lambda)}{\partial \alpha} \\ &= (1 - \alpha) \cdot \frac{\partial I(\alpha, \Pi)}{\partial \alpha} \cdot g(\Pi) - (1 - \alpha) \cdot \frac{\partial R(\alpha, \lambda)}{\partial \alpha} - r'(\alpha) + w'(\alpha).\end{aligned}$$

It follows from $r'(1) > w'(1)$ that $\partial W(1, \lambda, \Pi)/\partial \alpha < 0$ for all $\lambda \geq 0$ and $\Pi \geq b_\Pi$. It follows from $r'(0) < w'(0)$, $\partial I(\alpha, \Pi)/\partial \alpha > 0$, and $\partial R(0, \lambda)/\partial \alpha < 0$ that $\partial W(0, \lambda, \Pi)/\partial \alpha > 0$ for all $\lambda \geq 0$ and $\Pi \geq b_\Pi$. Moreover, $\partial W(\alpha, \lambda, \Pi)/\partial \alpha$ is continuously decreasing in α for all $\alpha \in [0, 1]$, $\lambda \in [0, \infty)$, $\Pi \in [b_\Pi, \infty)$.

Hence, given any $\lambda \geq 0$ and $\Pi \geq b_\Pi$, there exists a unique ownership share $\alpha \in (0, 1)$ that maximizes the expected payoff $W(\alpha, \lambda, \Pi)$ to agent B . The maximizer $\alpha(\lambda, \Pi)$ is implicitly defined by the first-order condition:

$$[1 - \alpha(\lambda, \Pi)] \cdot \frac{\partial I[\alpha(\lambda, \Pi), \Pi]}{\partial \alpha} \cdot g(\Pi) - [1 - \alpha(\lambda, \Pi)] \cdot \frac{\partial R[\alpha(\lambda, \Pi), \lambda]}{\partial \alpha} - r'[\alpha(\lambda, \Pi)] + w'[\alpha(\lambda, \Pi)] = 0.$$

We next describe how changes in the profit level Π affect the ownership share $\alpha(\lambda, \Pi)$ at a given level of investor protection λ . Recall that $e^2 \cdot C'(k \cdot e)$ is increasing in e for all k and e such that $0 < k < 1$ and $0 \leq e \leq c'(1)/k$. The only term in the first-order condition that depends directly on Π is:

$$[1 - \alpha(\lambda, \Pi)] \cdot \frac{\partial I[\alpha(\lambda, \Pi), \Pi]}{\partial \alpha} \cdot g(\Pi) = [1 - \alpha(\lambda, \Pi)] \cdot C'[\alpha(\lambda, \Pi) \cdot g(\Pi)] \cdot [g(\Pi)]^2.$$

If $\alpha(\lambda, \Pi)$ is constant, an increase in Π will decrease the preceding expression, thereby lowering the left-hand side of the first-order condition. In order to offset this change, $\alpha(\lambda, \Pi)$ must decrease, thereby raising the left-hand side of the first-order condition. This implies that the ownership share $\alpha(\lambda, \Pi)$ is decreasing in the profit level Π at a given level of investor protection λ .

We now describe how changes in investor protection λ affect the ownership share $\alpha(\lambda, \Pi)$ at a given profit level Π . By assumption, $x(\lambda)$ is increasing in λ for all $\lambda \geq 0$. Recall that $Z'(k/e)/e$ is decreasing in e for all k and e such that $0 < k < 1$ and $e \geq b_x$. The only term in the first-order condition that depends directly on λ is:

$$-[1 - \alpha(\lambda, \Pi)] \cdot \frac{\partial R[\alpha(\lambda, \Pi), \lambda]}{\partial \alpha} = [1 - \alpha(\lambda, \Pi)] \cdot Z'\{[1 - \alpha(\lambda, \Pi)]/x(\lambda)\}/x(\lambda)$$

If $\alpha(\lambda, \Pi)$ is constant, an increase in λ will decrease the preceding expression, thereby lowering the left-hand side of the first-order condition. In order to offset this change, $\alpha(\lambda, \Pi)$ must decrease, thereby raising the left-hand side of the first-order condition. This implies that the ownership share $\alpha(\lambda, \Pi)$ is decreasing in investor protection λ at a given profit level Π . \square

Proof of Proposition 5

Applying the envelope theorem, the partial derivative of $W(\lambda, \Pi)$ with respect to λ can be calculated as follows:

$$\begin{aligned} \frac{\partial W(\lambda, \Pi)}{\partial \lambda} &= \frac{\partial W[\alpha(\lambda, \Pi), \lambda, \Pi]}{\partial \lambda} - h'(\lambda) = \frac{\partial}{\partial \lambda}(-x(\lambda) \cdot z\{R[\alpha(\lambda, \Pi), \lambda]\}) - h'(\lambda) \\ &= \frac{\partial}{\partial \lambda} \left\{ -x(\lambda) \cdot z \left[Z \left(\frac{1 - \alpha(\lambda, \Pi)}{x(\lambda)} \right) \right] \right\} - h'(\lambda) \\ &= x'(\lambda) \cdot \left\{ -z \left[Z \left(\frac{1 - \alpha(\lambda, \Pi)}{x(\lambda)} \right) \right] + z' \left[Z \left(\frac{1 - \alpha(\lambda, \Pi)}{x(\lambda)} \right) \right] \cdot Z' \left(\frac{1 - \alpha(\lambda, \Pi)}{x(\lambda)} \right) \cdot \frac{1 - \alpha(\lambda, \Pi)}{x(\lambda)} \right\} - h'(\lambda) \end{aligned}$$

For any $\Pi \geq b_\Pi$, the preceding assumptions imply that $\partial W(0, \Pi)/\partial \lambda > 0$, $\lim_{\lambda \rightarrow \infty} \partial W(\lambda, \Pi)/\partial \lambda < 0$, and $\partial W(\lambda, \Pi)/\partial \lambda$ is decreasing in λ for all $\lambda \geq 0$. It follows that there exists a unique maximizer $\lambda(\Pi)$, which is defined by the first-order condition:

$$-z \left[Z \left(\frac{1 - \alpha[\lambda(\Pi), \Pi]}{x[\lambda(\Pi)]} \right) \right] + z' \left[Z \left(\frac{1 - \alpha[\lambda(\Pi), \Pi]}{x[\lambda(\Pi)]} \right) \right] \cdot Z' \left(\frac{1 - \alpha[\lambda(\Pi), \Pi]}{x[\lambda(\Pi)]} \right) \cdot \frac{1 - \alpha[\lambda(\Pi), \Pi]}{x[\lambda(\Pi)]} = \frac{h'[\lambda(\Pi)]}{x'[\lambda(\Pi)]}$$

We now describe how changes in the profit level Π affect the level of investor protection $\lambda(\Pi)$. If $\lambda(\Pi)$ is constant, then an increase in Π lowers $\alpha[\lambda(\Pi), \Pi]$, which raises $[1 - \alpha(\lambda, \Pi)]/x[\lambda(\Pi)]$, thereby increasing the left-hand side of the first-order condition. In order to offset this change, $\lambda(\Pi)$ must rise, thereby decreasing the left-hand side and increasing the right-hand side of the first-order condition. This implies that investor protection $\lambda(\Pi)$ is increasing in the profit level. Along with the results above, it also implies that the ownership share $\alpha[\lambda(\Pi), \Pi]$ is decreasing in the profit level Π . \square

References

- Admati, Anat R., Paul Pfleiderer, and Josef Zechner (1994). "Large Shareholder Activism, Risk Sharing, and Financial Market Equilibrium." *Journal of Political Economy* 102(6):1097–1130.
- Atanassov, Julian, and E. Han Kim (2009). "Labor and Corporate Governance: International Evidence from Restructuring Decisions," *Journal of Finance* 64(1):341–374.

- Bebchuk, Lucian Arye (1999). "A Rent-Protection Theory of Corporate Ownership and Control." National Bureau of Economic Research, Working Paper 7203, <http://www.nber.org/papers/w7203>.
- Bolton, Patrick and Ernst-Ludwig Von Thadden (1998). "Blocks, Liquidity, and Corporate Control." *Journal of Finance* 53(1):1–25.
- Burkart, Mike, Denis Gromb, and Fausto Panunzi (1997). "Large Shareholders, Monitoring, and the Value of the Firm." *Quarterly Journal of Economics* 112(3):693–728.
- Calmfors, Lars and John Driffill (1988). "Bargaining Structure, Corporatism, and Macroeconomic Performance." *Economic Policy* 3(6):14–61.
- Cukierman, Alex and Francesco Lippi (1999). "Central Bank Independence, Centralization of Wage Bargaining, Inflation and Unemployment: Theory and Some Evidence." *European Economic Review* 43(7):1395–1434.
- Djankov, Simeon, Rafael La Porta, Florencio Lopez-de-Silanes, and Andrei Shleifer (2008). "The Law and Economics of Self-Dealing." *Journal of Financial Economics* 88(3):430–465.
- Gourevitch, Peter A. and James Shinn (2005). *Political Power and Corporate Control: The New Global Politics of Corporate Governance*. Princeton, NJ: Princeton University Press.
- Hall, Peter A. and Robert J. Franzese, Jr. (1998). "Mixed Signals: Central Bank Independence, Coordinated Wage Bargaining, and European Monetary Union." *International Organization* 52(3):505–535.
- Haucap, Justus, and Christian Wey (2004). "Unionisation Structure and Innovation Incentives," *Economic Journal* 114(494):C149–C165.
- Högfeldt, Peter (2007). "The History and Politics of Corporate Ownership in Sweden." In Randall K. Morck ed., *A History of Corporate Governance around the World: Family Business Groups to Professional Managers*. Chicago: National Bureau of Economic Research.
- Iversen, Torben (1998). "Wage bargaining, Central Bank Independence, and the Real Effects of Money," *International Organization* 52(3):469–504, data available at <http://www.people.fas.harvard.edu/~iversen/centralization.htm>.
- Kenworthy, Lane (2001). "Wage-Setting Measures." *World Politics* 54(1):57–98.
- La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert W. Vishny (1997). "Legal Determinants of External Finance." *Journal of Finance* 52(3):1131–1150.
- La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert W. Vishny (1998). "Law and Finance." *Journal of Political Economy* 106(6):1113–1155.
- La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert W. Vishny (2000). "Investor Protection and Corporate Governance." *Journal of Financial Economics* 58(1):3–27.

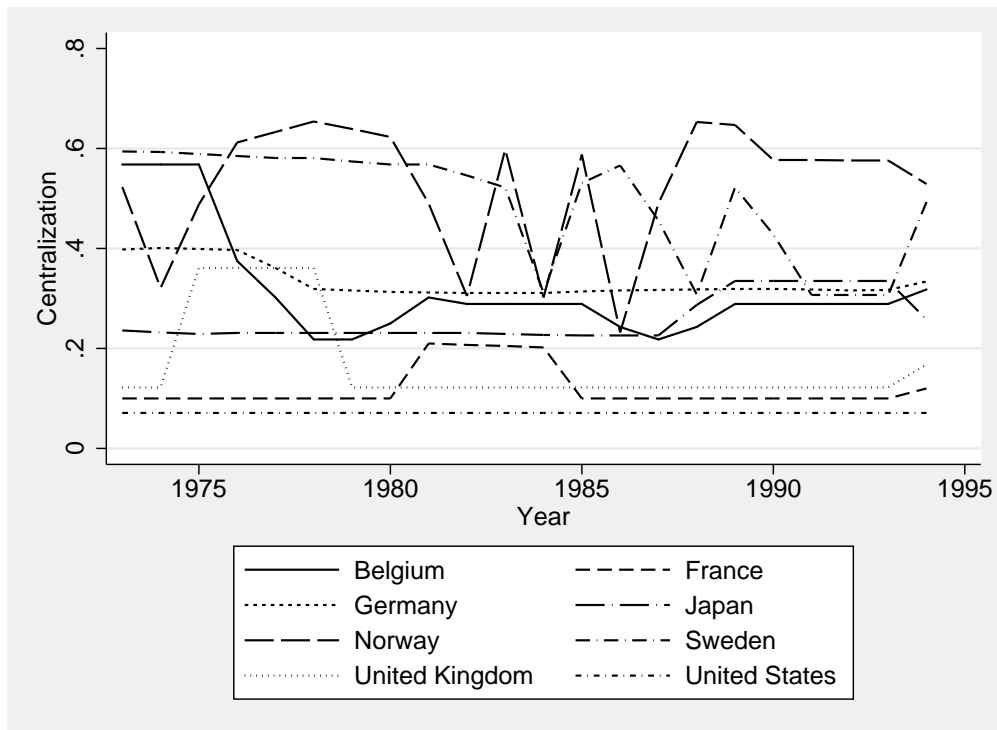
- Pagano, Marco, and Paolo F. Volpin (2005a). "The Political Economy of Corporate Governance," *American Economic Review* 95(4):1005–1030.
- Pagano, Marco, and Paolo F. Volpin (2005b). "Managers, Workers, and Corporate Control," *Journal of Finance* 60(2):841–868.
- Pontusson, Jonas, David Rueda, and Christopher Way (2002). "Comparative Political Economy of Wage Distribution: The Role of Partisanship and Labour Market Institutions." *British Journal of Political Science* 32(2):281–308.
- Rajan, Raghuram G. and Luigi Zingales (2003). "The Great Reversals: The Politics of Financial Development in the Twentieth Century." *Journal of Financial Economics* 69(1):5–50.
- Roe, Mark (2000). "Political Preconditions to Separating Ownership from Corporate Control," *Stanford Law Review* 53:539–606.
- Shleifer, Andrei, and Robert W. Vishny (1986). "Large Shareholders and Corporate Control," *Journal of Political Economy* 94(3):461–488.
- Traxler, Franz, Sabine Blaschke, and Bernhard Kittel (2001). *National Labour Relations in Internationalized Markets: A Comparative Study of Institutions, Change, and Performance*. Oxford: Oxford University Press.
- Jelle Visser (2009). *Database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts in 34 Countries between 1960 and 2007*, <http://www.uva-aias.net/208>, accessed April 16, 2013.
- Wallerstein, Michael (1999). "Wage-Setting Institutions and Pay Inequality in Advanced Industrial Societies." *American Journal of Political Science* 43(3):649–680.

Table 1: Centralization and Corporate Governance

Legal origin Country	Centralization (Traxler et al.)	Centralization (Iversen)	Union density	Ownership concentration	Anti-self- dealing	Market capitalization	Block premium
English	4.9	0.206	35.35	0.32	0.79	102.62	0.02
Australia	9.9	0.499	36.48	0.28	0.76	101.97	0.01
Canada	1	0.071	32.10	0.4	0.65	106.18	0.01
Ireland	9.9	.	45.62	0.39	0.79	67.65	.
New Zealand	5	.	42.39	0.48	0.95	40.10	0.04
United Kingdom	2.6	0.182	38.08	0.19	0.95	157.70	0.00
United States	1	0.071	17.41	0.2	0.65	142.14	0.02
French	5.83	0.242	32.68	0.46	0.39	85.29	0.07
Belgium	3.9	0.309	50.08	0.54	0.54	67.16	.
France	4	0.127	12.96	0.34	0.38	89.49	0.01
Italy	9.4	0.167	40.13	0.58	0.42	52.77	0.16
Netherlands	6	0.366	27.55	0.39	0.2	131.74	0.03
German	4.5	0.315	31.28	0.41	0.32	97.30	0.14
Austria	5	0.439	46.11	0.58	0.21	16.39	0.38
Germany	6	0.334	29.64	0.48	0.28	54.69	0.11
Japan	2	0.24	26.26	0.18	0.5	69.17	-0.01
Switzerland	5	0.248	23.23	0.41	0.27	248.96	0.07
Scandinavian	9.43	0.488	69.29	0.37	0.42	96.92	0.02
Denmark	7.3	0.482	73.26	0.45	0.46	58.60	0.04
Finland	11	0.428	70.69	0.37	0.46	177.11	0.01
Norway	11	0.517	55.72	0.36	0.42	39.69	0.01
Sweden	8.4	0.525	77.49	0.28	0.33	112.27	0.03
Mean	6.02	0.313	41.39	0.38	0.51	96.32	0.06
(s.d.)	(3.33)	(0.16)	(18.63)	(0.12)	(0.23)	(58.21)	(0.1)

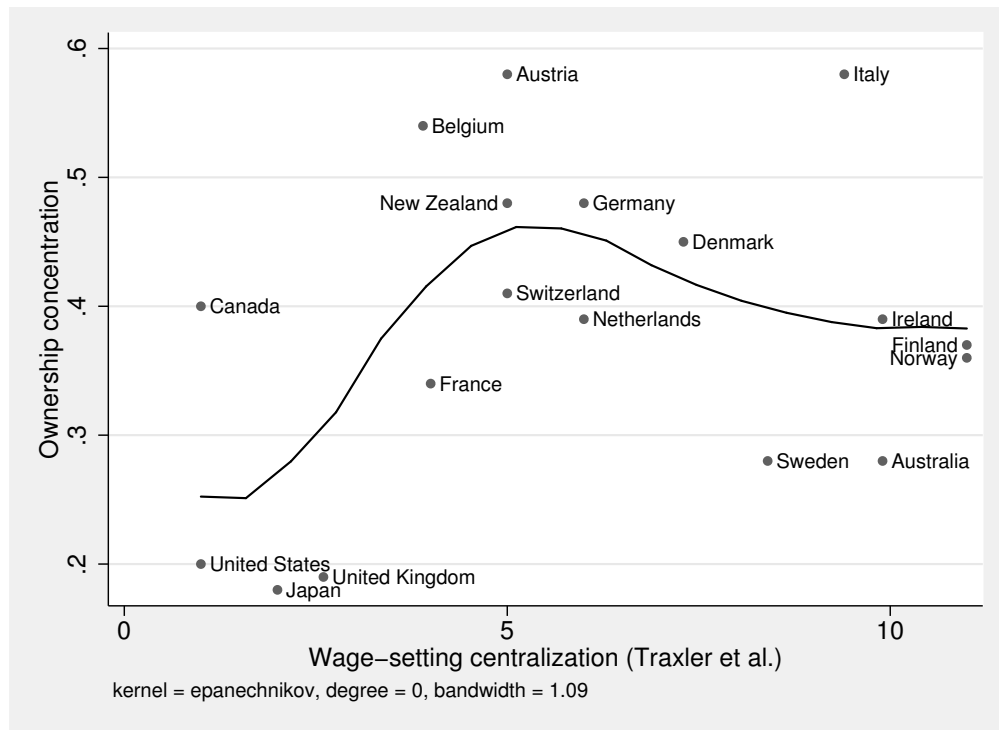
Sources: Centralization: Traxler et al. (2001) and Iversen (1998); union density: Visser (2009); ownership concentration, anti-self-dealing, market capitalization, and block premium: Djankov et al. (2008).

Figure 1: Centralization Across Time



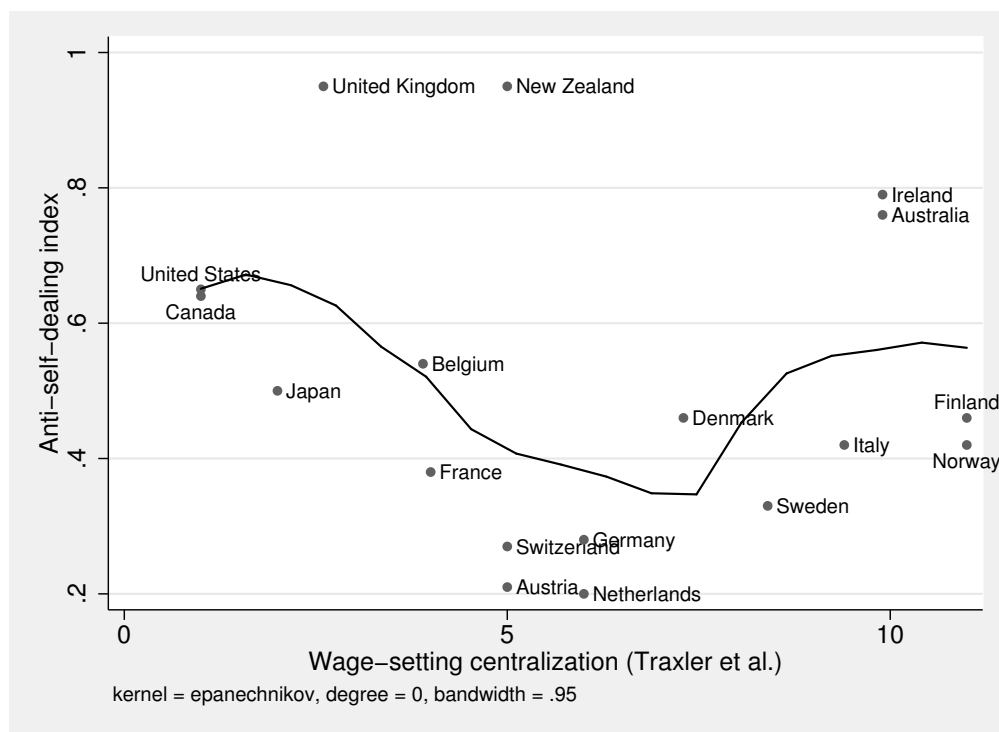
Sources: Iversen (1998).

Figure 2: Centralization and Ownership Concentration



Kernel-weighted local polynomial smoothing. Bandwidth chosen by Stata default, which is based on rule-of-thumb methods. Sources: centralization: Traxler et al. (2001); ownership concentration: Djankov et al. (2008).

Figure 3: Centralization and Anti-Self-Dealing



Kernel-weighted local polynomial smoothing. Bandwidth chosen by Stata default, which is based on rule-of-thumb methods. Sources: centralization: Traxler et al. (2001); anti-self-dealing: Djankov et al. (2008).