# CAPITAL, LABOR, AND THE FIRM: A STUDY OF GERMAN CODETERMINATION

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**Abstract**
Under the German corporate governance system of codetermination, employees are legally allocated control rights over corporate assets through seats on the supervisory board—that is, the board of nonexecutive directors. The supervisory board oversees the management board—the board of executive directors—approves or rejects its decisions, and appoints its members and sets their salaries. We empirically investigate the implications of this sort of labor participation in corporate decision making. We find that companies with equal representation of employees and shareholders on the supervisory board trade at a 31% stock market discount as compared with companies where employee representatives fill only one-third of the supervisory board seats. We show that under equal representation, management board compensation provides incentives that are not conducive to furthering shareholders' interests, possibly because labor maximizes a different objective function than shareholders. We document that, under equal representation, companies have longer payrolls than their one-third representation peers have. Finally, we provide evidence that shareholders respond to the allocation of control rights to labor by linking supervisory board compensation to firm performance and by leveraging up the firm. (JEL: G32, G34)

> *The campaigns for . . . codetermination on boards of directors appear to be attempts to control the wealth of stockholders' specialized assets . . . a wealth confiscations scheme.* (Alchian, 1984, p. 46)

> *Laws on Codetermination, combined with a tradition of patriarchal concern, have made European CEOs deeply committed to their employees, treating them more like partners in a long-term enterprise than anonymous factors of production.* (Henzler, 1992, p. 60)

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## 1. Introduction

Corporate governance structures vary in significant ways around the world, which raises important questions of economic welfare (see, e.g., Shleifer and Vishny 1997). Most notably, there are marked differences across countries in the degrees to which employees participate in running the firm (see, e.g., Rippey 1988; Hansmann 1990). In German corporations, for instance, depending on the number of staff, employees are legally allocated control rights through seats on the board; but, unlike shareholders, these employees have no cash flow rights (in the usual sense of residual financial claims). The concept of codetermination rests on the notion that the suppliers of equity capital and the suppliers of labor run the firm cooperatively. More specifically, codetermination, to a degree, legally "entrenches" employees in the firm, helping them protect their interests against potential opportunistic behavior of shareholders. If contracts are incomplete, allocating some control rights to employees may be optimal, as employees may only then be willing to develop firm-specific human capital.[1] Also, employees in a codetermined system may monitor management, which otherwise would not necessarily act in the interests of outside shareholders. In this paper, we empirically study the implications of the German system of labor participation in corporate decision making at the board level.

In Germany, the corporate board system is two-tiered. There is the supervisory board, which is the board of non-executive directors, and there is the management board, which consists of the executive directors and is chaired by the CEO. It is the management board that determines the strategic direction of the firm. The supervisory board, on the other hand, oversees the management board, approves or rejects its decisions, and appoints its members and sets their salaries. Codetermination laws apply to private limited corporations (GmbH) with more than 500 employees and to stock corporations (AG), which may be private or public. If a corporation has consistently more than 2,000 staff, one-half of the supervisory board seats are filled with employee representatives; otherwise, this share is one-third. Further, companies with equal representation are obliged to dedicate a management board position to labor affairs. Depending on the type of equal representation, of which there are two, this labor director (*Arbeitsdirektor*) may not be appointed against the majority of votes of the employee representatives on the supervisory board. Although equal-representation companies are unionized by means of law, codetermination is different from unionization because

1. Firm-specific human capital can be substantial. Topel (1990) finds that, in the United States, long-tenured employees that are laid off through no fault of their own (e.g., as a result of a plant closing) typically earn 15% to 25% less on their next jobs. May (1995) finds evidence that older (U.S.) managers, with (presumably) more at stake in their firm, are more likely to engage in diversifying actions.

employees, and not just those in unions, can potentially influence the firm's operations and the distribution of the surplus. Note that, in Germany, there is also labor participation in decision making at the shop-floor level.

Corporate control rights that emanate from voting stock have been found to be valuable (see Securities and Exchange Commission 1987, Lease, McConnell, and Mikkelson 1983, 1984, among others). The same cannot be said for voting rights that emanate from board seats. Studies have found that board structure, typically gauged by the combination of inside and outside directors, is not related to corporate performance. See Hermalin and Weisbach (2003) for a survey of the literature. Also, boards in the United States are widely held to be ineffective (see, e.g., Morck, Shleifer, and Vishny 1989). On the other hand, as Hermalin and Weisbach point out, the independence of outside directors is unobservable and the choice of directors is, in any case, endogenous, which means that the empirical results to date are far from definitive.

Codetermination is a governance structure that lends itself to scrutinizing the value of board seats. This is because codetermination is imposed by means of law and, consequently, exogenous. Employees may well maximize a different objective function from that of shareholders and bring this to bear in their voting behavior. It is an empirical question, though, whether the supervisory board is effective in influencing the behavior of the firm in important ways. Most notably, Kaplan (1994) provides some evidence that German supervisory boards are effective in removing managers when the firm performs poorly.

Codetermination also raises the welfare question of whether control rights that emanate from board seats should be allocated exclusively to shareholders. Jensen and Meckling (1979) point out that codetermination is a binding constraint and hence inefficient; if it were otherwise, the shareholders would adopt it voluntarily. Freeman and Lazear (1995) and Levine and Tyson (1990) take a different point of view, arguing that codetermination, although it might not be in the shareholders' interest, might be socially efficient. It is possible that the firm's total revenues would increase with codetermination, but the owners' share would shrink (Freeman and Lazear 1995; see also Dow 1993). Alternatively, it may be that, although codetermination may be privately beneficial for each firm individually, there is a coordination failure because no firm wants to risk being the first to adopt codetermination (see Levine and Tyson 1990).

The allocation of control rights over corporate assets may have important implications for economic efficiency. Owners of small and medium-sized companies regard the public limited corporation, which allows the firm to expand beyond the entrepreneur's limited wealth, as an unattractive organizational form, partly due to codetermination (see Bank of England 1984). Also, employees may want to use the firm as an intertemporal insurance vehicle, resisting restructuring, layoffs, and wage reductions and protecting themselves against (idiosyncratic or business cycle) shocks, as predicted by the theoretical models of Chang (1992)

and Miyazaki (1984). There is some indirect evidence for this. For instance, the wage structure in Germany is remarkably stable (Prasad 2000) and displays relatively little dispersion as compared with other developed economies (Nickell and Bell 1996). In a similar vein, companies with strong labor unions in the United States tend to be less responsive to labor market conditions (see e.g., Freeman and Medoff 1981, 1984).

We empirically investigate the following broad questions. First, does equal representation on the supervisory board, as compared with one-third representation, affect the performance of the firm, possibly because labor alters the firm's objective function? If labor succeeds in altering the objective function of the firm—away from maximizing shareholder wealth—this would be mirrored in the incentives the supervisory board provides to the management board—the board that runs the day-to-day operations of the firm. In other words, if labor succeeds in altering the operations of the firm, then it might be because labor alters managerial remuneration. On the other hand, it is possible that there are no discernable effects of codetermination, either because employee representation on the supervisory board does not wield enough power to affect the operations of the firm and the distribution of its surplus or because shareholders have implemented effective countermeasures.[2] Second, we investigate whether shareholders take countermeasures in attempts to offset the voting power of employee representatives on the supervisory board. One possible countermeasure concerns capital structure. Shareholders may increase firm leverage to commit more of the firm's cash flow to external creditors. As discussed below, this has been a response of shareholders to unionization in the United States. Another possible countermeasure concerns the performance sensitivity of the compensation of board members. The shareholders may change the incentives of the members of the supervisory board by altering the remuneration structure. We empirically investigate these issues.

The paper proceeds as follows. Section 2 is a brief literature survey. Section 3 provides some background on the German governance system of codetermination and German corporate finance. Section 4 introduces the data and discusses share ownership in Germany. Section 5 reports on the empirical results with regard to effects of equal representation on firm performance. Section 6 scrutinizes managerial compensation and staffing at the firm with equal representation for evidence that labor succeeds in altering the objective function of the firm. Section 7 studies supervisory board compensation and the firm's capital structure in attempt to learn about possible shareholder countermeasures to codetermination. Finally, Section 8 concludes.

2. For example, over the years, shareholders have tried to weaken the power of the supervisory board by curbing its competence in the firm (see Kommission Mitbestimmung 1998, p. 103). This has been the subject of numerous court cases.

## 2. The Literature on Codetermination and Related Issues of Worker Control

There is relatively little quantitative work on the effects of codetermination at the supervisory board level. As FitzRoy and Kraft (1993, p. 366) put it, "there have been few attempts to quantify economic effects, and they all suffer from inadequate data and methodology." In this section we briefly provide an overview of some recent literature on codetermination and some related issues. For a survey on earlier codetermination literature, see Kraft (1989).

FitzRoy and Kraft (1993) analyze 68 companies in two years: 1975, the year before the 1976 extension of equal representation beyond the coal and steel industries, and 1983. They estimate translog value-added equations and find that codetermination reduces productivity by 19.7%.[3] They also find that the return on equity declines. Cable and FitzRoy (1980) estimate a Cobb–Douglas production function using data on 42 companies. They employ a measure of participation derived from a questionnaire and find that participation increases productivity. Schmid and Seger (1998) analyze the effects of equal representation on firm performance for a sample of 64 observations, pooled over the years 1976, 1987, and 1991. These authors find that the 1976 codetermination regime depresses the market value of the affected corporations by between 18% and 20%. Baums and Frick (1998), using standard event study methodology, analyze for the period 1974–1995 the impact of 28 court decisions concerning the implementation of codetermination laws in 23 companies. In 14 of the 28 decisions, the court ruled in favor of extensive codetermination, while in 10 cases the court came down on the side of more restrictive labor participation in decision making. The authors find no statistically significant stock market response to the verdicts.

The question of how employee control or influence over the disposition of corporate assets affects firm behavior and value has been addressed generally in the literature on labor unions. With labor unions, workers are not allocated control rights, but may have more bargaining power than otherwise. Ruback and Zimmerman (1984), using event study methodology, find that announcements of unanticipated collective bargaining agreements reduce equity value. Salinger (1984) studies monopolized industries and finds that unions capture most monopoly rents. Abowd (1989) finds that union members' wealth and shareholders' wealth move in opposite directions when there is an unexpected change in bargained labor costs. Also, see Freeman and Medoff (1984), Clark (1984), Bronars and Deere (1990, 1991), and Voos and Mishel (1986), among others. In

3. Let $\beta$ be the regression coefficient of a 0/1 variable, then the change in the dependent variable as a result of a switch of this indicator variable from zero to one amounts to $e^{\beta} - 1$. For details see Halvorsen and Palmquist (1980). Based on the regression coefficients presented by FitzRoy and Kraft (1993, Table 2), the mentioned decrease of 19.7% is calculated as follows: $e^{0.13} - e^{-0.06}$.

general, the conclusion is that unionization is associated with lower firm profitability (see Hirsch 1991 for a brief survey.) But whereas unions are successful in redistributing firm surplus towards workers, there is little evidence that they are able to alter the firm's operating decisions, that is, its objective function.

Stockholders or capitalists respond to unions and the threat of unionization by leveraging up the firm, committing the firm to pay out cash. Bronars and Deere (1991, p. 232) "find strong evidence of a positive relationship between unionization and debt-equity ratios using a set of large, publicly traded firms." This empirical result is confirmed by Garvey and Gaston (1996) and is consistent with bargaining models in which financing with senior debt commits the firm to a tougher bargaining stance with respect to negotiated wages (Perotti and Spier 1993). We examine this issue as well.

## 3. The German Codetermination System and Corporate Governance

In this section we provide some background on the German system of corporate governance and pertinent codetermination laws. We also examine the identities of supervisory board members.

### *3.1. Legal Forms of Corporate Ownership and Codetermination*

German codetermination laws apply to corporations, which predominantly have the legal status of a GmbH (literally, corporations with limited liability) or an AG (literally, stock corporation). Whereas the GmbH is a private corporation, the AG may be public—that is, traded on the stock exchange—or private.

Both types of corporations are governed by a two-tier board system. This board system comprises a management board (*Vorstand*, or board of executive directors) and a supervisory board (*Aufsichtsrat*, or board of non-executive directors). The GmbH is not required to have a supervisory board as long as it is not subject to codetermination legislation, that is, as long as it does not have more than 500 employees. The management board runs the company and reports to the supervisory board. The main function of the supervisory board is to control and monitor management and, in this capacity, appoint and dismiss members of the management board, set their compensation, and (as detailed in the corporation's articles of association) approve the management board's decisions. In particular, management decisions on corporate restructuring, changes to the lines of business, and other strategic realignments require supervisory board approval.

There are three different regimes of labor representation at the board level in Germany, which are governed by three major codetermination laws. First, there is the so-called *Montan* Codetermination Act of 1951, which applies to a select set

of companies in the coal and steel industries. Under *Montan* codetermination, the supervisory board consists of the same number of shareholder and employee representatives. There is also a so-called neutral member on the supervisory board, to break ties. Moreover, there is a labor director (*Arbeitsdirektor*) on the management board. Unlike other members of the management board, this member cannot be appointed against the majority of votes of the employee representatives. Second, there is the Codetermination Act of 1976, which applies to all (not *Montan*-codetermined) corporations with consistently more than 2,000 staff. Similar to the 1951 *Montan* Codetermination Act, the 1976 Codetermination Act stipulates equal representation of shareholders and employees on the supervisory board. At least one employee representative must be from middle management (*leitende Angestellte*). Like under the 1951 *Montan* Codetermination Act, there is a labor director on the management board. But there are two significant differences between these two laws. Under the 1976 Codetermination Act, the labor director can be appointed against the majority of votes of the employee representatives, and the chairman of the supervisory board, who generally is elected from the shareholder representatives, commands over a second, tie-breaking vote. Third, there is the Industrial Constitution Act of 1952, which stipulates that for (not *Montan*-codetermined) corporations with staff between 500 and 2,000, one-third of the supervisory board consist of employee representatives. Stock corporations established prior to August 10, 1994, are subject to one-third representation even if they have fewer than 500 staff, unless they are family-owned.[4]

The importance of codetermination as an organizational characteristic of the German economy is displayed in Table 1. The table shows the degree to which employees are governed by various types of codetermination in the private sector and the economy overall. Employees are categorized as governed by so-called dual codetermination if their employers have works councils—that is, codetermination at the shop-floor level—as well as equal representation on the supervisory board. Equal representation on the supervisory board may be *Montan* codetermination or equal representation according to the 1976 Codetermination Act. Single codetermination refers to a regime where there are works councils but no equal representation on the supervisory board. Companies without equal representation on the supervisory board may have one-third representation according to the 1976 Codetermination Act or have no labor representation on the supervisory board at all. Employees are assigned to a regime of no codetermination if their employers

4. The Industrial Constitution Act exempts from codetermination companies that pursue political goals or goals related to the labor movement; also, the law exempts from codetermination companies that pursue religious, charitable, educational, scientific, artistic, or similar interests. Further, the law exempts from codetermination family-owned stock corporations with less than 500 employees. All these exemptions carry over to the 1976 Codetermination Act. Further, the 1976 Codetermination Act exempts from codetermination corporations in the media industry in accordance with the constitutional freedom of expression.

TABLE 1. Fraction of employees by codetermination type

| Fraction of employees by codetermination type | | |
|---|---|---|
| *Panel A: Private sector* | | |
| Codetermination type | 1984 | 1994–1996 |
| Dual codetermination | 30.5 | 24.5 |
| Single codetermination | 18.9 | 15.0 |
| No codetermination | 50.6 | 60.5 |
| Total (percent) | 100 | 100 |
| *Panel B: Whole economy (private, public, and nonprofit sectors)* | | |
| Codetermination type | 1984 | 1994–1996 |
| Dual codetermination | 22.2 | 18.2 |
| Single codetermination | 40.8 | 36.9 |
| No codetermination | 37.0 | 44.9 |
| Total (percent) | 100 | 100 |

Notes: Employees fall into the category of so-called dual codetermination if their employers have both works councils (codetermination at the shop-floor level) and equal representation on the supervisory board. Equal representation on the supervisory board may be *Montan* codetermination according to the 1956 *Montan* Codetermination Act or equal representation according to the 1976 Codetermination Act. Employees are assigned to the so-called single codetermination regime if their employers have works councils and no equal representation on the supervisory board. Companies without equal representation on the supervisory board may be subject to one-third representation according to the 1952 Industrial Constitution Act or have no labor representation on the supervisory board. Employees are assigned to a regime of no codetermination if their employers have neither works councils nor equal representation on the supervisory board. Source: Kommission Mitbestimmung (1998).

have neither works councils nor equal representation on the supervisory board. The public sector generally has representation at the shop-floor level, but supervisory boards do not exist. Media companies and many nonprofit organizations are exempt from codetermination due to the constitutional freedoms of expression and faith.

In our analysis, we concentrate on the most common forms of codetermination at the supervisory board level, which are equal representation (exclusive of *Montan* codetermination) and one-third representation. We measure the effect of equal representation—relative to one-third representation—on publicly traded corporations. The difference across the two codetermination regimes in the power that labor wields in firm decision making is illustrated by the jargon used in Table 1, which was taken from Kommission Mitbestimmung (1998), a bipartisan committee that was commissioned to study the effects of the 1976 Codetermination Act. As the table demonstrates, one-third representation, in labor union parlance, is not considered to be codetermination at all. The labor union practice of confining the term codetermination at the supervisory board level to equal representation is in concurrence with the findings of several field studies that confirm the extra influence of equal representation (Niedenhoff 2002; Gerum, Steinmann, and Fees 1988). Although the shareholders have the option to vote down labor by means of the chairman's second, tie-breaking vote, they rarely do

so, as reported by Kommission Mitbestimmung (1998, pp. 95, 103). Rather, the vast majority of decisions on the supervisory board of the equal-representation firm are unanimous.

### *3.2. The Ownership Structure of German Corporations, Banks, and Monitoring*

In addition to codetermination, there are other ways in which the German governance system differs from the Anglo-American system. One interesting feature of corporate governance in Germany is the prevalence of block shareholders. In stock market-based economies, outside block shareholders are often viewed as monitors of the firm's management (see, e.g., Shleifer and Vishny 1986, Kahn and Winton 1998, and Maug 1998). Yet, the empirical evidence for this in the United States is mixed (see, e.g., Demsetz and Lehn 1985, Mikkelson and Ruback 1985, and Holderness and Sheehan 1988). In Germany, block share holding is much more pervasive compared with the stock market-based economies of the United States or the United Kingdom. The samples in Gorton and Schmid (2000) display the importance of block shareholders in Germany: 65 (162) of 82 (283) corporations in their small (large) 1975 sample have investors holding at least 25%; for their small (large) 1986 sample it is 40 (171) of 56 (280). Also, Franks and Mayer (2001) study a sample of 171 German companies during the late 1980s and find that in 85% of these companies there is a single shareholder that holds at least 25%.

Such pervasive block holding is very different from what is observed in the United States and the United Kingdom. In the United States, a 1984 survey of corporations listed on stock exchanges showed that only 20% had at least one nonofficer who owned 10% of the stock, and only 13% of the companies were majority-owned (see Holderness and Sheehan 1988). In the United Kingdom, the fraction of public limited companies with a majority shareholder is also far smaller than in Germany (see Edwards and Fischer 1994). We will investigate the role of block shareholders, paying particular attention to their identities.

Another important feature of the German corporate governance system concerns the role of banks. Banks play a much more important role in corporate governance in Germany than in the United States or the United Kingdom, as described in Gorton and Schmid (2000) and Edwards and Fischer (1994). Gorton and Schmid study the effects of bank holdings of equity control rights on the performance of (nonfinancial) corporations. They find that in the 1970s and 1980s there is a significant, positive relation between bank equity control rights and firm performance as measured by the market-to-book ratio of equity. Here we will examine this question for the 1990s. Also, as shown by Gorton and Schmid (2000), bank control rights holdings translate into supervisory board seats. As

with nonbank block shareholders, the presence of bank representatives on the supervisory board may be important in bargaining with employees.

Other unique features of the German governance system are proxy voting by banks and voting restrictions. In Germany, banks cast votes by proxy for many of the shares of dispersed shareholders at the annual shareholder meeting. Although this would appear to drastically increase the power of banks, Gorton and Schmid (2000) find no discernable impact of proxy voting on firm performance. The authors explain this by the endogeneity of proxy voting, arguing that proxy voting results from the firm's shareholder structure, which the authors control for in their regression equations. Data on bank proxy voting are difficult and expensive to come by. As Gorton and Schmid do not find significant effects of proxy voting by banks, we do not pursue this issue here. A similar point can be made about voting restrictions, which existed during the sample period but have since phased out. Voting restrictions limit the votes of large shareholders to a certain fraction of the total voting stock. Because these caps are voted on at annual shareholders meetings, the information content of this variable may be encompassed in the company's shareholder structure.

Our analysis will take account of the firm's shareholder structure, which is the holding of equity control rights by various types of agents and the degree of equity control rights concentration. In Section 4 we explain how we measure these variables.

### *3.3. Supervisory Board Composition*

As the supervisory board is the central institution affected by codetermination, it is worth examining the identities of the individuals on the board. Information on the composition of the supervisory board was compiled by Gerum, Steinmann, and Fees (1988), a study that draws on a survey from May 31, 1979.

Gerum, Steinmann, and Fees (1988) report that companies without an equity interest in the firm hold 18.5% of the shareholder representatives' supervisory board seats—the largest fraction of any group representing the shareholders. These companies without an quity interest are typically related businesses, such as partners and suppliers. Consultants, such as lawyers and auditors, are the next largest group, totaling 13.5% of all shareholder representatives. Finally, there are bank and nonbank block shareholders. Overall, about one-third of the shareholder representatives have no equity interest in the company. Also, some of these groups, such as consultants, would appear to have interests more closely aligned with management than with outside shareholders.

The employee representatives on the supervisory board are overwhelmingly workers who are not affiliated with labor unions or works councils (58.6%). The next largest group, however, consists of labor union representatives that are

not actually employees of the company (29%). The third largest group consists of middle management (13.7%). In order for the employees to bring to bear significant influence in firm decision making, these three groups of employee representatives must act in concert.

## 4. The Ownership Structure of German Corporations

Our analysis primarily consists of regressing measures of firm value, leverage, board compensation, and other firm characteristics on control rights variables and a set of normalizing regressors. The set of control rights variables comprises an indicator variable that is equal to one for equal representation (and zero for one-third representation) and a set of equity control rights variables. Whereas codetermination is an allocation of control rights in the form of supervisory board seats, equity control rights emanate from voting stock. We are interested in measuring the size of the largest holder of equity control rights and the voting threshold it crosses—effectively, a measure of the concentration of equity ownership. We argue that equity control rights are predetermined, that is, not caused by firm performance or by the presence or absence of codetermination.

### *4.1. Data*

Our data set consists of annual observations for the period 1989–1993 of the largest 250 German nonfinancial stock corporations traded in at least one of the top-tier stock market segments at the time—*amtlicher Handel* or *geregelter Markt*. The construction of the sample is detailed in Appendix A. In forming the sample, company size is measured by total assets, based on unconsolidated reports. From the sample of 250 corporations, companies are omitted if they are in financial distress, involved in bankruptcy proceedings, or engaged in mergers.[5] Also omitted are financial holding shells, real estate companies, public transport companies, cooperatives, and *Kommanditgesellschaften auf Aktien* (KGaA)—a hybrid organizational form between a partnership and a stock corporation. We discard observations where a company, during the fiscal year in question, transformed into a stock corporation. Moreover, we drop companies that are subject to *Montan* codetermination (four observations) or not subject to codetermination at all (six observations).[6] This leaves a total of 902 observations for the five-year

5. We define financial distress as a situation where the absolute value of the firm's loss exceeds the reserves (*Rücklagen*), that is, where the book value of equity falls short of the nominal value.

6. We also eliminated two other companies, which have special codetermination arrangements. One of the two corporations operates (some of its) power plants in Switzerland. This company has a codetermination arrangement that is legalized by a special contract between Switzerland and

period analyzed. Due to missing data, the actual available number of observations may be smaller, and not all regressions will have the same number of observations. Also, the number of observations differs across years because new corporations enter the sample as they are founded or transformed into stock corporations within the analyzed time period.

### *4.2. Ownership of German Corporations*

Measuring control that emanates from equity ownership in Germany is complicated because pyramiding and cross-shareholding separate cash flow rights (claims to residual cash flows) from control rights. Franks and Mayer (2001) and Emmons and Schmid (1998) discuss these ownership structures in Germany. La Porta, Lopez-de-Silanes, and Shleifer (1999) provide a methodology for calculating equity control rights when equity ownership structures are complex. We proceed accordingly and calculate the equity control rights held by the so-called ultimate owner, taking account of pyramids and cross-shareholding.[7] See Gorton and Schmid (2000) for details.

Table 2 describes the size of equity control rights stakes and their ultimate owners. The pervasiveness of block holding is apparent. The last row of the table shows that 63% of the corporations have an ultimate owner who controls at least 50% of the voting rights. Families control at least 50% of the voting rights in 12% of the companies. Domestic nonfinancial companies constitute the modal category of the largest owner, followed by families, foreign nonfinancial companies, domestic banks, management, and domestic government entities.

Our regression analysis will take the structure of equity control rights as predetermined with respect to firm performance. In other words, we assume that holders of equity control rights do not purchase their shares in anticipation of the firm performing well. To examine if this is a reasonable assumption, we study the shareholder structure of our sample companies for control changes over the analyzed time period. We define a change of control as an instance where the identity of the largest ultimate owner changes. Such instances comprise block trades (an investor sells a block of shares to another investor, possibly of the same ultimate-owner type), floating of blocks in the market, or accumulation of

Germany. The second corporation is a gas utility that is majority-owned by the city of Frankfurt a.M. This company has agreed to increase the number of its employee representatives beyond what is required by law.

7. Faccio and Lang (2002) suggest an alternative method of calculating control rights. The only difference between the method of La Porta, Lopez-de-Silanes, and Shleifer (1999) and the one of Faccio and Lang is the handling of pyramids ("weakest link" versus "multiplication") and cross-shareholdings. In 1991, for instance, among the original 250 companies we started out with, we observed 28 pyramids (mostly just one layer) and one case of cross-shareholding.

TABLE 2. Equity control right stakes by size and identity of holder

| Type of ultimate owner | Number (percentage) of companies | | | | |
|---|---|---|---|---|---|
| Size of equity control rights stake | (1) ≥0.05 | (2) ≥0.25 | (3) ≥0.5 | (4) ≥0.75 | (5) Biggest stake |
| Management | 18 (10) | 13 (7) | 10 (5) | 2 (1) | 15 (8) |
| Families, incl. trusts | 44 (23) | 31 (17) | 22 (12) | 10 (5) | 30 (16) |
| Banks, domestic | 40 (22) | 24 (13) | 4 (2) | 2 (1) | 18 (10) |
| Banks, foreign | 1 (1) | 1 (1) | 0 (0) | 0 (0) | 0 (0) |
| Nonfinancial firm, domestic | 97 (52) | 87 (47) | 63 (34) | 36 (19) | 73 (39) |
| Nonfinancial firm, foreign | 26 (14) | 23 (12) | 20 (11) | 16 (9) | 23 (12) |
| Government entities (incl. trusts), domestic | 18 (10) | 11 (6) | 9 (5) | 2 (1) | 11 (6) |
| Government (incl. trusts), foreign | 2 (1) | 0 (0) | 0 (0) | 0 (0) | 1 (1) |
| Insurers, domestic | 23 (12) | 10 (5) | 2 (1) | 2 (1) | 9 (5) |
| Insurers, foreign | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Trusts not elsewhere classified | 1 (1) | 1 (1) | 0 (0) | 0 (0) | 1 (1) |
| Private equity fund, domestic | 3 (2) | 2 (1) | 2 (1) | 0 (0) | 2 (1) |
| Private equity fund, foreign | 1 (1) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Largest stakeholder | 177 (95) | 159 (85) | 117 (63) | 52 (28) | — |
| Number of companies | 186 | | | | |

Notes: Ultimate owners are shareholders that are viewed as agents in control of blocks of voting rights, as opposed to financial holding shells, which are simply control vehicles. The control rights stakes are not added up by type of ultimate owner. If, for instance, a company has two block shareholders of the same type, then these two blocks count as two observations. The observations itemized in column (5) are not mutually exclusive, due to ties. The table reports on the 1993 sample before observations with zero or missing sales and employees data were omitted for the regressions. The observations are from September 30, 1992. Source: *Saling Aktienführer* 1993, Darmstadt, Germany: Hoppenstedt & Co., 1992.

previously dispersed shares. We find that control in the firm changes, on average, once every 17 years. This leads us to conclude that we may treat the shareholder structure as a predetermined variable in our analysis.[8]

We control for equity control rights in the regression analysis in two ways. First, we control for the equity control rights held by three types of ultimate owners that have been found to affect the stock market performance or the objective function of the firm. Second, we control for shareholder concentration through the size of the largest equity control rights stake held by an individual investor and the voting threshold it crosses. Among the three types of ultimate owners we account for is the government, which may have a different objective function than private-sector shareholders. We also control for the influence of banks, which Gorton and Schmid (2000) have been found to be important for firm performance in Germany. Finally, we include in the regression equations the fraction

8. There is also the issue of whether codetermination bears on the firm's shareholder structure. It may be that, when a firm crosses the 2,000-employee threshold (and thus becomes subject to equal representation), the identity of the block shareholders changes, as well as the size of their blocks. Then again, the shareholder structures of our sample firms are remarkably stable over the analyzed time period.

of equity control rights held by firm insiders, defined as management, other employees, and families. By holding cash flow rights, insiders have an incentive to maximize the market value of the firm, but because of holding voting rights, insiders might be entrenched in the firm, allowing them to pursue their own private interests (see, e.g., Morck, Shleifer, and Vishny 1988). As Nenova (2003) and Dyck and Zingales (2002) show, private benefits matter for firm valuation.

As mentioned, we control for shareholder concentration through the size of the largest existing stake of equity control rights. We allow the influence on the firm of this stake to vary by the voting rights bracket the stake belongs to. Jenkinsons and Ljungqvist (2001) distinguish three important control rights thresholds in Germany: 25%, 50% plus one vote, and 75%. Jenkinson and Ljungqvist show that these voting rights thresholds are important in calculating the likelihood with which unsolicited control changes might succeed.

The applicable codetermination regime is essentially exogenous. A firm cannot get around equal representation by organizing into a group of affiliated companies, each with a maximum of 2,000 employees. This is because the codetermination regime rests on the number of employees of the group, not the parent company. The only way to avert equal representation is to keep the number of employees at or below 2,000 (for instance, through outsourcing) or to run the firm as a partnership. Often, the cost of evading equal representation on the supervisory board might be higher than deferring it.

## 5. Codetermination and Firm Performance

In this section we empirically investigate the effects of codetermination on firm performance, as measured by the firm's market-to-book ratio of equity, *MTB*, and, alternatively, its *Q Ratio* (Tobin's Q). Table 3 provides summary information on the *MTB* and *Q Ratio* variables (as well as other dependent variables, to be discussed below) for the last year of the sample period, 1993.

### *5.1. Variables*

With exceptions that will be mentioned later, all the regression equations have the same set of explanatory variables. This standard set of regressors comprises variables that represent the firm's control structure and variables that control for firm size and industry affiliation. The set of control structure variables consists of a variable that indicates the pertinent codetermination regime and of variables that represent the equity control rights structure. The equity control rights structure variables are lagged by one year. When analyzing firm performance, we also

TABLE 3. Summary measures of dependent variables

| | Minimum | Median | Mean | Maximum | Standard deviation |
|---|---|---|---|---|---|
| *MTB* (market-to-book ratio of equity) | 0.899 | 2.285 | 2.847 | 14.625 | 1.948 |
| *Q Ratio* | 0.871 | 1.616 | 1.898 | 8.867 | 0.957 |
| *Leverage* (debt-to-equity ratio) | 0.062 | 0.752 | 1.236 | 20.875 | 2.026 |
| *Wage Bill-to-Employees Ratio* | 42.12 | 85.23 | 99.05 | 675.4 | 79.22 |
| *Employees-to-Sales Ratio* | $1.485 \cdot 10^{-6}$ | $3.124 \cdot 10^{-3}$ | $3.480 \cdot 10^{-3}$ | $1.443 \cdot 10^{-2}$ | $2.186 \cdot 10^{-3}$ |
| *Wage Bill-to-Sales Ratio* | $2.525 \cdot 10^{-4}$ | $2.643 \cdot 10^{-1}$ | $3.176 \cdot 10^{-1}$ | 3.649 | $3.511 \cdot 10^{-1}$ |
| *Management Board Compensation* | 151.1 | 573.9 | 633.3 | 2,324 | 306.3 |
| *Supervisory Board Compensation* | 3.917 | 21.71 | 29.50 | 155.5 | 25.1 |

Notes: Due to missing values, the number of observations differs across variables. *MTB* (market-to-book ratio of equity, 156 observations) and *Q Ratio* (149) are calculated for the end of the calendar year 1993. *Leverage* (measured by the debt-to-equity ratio, 156 observations) is calculated for the fiscal year 1993 (or 1992–1993 for companies with other than calendar fiscal years). *Wage Bill-to-Employees Ratio* (156 observations), *Employees-to-Sales Ratio* (156), *Wage Bill-to-Sales Ratio* (156), and *Board Compensation* (per member; 150 observations for each board) are for the fiscal year 1993 (or 1992–1993 for companies with other than calendar fiscal years); wages, sales, and board compensation are measured in units of DM 1,000. Sources: *Saling Aktienführer* (Darmstadt; Hoppenstedt & Co.), various issues; *Handbuch der deutschen Aktiengesellschaften* (Darmstadt; Hoppenstedt & Co), various issues.

include the variable *Leverage*—the firm's logarithmic debt-to-equity ratio—in the set of explanatory variables.[9]

The set of control structure variables reads:

*Equal Representation*. Equal to one if there is equal representation on the supervisory board, zero otherwise.

*Insiders*. Fraction of equity control rights held by management, other employees, or founding families.

*Banks*. Fraction of equity control rights held by domestic banks.

*Government*. Fraction of equity control rights held by domestic government entities.

*ECR25*. Largest fraction of equity control rights held by a single investor; zero if this fraction is either 0.25 or less or more than 0.5.

*ECR50*. Largest fraction of equity control rights held by a single investor; zero if this fraction is either 0.5 or less or 0.75 or more.

*ECR75*. Largest fraction of equity control rights held by a single investor; zero if this fraction is less than 0.75.

The standard set of regressors includes a measure of firm size. By default, firm size is represented in the regression equations by the variable *Stock Market Capitalization*—the firm's logarithmic stock market capitalization, lagged by one year. Further, we include industry indicator variables, *ISIC*, which categorize companies by industry affiliation based on International Standard Industrial Classification (United Nations 1990). ISIC category D (manufacturing) serves as the numeraire industry (See Appendix B).

### *5.2. Econometric Methodology*

When analyzing the influence of equal representation on the firm, we face the problem of separating the influence of equal representation from the influence of firm size. Roughly half of the companies in our sample are subject to equal representation, whereas the other half has one-third representation. Large companies tend to have many employees and, consequently, tend to operate in the equal-representation regime. Our main identification strategy rests on the regression discontinuity introduced by the binary nature of the codetermination variable (see Hahn, Todd, and Van der Klaauw 2001). We can identify the two influences—firm size and equal representation—because equal representation is a discontinuous function of firm size—the number of employees of the group of affiliated

9. Note that we can use leverage as an explanatory variable because the performance regression and the leverage regression (shown later in the paper) constitute a recursive system, which can be estimated using ordinary least squares.

companies—whereas firm size—measured by stock market capitalization—can be assumed to have a continuous effect on firm performance. We estimate a semi-parametric model in which firm size is included in the nonparametric component, while the binary codetermination variable (along with all other nonconstant) explanatory variables) are in the parametric component. This way we are able to "purge" the data from the influence of firm size, before estimating the influence of equal representation. For details on the econometric methodology, see Appendix C.

### *5.3. Results*

The results from regressing firm performance, as measured by logarithmic *MTB*, on firm size, control structure variables and industry indicator variables are shown in Table 4. The main regressor of interest is the control-structure variable *Equal Representation*, which indicates equal representation on the supervisory board, as opposed to one-third representation. The important result in the table is that equal representation does affect the public value of the firm. For all five analyzed years we find a significant negative impact of equal representation (compared with one-third representation) on the market-to-book ratio of equity. This stock market discount varies between 21% in 1989 and 43% in 1992; it averages 31% over the analyzed five-year period.[10] We will offer a sensitivity analysis of this result below.

An equal-representation discount of 31% is evidence that the composition of the supervisory board is important for shareholder wealth. In other words, control rights that emanate from board seats are valuable. The large equal-representation discount is consistent with the fierce resistance that German employers offered to the 1976 Codetermination Act, which extended equal representation beyond the coal and steel industries. (In 1979, the German Supreme Court upheld the 1976 Codetermination Act and the concept of codetermination in general.) Also, our findings accord well with Addison, Schnabel, and Wagner (2001), who study a panel of small companies in the German state of Lower Saxony and find that labor participation at the shop-floor level—that is, in works councils—reduces firm profitability.[11]

Inevitably, concepts of firm valuation, such as the market-to-book ratio, rest on financial statements. Reporting standards generally allow some discretion

10. Remember that, if $\beta$ is the regression coefficient of a 0/1 variable in a semi-logarithmic model, then the change in the dependent variable as a result of a switch of this indicator variable from zero to one equals $e^{\beta} - 1$ (Halvorsen and Palmquist 1980).

11. Note that, in our sample, all companies, because of their large size, are subject to labor participation in decision making at the shop-floor level. Hence, we have no variation in this variable across time or cross-section.

TABLE 4. *MTB* and control rights allocation

| Dependent variable: *MTB* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | (1) 1989 | | (2) 1990 | | (3) 1991 | | (4) 1992 | | (5) 1993 | |
| Explanatory variable | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic |
| *Equal Rep.* | $-2.359 \cdot 10^{-1}$ | $-2.667^{***}$ | $-3.106 \cdot 10^{-1}$ | $-3.171^{***}$ | $-3.709 \cdot 10^{-1}$ | $-3.869^{***}$ | $-5.603 \cdot 10^{-1}$ | $-5.487^{***}$ | $-3.813 \cdot 10^{-1}$ | $-4.432^{***}$ |
| *Leverage* | $-3.334 \cdot 10^{-2}$ | $-0.574$ | $2.740 \cdot 10^{-3}$ | $0.060$ | $8.902 \cdot 10^{-2}$ | $1.792^{*}$ | $5.111 \cdot 10^{-2}$ | $1.062$ | $1.536 \cdot 10^{-1}$ | $3.380^{***}$ |
| *Insiders* | $2.418 \cdot 10^{-1}$ | $1.407$ | $3.016 \cdot 10^{-1}$ | $2.001^{**}$ | $2.865 \cdot 10^{-1}$ | $1.738^{*}$ | $4.134 \cdot 10^{-1}$ | $2.568^{**}$ | $2.581 \cdot 10^{-1}$ | $2.045^{**}$ |
| *Banks* | $5.089 \cdot 10^{-1}$ | $2.462^{**}$ | $4.001 \cdot 10^{-1}$ | $1.600$ | $3.745 \cdot 10^{-1}$ | $1.536$ | $1.007 \cdot 10^{-2}$ | $0.044$ | $1.022 \cdot 10^{-1}$ | $0.384$ |
| *Government* | $-8.217 \cdot 10^{-1}$ | $-2.722^{***}$ | $-1.153$ | $-3.801^{***}$ | $-8.922 \cdot 10^{-1}$ | $-2.647^{***}$ | $-5.897 \cdot 10^{-1}$ | $-1.976^{**}$ | $-9.573 \cdot 10^{-1}$ | $-2.975^{***}$ |
| *ECR25* | $2.898 \cdot 10^{-1}$ | $1.056$ | $4.163 \cdot 10^{-1}$ | $1.498$ | $7.519 \cdot 10^{-1}$ | $2.604^{***}$ | $5.011 \cdot 10^{-1}$ | $1.527$ | $1.402 \cdot 10^{-1}$ | $0.474$ |
| *ECR50* | $2.236 \cdot 10^{-1}$ | $1.188$ | $2.467 \cdot 10^{-1}$ | $1.287$ | $4.770 \cdot 10^{-1}$ | $2.482^{**}$ | $9.164 \cdot 10^{-2}$ | $0.495$ | $-3.103 \cdot 10^{-2}$ | $-0.158$ |
| *ECR75* | $2.186 \cdot 10^{-1}$ | $2.000^{**}$ | $2.364 \cdot 10^{-1}$ | $1.985^{**}$ | $3.657 \cdot 10^{-1}$ | $2.843^{***}$ | $2.660 \cdot 10^{-1}$ | $1.817^{*}$ | $9.436 \cdot 10^{-2}$ | $0.540$ |
| *ISIC A* | $1.220 \cdot 10^{-3}$ | $0.012$ | $4.330 \cdot 10^{-2}$ | $0.460$ | $1.180 \cdot 10^{-1}$ | $1.174$ | $1.356 \cdot 10^{-1}$ | $1.234$ | $3.247 \cdot 10^{-1}$ | $3.084^{***}$ |
| *ISIC C* | $4.642 \cdot 10^{-1}$ | $1.433$ | $7.953 \cdot 10^{-1}$ | $2.405^{**}$ | $4.918 \cdot 10^{-1}$ | $1.206$ | $3.631 \cdot 10^{-1}$ | $1.168$ | $1.022$ | $2.954^{***}$ |
| *ISIC E* | $1.373 \cdot 10^{-1}$ | $0.872$ | $3.573 \cdot 10^{-1}$ | $2.043^{**}$ | $2.417 \cdot 10^{-1}$ | $1.494$ | $1.151 \cdot 10^{-1}$ | $0.742$ | $2.765 \cdot 10^{-1}$ | $1.807^{*}$ |
| *ISIC F* | $1.906 \cdot 10^{-1}$ | $1.125$ | $2.828 \cdot 10^{-1}$ | $2.519^{**}$ | $1.737 \cdot 10^{-1}$ | $1.798^{*}$ | $2.194 \cdot 10^{-1}$ | $1.795^{*}$ | $-9.311 \cdot 10^{-3}$ | $-0.052$ |
| *ISIC G* | $-2.416 \cdot 10^{-1}$ | $-2.068^{**}$ | $-1.555 \cdot 10^{-1}$ | $-1.206$ | $-1.256 \cdot 10^{-1}$ | $-1.246$ | $6.737 \cdot 10^{-2}$ | $0.473$ | $-2.396 \cdot 10^{-2}$ | $-0.180$ |
| *ISIC H* | $5.509 \cdot 10^{-1}$ | $4.308^{***}$ | $8.206 \cdot 10^{-1}$ | $6.039^{***}$ | $1.053$ | $7.095^{***}$ | $9.382 \cdot 10^{-1}$ | $5.357^{***}$ | $1.003$ | $5.143^{***}$ |
| *ISIC I* | $-3.555 \cdot 10^{-1}$ | $-3.563^{***}$ | $-1.556 \cdot 10^{-1}$ | $-1.338$ | $-8.977 \cdot 10^{-2}$ | $-0.406$ | $-3.218 \cdot 10^{-1}$ | $-1.213$ | $-2.296 \cdot 10^{-1}$ | $-1.689^{*}$ |
| *ISIC K* | $6.587 \cdot 10^{-1}$ | $2.291^{**}$ | $5.249 \cdot 10^{-1}$ | $3.796^{***}$ | $7.040 \cdot 10^{-1}$ | $4.535^{***}$ | $5.428 \cdot 10^{-1}$ | $2.691^{***}$ | $4.902 \cdot 10^{-1}$ | $2.687^{***}$ |
| *ISIC N* | — | — | — | — | — | — | $-4.433 \cdot 10^{-2}$ | $-0.308$ | $3.562 \cdot 10^{-1}$ | $2.838^{***}$ |
| $R^2$ | 0.258 | | 0.312 | | 0.319 | | 0.400 | | 0.362 | |
| Effect of *Equal Rep.* | −0.210 | | −0.267 | | −0.310 | | −0.429 | | −0.317 | |
| Number of observations | 150 | | 158 | | 158 | | 161 | | 156 | |

Notes: The regression model is semiparametric. The nonparametric component comprises the firm size variable (log of stock market capitalization) and the intercept. The standard errors of the regression coefficients of the parametric component (shown in the table) are corrected following White (1980); *t*-statistics significance levels (in two-tailed tests): * denotes 10% level, ** denotes 5% level, and *** denotes 1% level. The $R^2$ is the ratio of regression sum of squares and the sum of regression sum of squares and error sum of squares. The effect of equal representation on *MTB* is calculated following Halvorsen and Palmquist (1980): $e^{\beta} - 1$, where $\beta$ is the regression coefficient of the respective indicator variable. For the year 1991, for instance, we find that equal representation depressed the market-to-book ratio of equity by 31%. To preserve space, charts of the effect of firm size on firm performance are not shown, except for the year 1991, which is displayed in Figure 1.

in the valuation of assets and the reported income. Evidence regarding option accounting at U.S. corporations suggests that investors see through the accounting veil (Aboody 1996; Aboody, Barth, and Kasznik 2004). But even if financial markets, by recognizing misrepresentation in financial statements, deliver valid market valuations, the denominator of the market-to-book ratio equity (and, similarly, Tobin's Q ratio) would still be distorted. For instance, it is possible that companies accumulate "hidden reserves" by avoiding asset write-ups from historic valuations to current market values. In the most favorable case, managerial discretion in financial reporting adds to noise in the dependent variable or, if such discretion is correlated with industry affiliation or firm size, bears on the regression coefficients of variables that are not of interest in this study. However, if misrepresentation of asset values in financial statements correlates with the codetermination regime, then indeed, our regression results would have to be interpreted with caution. Although we know of no empirical evidence for labor biasing financial statements at German corporations, it is conceivable that labor has an incentive to accumulate hidden reserves in an attempt to ward off restructuring or because labor uses the firm as an intertemporal insurance vehicle.[12] In this case then, equal-representation companies would contribute to an increase in the market-to-book value of equity by depressing its denominator; our empirical estimates of the influence of codetermination would then be conservative.

The impact of the equity control rights structure on firm performance is also interesting. Table 4 shows that the single most consistent effect on firm performance next to codetermination originates from the control rights exercised by the government. At the margin, an increase in the fraction of control rights held by government entities by 1 percentage point decreases the stock market valuation of the firm by between 1.15% (1990) and 0.59% (1992). The effect of firm insiders is significantly positive in four of the five years. At the margin, an increase in the control rights held by firm insiders by 1 percentage point increases the stock market valuation of the firm, when significant, by between 0.26% (1993) and 0.41% (1992). Unlike in Gorton and Schmid (2000), here there is only weak evidence for a positive marginal impact of banks on firm performance. Similarly weak is the evidence for a marginal role of stakes of control rights on firm performance. Further, leverage, as measured by the debt-equity ratio, has a significant positive marginal effect on the market value of equity in two years only. Finally, the influence of firm size on firm performance is displayed in Figure 1. As an example, we show the median year of the analyzed time period (1991); the charts of the other four analyzed years exhibit similar concavity. The solid symbols indicate companies with equal determination.

12. In restructuring, be it internal or through takeovers, asset may have to be written up to fair value, possibly invoking taxation of realized capital gains. For details see Beinert (2000) and Schmid and Wahrenburg (2004).

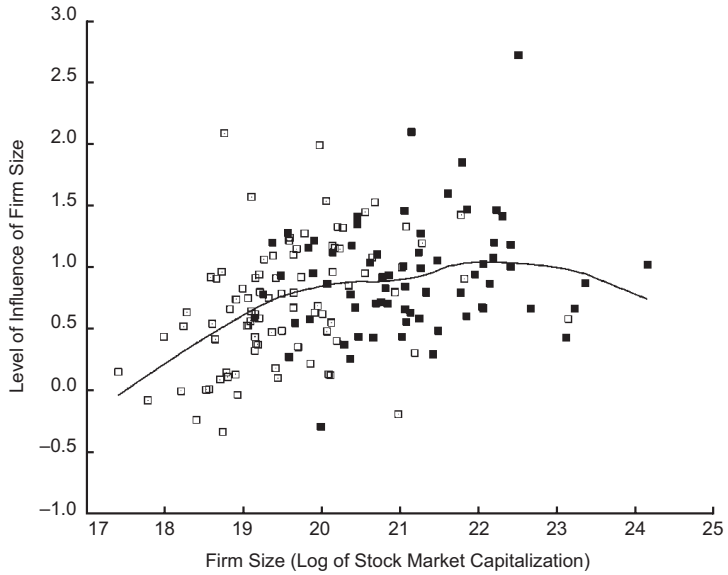


FIGURE 1. *MTB* and firm size for the year 1991. The regression model is semiparametric. The figure shows the impact of the nonparametric component (firm size, measured by the variable *Stock Market Capitalization*) on the dependent variable (firm performance, measured by *MTB*) of the regression approach for which the parametric results are displayed in Table 4. Because the intercept (which is part of the nonparametric component) is not identified, only changes in the level of the estimated impact, not the level itself are economically meaningful. The solid squares indicate observations with equal representation.

The overwhelming lack of statistical significance of the effect on firm performance of the debt-equity ratio, the control rights held by banks, and the largest control rights block is consistent with an equilibrium in which every company has adopted its optimal capital and shareholder structures (Demsetz 1983). A necessary condition for such an optimum is that—at the margin—none of these variables bears on firm value. From this perspective, the negative marginal effect on firm performance of control rights held by government entities indicates that the objective function of the government may be different from that of private-sector shareholders. Further, the documented statistical significance of the regression coefficient of insider-held equity control rights suggests that firm insiders, possibly due to wealth constraints, exercise a suboptimal amount of control over the public firm in Germany. Note that the lack of statistical significance of bank equity control rights, for instance, does not imply that banks are not important for corporate control in Germany. Rather, it means that marginal changes in bank-held control rights are no source of value.

### *5.4. Robustness*

To test the robustness of our results, we repeat the analysis presented in Table 4 with different sets of explanatory variables (the results are not shown) and a different dependent variable (Table 5). First, we estimate the model without industry indicator variables. Here again, the stock market discount associated with equal representation is statistically significant in all years, averaging 36%. Second, we use a different dependent variable—Tobin's Q ratio. When calculating the *Q Ratio* variable, we approximate the market values of debt and the replacement value of assets by their book values. (The bulk of debt does not trade.) Because we have no financially distressed companies in our sample, we expect the shadow market value of debt to be close to the book value. Following the Modigliani–Miller theorem, leverage is not included as an explanatory variable. The results in Table 5 show that the depressing effect on the market value of the firm of equal representation is statistically significant for all years, averaging 26% with little variation across the years.

Next we scrutinize the impact of codetermination on firm performance using a nearest-neighbor approach. This nonparametric method compares the performance of a given company in a given year, as measured by *MTB* or, alternatively, the *Q Ratio*, with the performance of its peer group or (single) nearest neighbor in the other codetermination regime. The peer group, of which the nearest neighbor is a member, comprises all companies that operate in the same industry (but not under the same codetermination regime) as the firm in question. For all members of the peer group, the Euclidean distance to the firm in question is calculated based on the set of explanatory variables used in Tables 4 (*MTB*) and 5 (*Q Ratio*), that is, *Stock Market Capitalization*, *Leverage* (for *MTB*), and the standard set of equity control rights variables.[13] The peer group is the weighted average of the members, where the weights are calculated from the Euclidean distances using a tricube weight function as suggested by Cleveland and Devlin (1988). The nearest neighbor is the peer with the shortest Euclidean distance to the company in question. After identifying the firm's peer group and nearest neighbor, we calculate *Relative MTB* (and *Relative Q Ratio*) values. *Relative MTB*, for instance, is defined as the ratio of the firm's *MTB* to the *MTB* of the peer group or nearest neighbor, respectively. A value greater than one means that the company in question has a higher market-to-book ratio of equity than have its peers or nearest neighbor in the other codetermination regime. Finally, we employ distribution-free bootstrap-*t* intervals (see Efron and Tibshirani 1993) to test if the mean *Relative MTB* (*Relative Q Ratio*) is significantly different from unity.

13. The Euclidean distances are calculated from normalized variables—that is, from variables that are divided by their respective standard deviations.

TABLE 5. *Q* Ratio and control rights allocation

| Dependent variable: *Q ratio* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | | (2) | | (3) | | (4) | | (5) | |
| Year | 1989 | | 1990 | | 1991 | | 1992 | | 1993 | |
| Explanatory variable | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic |
| *Equal Rep.* | $-3.093 \cdot 10^{-1}$ | $-5.157^{***}$ | $-3.364 \cdot 10^{-1}$ | $-5.703^{***}$ | $-2.803 \cdot 10^{-1}$ | $-5.315^{***}$ | $-3.064 \cdot 10^{-1}$ | $-6.328^{***}$ | $-2.786 \cdot 10^{-1}$ | $-5.471^{***}$ |
| *Insiders* | $2.063 \cdot 10^{-1}$ | $2.226^{**}$ | $2.405 \cdot 10^{-1}$ | $3.212^{***}$ | $1.854 \cdot 10^{-1}$ | $2.244^{**}$ | $2.006 \cdot 10^{-1}$ | $2.588^{***}$ | $1.271 \cdot 10^{-1}$ | $1.812^{*}$ |
| *Banks* | $3.840 \cdot 10^{-1}$ | $2.414^{**}$ | $2.410 \cdot 10^{-1}$ | 1.183 | $1.260 \cdot 10^{-1}$ | 0.743 | $4.760 \cdot 10^{-2}$ | 0.501 | $1.270 \cdot 10^{-1}$ | 1.040 |
| *Government* | $-4.742 \cdot 10^{-1}$ | $-2.234^{**}$ | $-6.662 \cdot 10^{-1}$ | $-3.278^{***}$ | $-5.703 \cdot 10^{-1}$ | $-2.761^{***}$ | $-3.379 \cdot 10^{-1}$ | $-2.132^{**}$ | $-6.565 \cdot 10^{-1}$ | $-3.324^{***}$ |
| *ECR25* | $-2.245 \cdot 10^{-1}$ | $-1.325$ | $-1.126 \cdot 10^{-1}$ | $-0.653$ | $1.877 \cdot 10^{-1}$ | 1.253 | $1.114 \cdot 10^{-1}$ | 0.721 | $-1.300 \cdot 10^{-1}$ | $-0.092$ |
| *ECR50* | $8.292 \cdot 10^{-2}$ | 0.606 | $9.884 \cdot 10^{-2}$ | 0.768 | $2.662 \cdot 10^{-1}$ | $2.076^{**}$ | $9.121 \cdot 10^{-2}$ | 0.959 | $6.756 \cdot 10^{-2}$ | 0.782 |
| *ECR75* | $-1.202 \cdot 10^{-2}$ | $-0.154$ | $1.156 \cdot 10^{-2}$ | 0.152 | $8.791 \cdot 10^{-2}$ | 1.203 | $9.838 \cdot 10^{-2}$ | 1.404 | $5.145 \cdot 10^{-2}$ | 0.717 |
| *ISIC A* | $-9.977 \cdot 10^{-2}$ | $-1.320$ | $-6.979 \cdot 10^{-2}$ | $-1.213$ | $-3.463 \cdot 10^{-2}$ | $-0.602$ | $3.619 \cdot 10^{-2}$ | 0.606 | $1.553 \cdot 10^{-1}$ | $2.404^{**}$ |
| *ISIC C* | $5.331 \cdot 10^{-1}$ | $1.880^{*}$ | $6.738 \cdot 10^{-1}$ | $2.632^{***}$ | $4.660 \cdot 10^{-1}$ | 1.591 | $3.711 \cdot 10^{-1}$ | $1.649^{*}$ | $7.421 \cdot 10^{-1}$ | $3.595^{***}$ |
| *ISIC E* | $-4.978 \cdot 10^{-2}$ | $-0.440$ | $8.206 \cdot 10^{-2}$ | 0.667 | $2.170 \cdot 10^{-2}$ | 0.210 | $-9.849 \cdot 10^{-3}$ | $-0.125$ | $5.479 \cdot 10^{-2}$ | 0.570 |
| *ISIC F* | $-8.552 \cdot 10^{-2}$ | $-0.836$ | $3.117 \cdot 10^{-2}$ | 0.486 | $-3.147 \cdot 10^{-3}$ | $-0.045$ | $4.550 \cdot 10^{-2}$ | 0.462 | $1.860 \cdot 10^{-2}$ | 0.128 |
| *ISIC G* | $-1.158 \cdot 10^{-1}$ | $-1.723^{*}$ | $-9.144 \cdot 10^{-2}$ | $-1.374$ | $-1.097 \cdot 10^{-1}$ | $-2.273^{**}$ | $-2.538 \cdot 10^{-2}$ | $-0.469$ | $-5.041 \cdot 10^{-2}$ | $-1.014$ |
| *ISIC H* | $6.317 \cdot 10^{-1}$ | $7.325^{***}$ | $7.717 \cdot 10^{-1}$ | $7.910^{***}$ | $9.875 \cdot 10^{-1}$ | $10.765^{***}$ | $1.755 \cdot 10^{-1}$ | $2.371^{**}$ | $3.222 \cdot 10^{-1}$ | $3.883^{***}$ |
| *ISIC I* | $-2.952 \cdot 10^{-1}$ | $-6.116^{***}$ | $-6.574 \cdot 10^{-2}$ | $-0.928$ | $-1.090 \cdot 10^{-1}$ | $-1.016$ | $-2.320 \cdot 10^{-1}$ | $-2.054^{**}$ | $-1.963 \cdot 10^{-1}$ | $-2.284^{**}$ |
| *ISIC K* | $6.161 \cdot 10^{-1}$ | $1.680^{*}$ | $4.342 \cdot 10^{-1}$ | $3.342^{***}$ | $5.361 \cdot 10^{-1}$ | $3.131^{***}$ | $7.841 \cdot 10^{-1}$ | $9.050^{***}$ | $6.357 \cdot 10^{-1}$ | $7.969^{***}$ |
| *ISIC N* | — | — | — | — | — | — | $1.253 \cdot 10^{-1}$ | $1.729^{*}$ | $4.358 \cdot 10^{-1}$ | $6.388^{***}$ |
| $R^2$ | 0.392 | | 0.422 | | 0.433 | | 0.437 | | 0.474 | |
| Effect of *Equal Rep.* | $-0.266$ | | $-0.286$ | | $-0.244$ | | $-0.264$ | | $-0.243$ | |
| Number of observations | 148 | | 156 | | 155 | | 160 | | 156 | |

Notes: The regression model is semiparametric. The nonparametric component comprises the firm size variable (log of stock market capitalization) and the intercept. The standard errors of the regression coefficients of the parametric component (shown in the table) are corrected following White (1980); *t*-statistics significance levels (in two-tailed tests): * denotes 10% level, ** denotes 5% level, and *** denotes 1% level. The $R^2$ is the ratio of regression sum of squares and the sum of regression sum of squares and error sum of squares. The effect of equal representation on *Q Ratio* is calculated following Halvorsen and Palmquist (1980): $e^{\beta} - 1$, where $\beta$ is the regression coefficient of the respective indicator variable. For the year 1991, for instance, we find that equal representation depressed *Q Ratio* by 24%.

TABLE 6. Firm performance and control rights allocation

| Performance relative to peer group or nearest neighbor | | |
|---|---|---|
| *Panel A: Equal representation companies* | | |
| | Relative to peer group | Relative to nearest neighbor |
| Mean *Relative MTB* | 0.849*** | 0.911** |
| Number of observations | 445 | 445 |
| Mean *Relative Q Ratio* | 0.844*** | 9.272* |
| Number of observations | 437 | 437 |
| *Panel B: One-third representation companies* | | |
| | Relative to peer group | Relative to nearest neighbor |
| Mean *Relative MTB* | 1.378*** | 1.671*** |
| Number of observations | 328 | 328 |
| Mean *Relative Q Ratio* | 1.278*** | 1.435*** |
| Number of observations | 328 | 328 |

Notes: The statistical analysis rests on the companies' *Relative MTB* or *Relative Q Ratio* values. For instance, *Relative MTB* is defined as the ratio of the firm's *MTB* to the *MTB* of the peer group or nearest neighbor, respectively. A value greater than 1 means that the company in question has a higher market-to-book ratio of equity than have its peers or nearest neighbor in the other codetermination regime. The significance tests on the means are based on bootstrap-*t* intervals from 10,000 draws; these confidence intervals are distribution-free and not necessarily symmetric (see Efron and Tibshirani 1993). The following symbols indicate that the means are statistically different from 1: * denotes 10% level, ** denotes 5% level, and *** denotes 1% level.

The findings from the nearest-neighbor method are displayed in Table 6. Companies with equal representation, when compared with their respective one-third representation nearest neighbor or peer group, have significantly lower market-to-book and Q ratios (Panel A). The implied stock market discount varies between 15% (peer group) and 9% (nearest neighbor). Correspondingly, when one-third representation companies are compared with their equal-representation nearest neighbors, one-third representation companies exhibit significantly higher market-to-book and Q ratios. The implied stock market premium ranges between 38% (peer group) and 67% (nearest neighbor).

## 6. Does Labor Succeed in Altering the Objective Function of the Firm?

Equal representation depresses the stock market valuation of the firm, as measured by the market-to-book ratio of equity. Conceptually, there are two possible explanations for the negative effect of codetermination on the public value of the firm; these explanations are not mutually exclusive. One possibility is that the firm is simply run less efficiently. In this case, codetermination is a Pareto-inferior allocation of control rights in the firm, producing a deadweight loss. The other possibility is that labor succeeds—at least to a degree—in altering the objective function of the firm, away from maximizing shareholder wealth. While codetermination depresses shareholder wealth, it might allow labor to appropriate

more of the firm's surplus. For instance, the employees might use the firm as an insurance vehicle, as discussed. Although we cannot rule out the hypothesis that codetermination makes the firm less efficient, we can provide some evidence that labor indeed succeeds in altering the objective function of the firm.

A direct test as to whether labor alters the objective function of the firm is to examine labor's influence on managerial compensation. Remember that it is the supervisory board that sets the salary of the management board—the board that runs the day-to-day operations of the firm. If labor has a different objective function than shareholders, and if equal representation on the supervisory board delivers sufficient voting power to bring this to bear, then equal representation will weaken the link between firm performance—measured by *MTB*—and managerial compensation. Further, to the degree that labor's objectives are opposed to those of shareholders, the link between management board compensation and the public value of the firm might even be negative.

To date there has been little work on board compensation in Germany. As Pistor (1999, p. 30) writes: "An empirical analysis of codetermined supervisory boards is constrained by the lack of systematic data." This is because, to date, German corporations are not obliged to publish the amount or composition of the remuneration of individual board members. Only the totals of the management and supervisory board remuneration are disclosed; next to nothing is known about the individual contracts.[14] There are, however, a few studies on board compensation in Germany. For instance, Schwalbach and Grasshoff (1997) use proprietary data on the remuneration of individual board members provided by a consulting company; they find little sensitivity of compensation to firm performance. Kaplan (1994), on the other hand, shows that the elasticity of cash compensation to stock price performance in Germany is roughly comparable with that in the United States. Similarly, Schmid (1997) finds that both management board and supervisory board compensation are responsive to the stock market valuation of the firm, even though the link between supervisory board compensation and firm performance is typically implicit rather than contractually predetermined. None of these studies examines the potential effect of codetermination on board compensation.

Analyzing the impact of the firm's control structure on managerial compensation is involved. This is because any of the control structure variables—*Equal Representation* and any of the equity control rights variables—may bear on the level and the performance-sensitivity of compensation. What is more, level and performance-sensitivity of compensation are a function of the measurement error in gauging managerial performance, and this measurement error in turn is a

14. A 2003 revision of the German Corporate Governance Code, which was introduced in 2002, calls for publication of both the total amount and the composition of the remuneration of the members of the management board; adherence to this code is voluntary.

function of firm size and industry (see Murphy 1999). In other words, any of the variables in Table 4, including the industry indicator variables, may bear both on the intercept and the performance-sensitivity in a managerial compensation regression equation. Accounting for all these influences would lead to a proliferation of regression coefficients (and interaction terms in particular), rendering the statistical efficiency of such an approach highly inefficient, if not impossible (because of matrix singularity). To avoid these problems, we employ the nearest-neighbor method discussed above in Section 5.4.

Because of the mentioned lack of remuneration data for individual board members, our analysis rests on the ratio of total management board compensation to number of members. The nearest-neighbor method compares management board compensation (per member) and firm performance—measured by *MTB*—of a given company in a given year with the management board compensation and performance of its peer group or (single) nearest neighbor in the other codetermination regime. The peer group, of which the nearest neighbor is a member, comprises all companies that operate in the same industry (but not under the same codetermination regime) as the firm in question. As above, for all members of the peer group, the Euclidean distance to the firm in question is calculated based on the set of explanatory variables used in Table 4, that is, *Stock Market Capitalization*, *Leverage*, and the standard set of equity control rights variables. Here, again, the peer group is the weighted average of the members—based on tricube-weighted Euclidean distances—and the nearest neighbor is the peer with the shortest Euclidean distance to the company in question. After identifying the firm's peer group and nearest neighbor, we calculate *Relative Compensation* and *Relative MTB* values. Similar to *Relative MTB*, which again is defined as the ratio of the firm's *MTB* to the *MTB* of the peer group or nearest neighbor, *Relative Compensation* is defined as the respective ratio of the per-member management board compensation. The statistical analysis regresses logarithmic *Relative Board Compensation* on *Equal Representation*, logarithmic *Relative MTB*, and the product of the two variables (*Equal Representation*: Equal to 1 if there is equal representation on the supervisory board, 0 otherwise). The significance tests on the regression coefficients rest on distribution-free bootstrap-$t$ intervals.

The findings of this nearest-neighbor analysis of management board compensation are shown in Table 7. Panel A compares equal-representation companies with their respective peer group or nearest neighbor operating under one-third codetermination; Panel B, on the other hand, compares one-third representation companies with equal-representation peers or nearest neighbors. The regression coefficient of the variable *Relative MTB* represents the link between management board compensation and firm performance for one-third representation companies. This link is positive and statistically significant in Panel A, but not so in Panel B. The sum of the regression coefficients of the variables *Relative MTB* and *Equal Representation* $\times$ *Relative MTB* gauges the impact of firm performance

TABLE 7. *Board compensation* and control rights allocation

| Dependent variable: *relative board compensation* | | | | |
|---|---|---|---|---|
| *Panel A: Equal representation companies* | | | | |
| | Relative to peer group | | Relative to nearest neighbor | |
| | Management board | Supervisory board | Management board | Supervisory board |
| Explanatory variable | Coefficient | Coefficient | Coefficient | Coefficient |
| Intercept | $5.907^{***}$ | $2.752^{***}$ | $6.136^{***}$ | $2.857^{***}$ |
| *Equal representation* | $6.279 \cdot 10^{-1***}$ | $3.149 \cdot 10^{-1***}$ | $3.997 \cdot 10^{-1***}$ | $2.105 \cdot 10^{-1*}$ |
| *Relative MTB* (1) | $2.115 \cdot 10^{-1***}$ | $3.608 \cdot 10^{-1***}$ | $9.095 \cdot 10^{-2*}$ | $1.841 \cdot 10^{-1**}$ |
| *Equal representation* × *Relative MTB* (2) | $-3.202 \cdot 10^{-1***}$ | $-9.595 \cdot 10^{-2}$ | $-1.997 \cdot 10^{-1***}$ | $8.075 \cdot 10^{-2}$ |
| Sum of coefficients (1) and (2) | $-1.087 \cdot 10^{-1**}$ | $2.648 \cdot 10^{-1***}$ | $-1.087 \cdot 10^{-1**}$ | $2.648 \cdot 10^{-1***}$ |
| Number of observations | 844 | 844 | 844 | 844 |
| *Panel B: One-third codetermination companies* | | | | |
| | Relative to peer group | | Relative to nearest neighbor | |
| | Management board | Supervisory board | Management board | Supervisory board |
| Explanatory variable | Coefficient | Coefficient | Coefficient | Coefficient |
| Intercept | $6.059^{***}$ | $2.827^{***}$ | $6.059^{***}$ | $2.827^{***}$ |
| *Equal representation* | $6.868 \cdot 10^{-1***}$ | $4.673 \cdot 10^{-1***}$ | $3.856 \cdot 10^{-1***}$ | $1.668 \cdot 10^{-1}$ |
| *Relative MTB* (1) | $-4.451 \cdot 10^{-3}$ | $1.198 \cdot 10^{-1}$ | $-4.451 \cdot 10^{-3}$ | $1.198 \cdot 10^{-1}$ |
| *Equal representation* × *Relative MTB* (2) | $-2.690 \cdot 10^{-1***}$ | $7.241 \cdot 10^{-2}$ | $-1.939 \cdot 10^{-1***}$ | $-4.670 \cdot 10^{-2}$ |
| Sum of coefficients (1) and (2) | $-2.735 \cdot 10^{-1***}$ | $1.922 \cdot 10^{-1***}$ | $-1.983 \cdot 10^{-1***}$ | $7.309 \cdot 10^{-2}$ |
| Number of observations | 644 | 644 | 644 | 644 |

Notes: In Panel A, board compensation and performance of each equal-representation company (for each year) are compared with board compensation and performance of the respective one-third representation peer group and nearest neighbor, respectively. In Panel B, each company with one-third representation is compared with its equal-representation peer group and nearest neighbor. The statistical analysis regresses logarithmic *Relative Board Compensation* on *Equal Representation*, logarithmic *Relative MTB*, and the product of the two variables. (*Equal Representation*: Equal to 1 if there is equal representation on the supervisory board, 0 otherwise.) The significance tests on the regression coefficients are based on bootstrap-*t* intervals from 10,000 draws; these confidence intervals are distribution-free and not necessarily symmetric (see Efron and Tibshirani 1993). The following symbols indicate that the coefficients (or sum of coefficients) are statistically different from 0: * denotes 10% level, ** denotes 5% level, and *** denotes 1% level.

on managerial compensation at equal-representation companies. In both panels, and for both the peer group and the nearest neighbor approaches, the link between management board compensation and firm performance at equal-representation companies is significantly negative. (The negative relation between managerial remuneration and firm performance explains—at least, in part—the larger intercept of the compensation equation at equal-representation companies, as implied

by the statistical significance of the indicator variable *Equal Representation*.) This negative link between managerial compensation and firm performance does not imply that management is rewarded for destroying shareholder wealth *per se*. Rather, it means that the objective function of labor differs from the objective function of shareholders—at least to a degree. Taken together, there is weak evidence that at the firm that operates under one-third codetermination, managerial compensation is positively related to firm performance. And, more importantly, there is strong evidence that at the firm that is subject to equal representation on the supervisory board, managerial compensation is negatively related to firm performance. This finding is consistent with the hypothesis that labor uses its voting power on the supervisory board to alter the objective function of the firm.

We now ask: What are labor's objectives? In an attempt to answer this question, we refer to the institutional characteristics of collective wage bargaining in Germany. As modeled in Kraft (2001), wages are not bargained over by employee representatives at the supervisory board level. Rather, wages are negotiated between labor unions and employers' associations at the industry level. The residual decision, staffing, is made at the firm level. Here, at the firm level, the employee representatives might use their voting power to turn the firm into an insurance vehicle, as discussed above. When the firm is hit by a negative (idiosyncratic or business cycle) shock, shareholders might want to restructure and possibly lay off workers. By resisting layoffs, labor may be able to appropriate some of the shareholders' surplus. The present value of this appropriation is reflected in the firm's stock market valuation, explaining the discount. Also, if the codetermined firm is optimally staffed in good times (that is, when expanding) and overstaffed in bad times (when it tries to downsize), then, on average, the firm is overstaffed.

There is casual evidence of labor's power to affect employment at the firm level and the distribution of the firm's surplus. For instance, there are *Standortvereinbarungen*—that is, compacts between labor and shareholders on the preservation of existing manufacturing sites by maintaining a minimum level of fixed investment—essentially employment guarantees. The previously mentioned bipartisan committee, Kommission Mitbestimmung (1998, p. 101), in alluding to *Standortvereinbarungen*, explicitly states that "there is no compelling reason why, in return for fixed investment, labor would not *allow* higher corporate profits" (translation and italics our own).

We investigate the effect of equal representation on wages and staffing in three regression approaches, each employing identical sets of explanatory variables and the semiparametric technique used in Table 4. We start out by regressing the logarithmic ratio of the wage bill to the number of employees on firm size, the standard set of control structure variables (that is, *Equal Representation* and

the standard set of equity control rights variables), and the usual industry indicator variables. (As usual, firm size is represented by the variable *Stock Market Capitalization* and included in the nonparametric component of the regression equation.) The results, reported in Table 8, show that none of the control structure variables is consistently statistically significant over the analyzed time period. In particular, there is no evidence that differences across codetermination regimes bears on the average wage at the firm level. The lack of statistical significance squares with the German practice of wage bargaining at the industry, rather than the firm level. Although absence of evidence is not evidence of absence, in the light of how wage setting is institutionalized in Germany, we conclude that equal representation on the supervisory board has no discernable effect on the average wage paid by the codetermined firm.

The second and third regression approaches investigate if companies with equal representation employ comparatively more staff. To this end, we first regress the (log) ratio of employees to sales on the above-mentioned set of explanatory variables. The results are shown in Table 9. For all five analyzed years, the influence of codetermination on the staffing level is statistically significant. Averaged over the five years, the payroll of companies with equal representation is 48% longer than the payroll of companies with one-third representation. We repeat this regression analysis, substituting the wage bill for the number of employees. The results are shown in Table 10. Again, for all five analyzed years, equal representation is associated with a higher staffing level. On average, companies with equal representation have a 55% higher payroll tab than companies with one-third representation.

Overstaffing is only one of two main, nonmutually exclusive explanations of the higher staffing levels of companies with equal representation. Another possible explanation is that codetermination, by affecting the productivity of labor, leads companies with equal representation to produce more labor-intensively than otherwise. For instance, the above-mentioned study by Addison, Schnabel, and Wagner (2001) finds that labor participation at the shop-floor level—that is, in works councils—increases labor productivity. Then again, these findings are not robust to changes in model specification, and there is no analysis of total factor productivity (that is, labor productivity net of the contribution of capital). What is more, earlier studies by FitzRoy and Kraft (1987, 1995) find adverse effects of works councils on total factor productivity (which the authors find can be compensated for with profit sharing arrangements). Also, Addison, Kraft, and Wagner (1993) cannot identify a productivity-enhancing effect of labor participation at the shop-floor level. Yet, codetermination-induced productivity effects cannot be ruled out as an explanation for the higher staffing level at companies with equal representation. Note that, in growth theory, the link between total-factor productivity and labor-intensity of production is not unambiguous, even for given relative factor prices.

TABLE 8. *Wage Bill-to-Employees Ratio* and control rights allocation

| Dependent variable: *Wage Bill-to-Employees ratio* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | (1) 1989 | | (2) 1990 | | (3) 1991 | | (4) 1992 | | (5) 1993 | |
| Explanatory variable | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic |
| *Equal Rep.* | $1.288 \cdot 10^{-1}$ | 1.272 | $-1.859 \cdot 10^{-2}$ | −0.297 | $9.831 \cdot 10^{-2}$ | 1.248 | $3.302 \cdot 10^{-2}$ | 0.486 | $2.209 \cdot 10^{-2}$ | 0.268 |
| *Insiders* | $-1.044 \cdot 10^{-1}$ | −0.819 | $-2.237 \cdot 10^{-1}$ | −2.173** | $-2.152 \cdot 10^{-1}$ | −1.744* | $-3.181 \cdot 10^{-2}$ | −0.330 | $1.466 \cdot 10^{-1}$ | 1.051 |
| *Banks* | $-2.893 \cdot 10^{-1}$ | −1.151 | $3.788 \cdot 10^{-2}$ | 0.121 | $2.217 \cdot 10^{-1}$ | 0.661 | $1.155 \cdot 10^{-1}$ | 0.42 | $3.918 \cdot 10^{-1}$ | 0.768 |
| *Government* | $4.119 \cdot 10^{-2}$ | 0.357 | $1.211 \cdot 10^{-1}$ | 1.343 | $1.082 \cdot 10^{-1}$ | 0.978 | $2.362 \cdot 10^{-1}$ | 2.522** | $2.303 \cdot 10^{-1}$ | 2.077** |
| *ECR25* | $5.379 \cdot 10^{-1}$ | 2.283** | $7.673 \cdot 10^{-2}$ | 0.274 | $3.140 \cdot 10^{-1}$ | 1.021 | $1.803 \cdot 10^{-1}$ | 0.764 | $-1.761 \cdot 10^{-1}$ | −0.620 |
| *ECR50* | $3.385 \cdot 10^{-1}$ | 2.018** | $1.103 \cdot 10^{-1}$ | 0.660 | $1.724 \cdot 10^{-1}$ | 0.819 | $3.635 \cdot 10^{-2}$ | 0.215 | $-1.858 \cdot 10^{-2}$ | −0.102 |
| *ECR75* | $1.307 \cdot 10^{-1}$ | 0.822 | $1.554 \cdot 10^{-1}$ | 1.234 | $2.199 \cdot 10^{-1}$ | 1.547 | $1.549 \cdot 10^{-1}$ | 1.224 | $1.435 \cdot 10^{-1}$ | 0.975 |
| *ISIC A* | $1.569 \cdot 10^{-1}$ | 1.029 | $2.162 \cdot 10^{-2}$ | 0.358 | $2.209 \cdot 10^{-2}$ | 0.347 | $-6.257 \cdot 10^{-2}$ | −1.185 | $-8.287 \cdot 10^{-2}$ | −0.998 |
| *ISIC C* | $5.672 \cdot 10^{-2}$ | 0.326 | $-7.696 \cdot 10^{-2}$ | −0.985 | $-7.639 \cdot 10^{-3}$ | −0.066 | $-1.268 \cdot 10^{-1}$ | −1.353 | $-4.806 \cdot 10^{-2}$ | −0.372 |
| *ISIC E* | $2.541 \cdot 10^{-2}$ | 0.282 | $6.777 \cdot 10^{-2}$ | 0.933 | $1.680 \cdot 10^{-1}$ | 2.388** | $1.172 \cdot 10^{-1}$ | 1.824* | $1.686 \cdot 10^{-1}$ | 2.149** |
| *ISIC F* | $-4.502 \cdot 10^{-1}$ | −2.270** | $-1.449 \cdot 10^{-1}$ | −1.396 | $-1.502 \cdot 10^{-1}$ | −1.315 | $1.989 \cdot 10^{-1}$ | 0.761 | $8.668 \cdot 10^{-2}$ | 0.298 |
| *ISIC G* | $-4.476 \cdot 10^{-1}$ | −4.266*** | $-3.945 \cdot 10^{-1}$ | −3.601*** | $-4.479 \cdot 10^{-1}$ | −4.510*** | $-3.898 \cdot 10^{-1}$ | −4.426*** | $-3.030 \cdot 10^{-1}$ | −2.405** |
| *ISIC H* | $-4.285 \cdot 10^{-1}$ | −2.727*** | $-4.658 \cdot 10^{-1}$ | −2.912*** | $-5.839 \cdot 10^{-1}$ | −4.186*** | $-5.915 \cdot 10^{-1}$ | −5.208*** | $-3.895 \cdot 10^{-1}$ | −3.112*** |
| *ISIC I* | $1.349 \cdot 10^{-2}$ | 0.114 | $4.063 \cdot 10^{-2}$ | 0.733 | $9.620 \cdot 10^{-2}$ | 1.360 | $6.002 \cdot 10^{-2}$ | 0.897 | $2.959 \cdot 10^{-2}$ | 0.382 |
| *ISIC K* | $5.261 \cdot 10^{-1}$ | 3.627*** | $4.488 \cdot 10^{-1}$ | 2.720*** | $5.239 \cdot 10^{-1}$ | 2.818*** | $4.813 \cdot 10^{-1}$ | 4.430*** | $2.751 \cdot 10^{-1}$ | 1.899* |
| *ISIC N* | — | — | — | — | — | — | $-1.405 \cdot 10^{-1}$ | −2.249** | $-2.251 \cdot 10^{-1}$ | −1.844* |
| $R^2$ | 0.132 | | 0.161 | | 0.199 | | 0.221 | | 0.168 | |
| Effect of *Equal Rep.* | 0 | | 0 | | 0 | | 0 | | 0 | |
| Number of observations | 149 | | 158 | | 157 | | 161 | | 156 | |

Notes: The regression model is semiparametric. The nonparametric component comprises the firm size variable (log of stock market capitalization) and the intercept. The standard errors of the regression coefficients of the parametric component (shown in the table) are corrected following White (1980); *t*-statistics significance levels (in two-tailed tests): * denotes 10% level, ** denotes 5% level, and *** denotes 1% level. The $R^2$ is the ratio of regression sum of squares and the sum of regression sum of squares and error sum of squares. The effect of equal representation on *Wage Bill-to-Employees Ratio* is calculated following Halvorsen and Palmquist (1980): $e^{\beta} - 1$, where $\beta$ is the regression coefficient of the respective indicator variable. This value is set at zero if the corresponding regression coefficient is not statistically significant.

TABLE 9. *Employees-to-Sales ratio* and control rights allocation

| Dependent variable: *Employees-to-Sales ratio* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | (1) 1989 | | (2) 1990 | | (3) 1991 | | (4) 1992 | | (5) 1993 | |
| Explanatory variable | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic |
| *Equal Rep.* | $3.642 \cdot 10^{-1}$ | 2.917*** | $4.868 \cdot 10^{-1}$ | 2.861*** | $4.274 \cdot 10^{-1}$ | 2.557** | $3.744 \cdot 10^{-1}$ | 2.468** | $3.057 \cdot 10^{-1}$ | 1.809* |
| *Insiders* | $3.145 \cdot 10^{-1}$ | 1.649* | $1.920 \cdot 10^{-1}$ | 0.698 | $3.116 \cdot 10^{-1}$ | 1.303 | $5.391 \cdot 10^{-2}$ | 0.279 | $1.983 \cdot 10^{-1}$ | 0.679 |
| *Banks* | $6.658 \cdot 10^{-1}$ | 1.823* | $3.237 \cdot 10^{-1}$ | 0.674 | 1.991 | 2.236** | 1.269 | 3.417*** | 1.214 | 2.974*** |
| *Government* | $-4.042 \cdot 10^{-2}$ | −0.154 | $-3.475 \cdot 10^{-1}$ | −1.186 | $-1.923 \cdot 10^{-2}$ | −0.062 | $2.414 \cdot 10^{-2}$ | 0.096 | $-6.923 \cdot 10^{-2}$ | −0.224 |
| *ECR25* | $-8.465 \cdot 10^{-1}$ | −1.875* | $-2.715 \cdot 10^{-2}$ | −0.052 | $4.041 \cdot 10^{-1}$ | 0.405 | $-2.935 \cdot 10^{-1}$ | −0.729 | $-2.814 \cdot 10^{-1}$ | −0.551 |
| *ECR50* | $-2.538 \cdot 10^{-1}$ | −0.797 | $2.263 \cdot 10^{-1}$ | 0.605 | $5.006 \cdot 10^{-1}$ | 0.674 | $1.680 \cdot 10^{-1}$ | 0.543 | $-5.694 \cdot 10^{-2}$ | −0.122 |
| *ECR75* | $-2.024 \cdot 10^{-1}$ | −1.056 | $5.342 \cdot 10^{-2}$ | 0.233 | $4.305 \cdot 10^{-1}$ | 0.793 | $1.079 \cdot 10^{-1}$ | 0.417 | $2.085 \cdot 10^{-1}$ | 0.707 |
| *ISIC A* | $2.148 \cdot 10^{-1}$ | 0.994 | $1.932 \cdot 10^{-1}$ | 0.648 | $1.624 \cdot 10^{-1}$ | 0.835 | $2.295 \cdot 10^{-1}$ | 1.463 | $1.278 \cdot 10^{-1}$ | 0.622 |
| *ISIC C* | $7.987 \cdot 10^{-1}$ | 2.376** | $8.205 \cdot 10^{-1}$ | 2.561** | $5.580 \cdot 10^{-1}$ | 1.816* | $7.266 \cdot 10^{-1}$ | 2.824*** | $9.415 \cdot 10^{-1}$ | 2.749*** |
| *ISIC E* | $-4.450 \cdot 10^{-1}$ | −2.393** | $-6.454 \cdot 10^{-1}$ | −2.813*** | $-2.238 \cdot 10^{-1}$ | −1.049 | $-4.082 \cdot 10^{-1}$ | −2.236** | $-2.720 \cdot 10^{-1}$ | −1.116 |
| *ISIC F* | $6.306 \cdot 10^{-1}$ | 4.007*** | $2.150 \cdot 10^{-1}$ | 1.395 | $4.626 \cdot 10^{-1}$ | 2.400** | $-1.478 \cdot 10^{-1}$ | −0.620 | $6.414 \cdot 10^{-2}$ | 0.218 |
| *ISIC G* | $-1.678 \cdot 10^{-1}$ | −0.904 | $-2.746 \cdot 10^{-1}$ | −1.374 | $-6.910 \cdot 10^{-2}$ | −0.326 | $-4.931 \cdot 10^{-1}$ | −2.712*** | $-4.240 \cdot 10^{-1}$ | −1.639 |
| *ISIC H* | 1.268 | 4.579*** | 1.028 | 3.957*** | $5.997 \cdot 10^{-1}$ | 1.457 | 1.040 | 4.401*** | 1.434 | 5.125*** |
| *ISIC I* | $-8.472 \cdot 10^{-2}$ | −0.256 | $-1.318 \cdot 10^{-1}$ | −0.364 | $7.583 \cdot 10^{-2}$ | 0.197 | $-1.874 \cdot 10^{-1}$ | −0.721 | $-1.502 \cdot 10^{-1}$ | −0.529 |
| *ISIC K* | $-7.220 \cdot 10^{-1}$ | −1.452 | $-5.179 \cdot 10^{-1}$ | −0.931 | $1.374 \cdot 10^{-1}$ | 0.131 | $9.071 \cdot 10^{-2}$ | 0.394 | −6.521 | −0.002 |
| *ISIC N* | — | — | — | — | — | — | $7.950 \cdot 10^{-1}$ | 4.785*** | $9.867 \cdot 10^{-1}$ | 3.876*** |
| $R^2$ | 0.231 | | 0.149 | | 0.089 | | 0.174 | | 0.079 | |
| Effect of *Equal Rep.* | 0.439 | | 0.627 | | 0.533 | | 0.454 | | 0.358 | |
| Number of observations | 150 | | 158 | | 158 | | 161 | | 156 | |

Notes: The regression model is semiparametric. The nonparametric component comprises the firm size variable (log of stock market capitalization) and the intercept. The standard errors of the regression coefficients of the parametric component (shown in the table) are corrected following White (1980); *t*-statistics significance levels (in two-tailed tests): * denotes 10% level, ** denotes 5% level, and *** denotes 1% level. The $R^2$ is the ratio of regression sum of squares and the sum of regression sum of squares and error sum of squares. The effect of equal representation on *Employees-to-Sales Ratio* is calculated following Halvorsen and Palmquist (1980): $e^{\beta} - 1$, where $\beta$ is the regression coefficient of the respective indicator variable. For the year 1991, for instance, we find that equal representation increased *Employees-to-Sales Ratio* by 53%.

TABLE 10. *Wage Bill-to-Sales ratio* and control rights allocation

| Dependent variable: *Wage Bill-to-Sales ratio* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | | (2) | | (3) | | (4) | | (5) | |
| Year | 1989 | | 1990 | | 1991 | | 1992 | | 1993 | |
| Explanatory variable | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic |
| *Equal Rep.* | $4.726 \cdot 10^{-1}$ | 3.756*** | $4.682 \cdot 10^{-1}$ | 2.887*** | $5.186 \cdot 10^{-1}$ | 3.607*** | $4.074 \cdot 10^{-1}$ | 3.266*** | $3.278 \cdot 10^{-1}$ | 2.326** |
| *Insiders* | $1.914 \cdot 10^{-1}$ | 0.976 | $-3.167 \cdot 10^{-2}$ | −0.118 | $4.779 \cdot 10^{-2}$ | 0.205 | $2.210 \cdot 10^{-2}$ | 0.127 | $3.449 \cdot 10^{-1}$ | 1.187 |
| *Banks* | $3.875 \cdot 10^{-1}$ | 0.979 | $3.616 \cdot 10^{-1}$ | 0.565 | 2.226 | 2.268** | 1.384 | 2.446** | 1.605 | 2.445** |
| *Government* | $6.904 \cdot 10^{-3}$ | 0.030 | $-2.264 \cdot 10^{-1}$ | −0.845 | $6.096 \cdot 10^{-2}$ | 0.210 | $2.604 \cdot 10^{-1}$ | 1.135 | $1.611 \cdot 10^{-1}$ | 0.579 |
| *ECR25* | $-3.008 \cdot 10^{-1}$ | −0.671 | $4.958 \cdot 10^{-2}$ | 0.095 | $8.168 \cdot 10^{-1}$ | 0.770 | $-1.132 \cdot 10^{-1}$ | −0.254 | $-4.574 \cdot 10^{-1}$ | −0.859 |
| *ECR50* | $6.640 \cdot 10^{-2}$ | 0.204 | $3.365 \cdot 10^{-1}$ | 0.913 | $6.888 \cdot 10^{-1}$ | 0.932 | $2.043 \cdot 10^{-1}$ | 0.641 | $-7.551 \cdot 10^{-2}$ | −0.166 |
| *ECR75* | $-6.424 \cdot 10^{-2}$ | −0.327 | $2.088 \cdot 10^{-1}$ | 0.869 | $6.845 \cdot 10^{-1}$ | 1.254 | $2.628 \cdot 10^{-1}$ | 1.106 | $3.520 \cdot 10^{-1}$ | 1.421 |
| *ISIC A* | $3.755 \cdot 10^{-1}$ | 1.547 | $2.149 \cdot 10^{-1}$ | 0.738 | $2.035 \cdot 10^{-1}$ | 1.031 | $1.669 \cdot 10^{-1}$ | 1.052 | $4.488 \cdot 10^{-2}$ | 0.223 |
| *ISIC C* | $8.340 \cdot 10^{-1}$ | 3.112*** | $7.436 \cdot 10^{-1}$ | 2.640*** | $5.103 \cdot 10^{-1}$ | 1.810* | $5.998 \cdot 10^{-1}$ | 3.002*** | $8.935 \cdot 10^{-1}$ | 2.858*** |
| *ISIC E* | $-4.232 \cdot 10^{-1}$ | −2.722*** | $-5.776 \cdot 10^{-1}$ | −2.755*** | $-5.948 \cdot 10^{-2}$ | −0.300 | $-2.910 \cdot 10^{-1}$ | −1.769* | $-1.034 \cdot 10^{-1}$ | −0.484 |
| *ISIC F* | $1.843 \cdot 10^{-1}$ | 1.184 | $7.012 \cdot 10^{-2}$ | 0.474 | $2.996 \cdot 10^{-1}$ | 1.499 | $5.109 \cdot 10^{-2}$ | 0.269 | $1.508 \cdot 10^{-1}$ | 0.801 |
| *ISIC G* | $-6.084 \cdot 10^{-1}$ | −2.942*** | $-6.691 \cdot 10^{-1}$ | −3.106*** | $-5.228 \cdot 10^{-1}$ | −2.179** | $-8.828 \cdot 10^{-1}$ | −4.682*** | $-7.270 \cdot 10^{-1}$ | −2.807*** |
| *ISIC H* | $8.357 \cdot 10^{-1}$ | 2.796*** | $5.617 \cdot 10^{-1}$ | 1.893* | $-3.183 \cdot 10^{-2}$ | −0.068 | $4.485 \cdot 10^{-1}$ | 1.686* | 1.044 | 4.048*** |
| *ISIC I* | $-7.147 \cdot 10^{-2}$ | −0.174 | $-9.118 \cdot 10^{-2}$ | −0.266 | $1.798 \cdot 10^{-1}$ | 0.477 | $-1.274 \cdot 10^{-1}$ | −0.560 | $-1.206 \cdot 10^{-1}$ | −0.410 |
| *ISIC K* | $-1.849 \cdot 10^{-1}$ | −0.341 | $-6.909 \cdot 10^{-2}$ | −0.105 | $7.646 \cdot 10^{-1}$ | 0.641 | $5.720 \cdot 10^{-1}$ | 2.597*** | $2.745 \cdot 10^{-1}$ | 0.959 |
| *ISIC N* | — | — | — | — | — | — | $6.546 \cdot 10^{-1}$ | 3.855*** | $7.616 \cdot 10^{-1}$ | 3.069*** |
| $R^2$ | 0.171 | | 0.138 | | 0.121 | | 0.211 | | 0.113 | |
| Effect of *Equal Rep.* | 0.604 | | 0.597 | | 0.680 | | 0.503 | | 0.388 | |
| Number of observations | 149 | | 158 | | 157 | | 161 | | 156 | |

Notes: The regression model is semiparametric. The nonparametric component comprises the firm size variable—*Stock Market Capitalization*—and the intercept. The standard errors of the regression coefficients of the parametric component (shown in the table) are corrected following White (1980); *t*-statistics significance levels (in two-tailed tests): * denotes 10% level, ** denotes 5% level, and *** denotes 1% level. The $R^2$ is the ratio of regression sum of squares and the sum of regression sum of squares and error sum of squares. The effect of equal representation on *Wage Bill-to-Sales Ratio* is calculated following Halvorsen and Palmquist (1980): $e^{\beta} - 1$, where $\beta$ is the regression coefficient of the respective indicator variable. For the year 1991, for instance, we find that equal representation increased *Wage Bill-to-Sales Ratio* by 68%.

## 7. Shareholder Countermeasures

We now explore if shareholders respond to codetermination by taking counteracting measures. One way shareholders can influence the decision making of the firm is by altering the remuneration structure of the supervisory board—the board where employee representatives exercise their voting power. Remember that not all employee representatives are also employees, just as not all shareholder representatives are necessarily shareholders. Another way of changing the incentives of labor is to alter the firm's capital structure. As mentioned, studies have found that, in the United States, companies respond to unionization by increasing leverage, committing more cash to leaving the firm. In what follows we investigate these two possible shareholder responses.

The remuneration of the supervisory board is voted on by the shareholders at the annual meeting. In other words, supervisory board compensation is under the immediate influence of the shareholders. We analyze the impact of equal representation—that is, the shareholders' response to it—on supervisory board compensation using the same nearest-neighbors method we used in studying management board compensation. The findings of this analysis are displayed in Table 7, alongside the results for the management board discussed previously. As before, the variable *Relative MTB* represents the link between supervisory board compensation and firm performance for companies that operate under one-third representation. Again, the sum of the coefficients of the variables *Relative MTB* and *Equal Representation* $\times$ *Relative MTB* gauges the performance-sensitivity of supervisory board compensation at the equal-representation firm. The table shows that there is no statistically significant link between supervisory board compensation and firm performance at companies with one-third representation. At the equal-representation firm, however, this link is positive and statistically significant (save for an insignificant coefficient when the (single) nearest neighbor is taken from the control group of equal-representation companies). Taken together, there is evidence that shareholders respond to equal representation by increasing the performance-sensitivity of the supervisory board compensation.

Similar to supervisory board compensation, leverage is voted on by the shareholders at the annual shareholder meeting. In response to the increased power employee representatives can bring to bear when voting on operating decisions of the firm, the shareholders may use leverage in an attempt to reassert their authority over decision making. For example, if employees wish to alter the firm's operations toward less restructuring activity and potentially associated layoffs, the shareholders may attempt to discipline labor by inducing the firm to operate with higher financial leverage. Higher financial leverage increases the probability that the firm defaults on its debt, making an inevitable reallocation of assets more likely. Also, as with U.S. companies responding to labor unions, shareholders

can increase leverage to commit cash to leave the firm—cash that will not be available to maintain a long payroll when the firm falls on a rough patch.

We employ the same semi-parametric regression technique with our standard set of explanatory variables. The dependent variable is the (logarithmic) debt-to-equity ratio. The regression results are displayed in Table 11. For all five years, equal representation has a statistically significant impact on firm leverage. Averaged over the analyzed time period, equal representation increases the debt-to-equity ratio by 69% (not percentage points, that is).

## 8. Conclusion

The German codetermination system legally allocates board seats in corporations to employee representatives. The degree of codetermination, that is, the fraction of board seats held by labor, depends on the number of employees of the respective group of affiliated companies. Shareholders can avoid codetermination only by breaking up the firm into unaffiliated separate legal entities or by transforming into a partnership—a move that is prohibitively costly for large corporations. We compare corporations with equal representation on the supervisory board with corporations that are subject to less extensive labor participation. We find that corporations with equal representation trade at a discount of 31% compared with corporations that are subject to one-third representation on the supervisory board. Employee representatives appear to succeed in altering the objective function of the firm; they use their voting power on the supervisory board to maintain a high staffing level, a finding consistent with resistance to corporate restructuring. Shareholders attempt to align with shareholder wealth the interests of the employee representatives on the supervisory board by linking supervisory board compensation to firm performance and by leveraging up the firm. These countermeasures are costly and imperfect, which explains the discount in the stock market. In conclusion, equal representation appears to be a binding constraint on the shareholders.

## Appendix A: Data Sources and Construction

The sample consists of the largest 250 stock corporations in Germany that traded at the end of the year 1993 in at least one of the two top-tier market segments: *amtlicher Handel* or *geregelter Markt*. In forming the sample, company size was measured by total assets. The sample does not include:

- *Kommanditgesellschaften auf Aktien* (KGaA; a hybrid organizational form between a partnership and a stock corporation);
- financial companies (banks, insurance companies, brokerages, financial holding shells);

TABLE 11. *Leverage* and control rights allocation

| Dependent variable: *leverage* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | | (2) | | (3) | | (4) | | (5) | |
| Year | 1989 | | 1990 | | 1991 | | 1992 | | 1993 | |
| Explanatory variable | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic | Coefficient | *t*-Statistic |
| *Equal Rep.* | $5.251 \cdot 10^{-1}$ | 3.435*** | $5.916 \cdot 10^{-1}$ | 3.555*** | $5.327 \cdot 10^{-1}$ | 3.622*** | $3.880 \cdot 10^{-1}$ | 2.368** | $4.083 \cdot 10^{-1}$ | 2.200** |
| *Insiders* | $-3.214 \cdot 10^{-2}$ | −0.137 | $1.473 \cdot 10^{-1}$ | 0.531 | $1.256 \cdot 10^{-1}$ | 0.488 | $6.677 \cdot 10^{-1}$ | 2.399** | $7.523 \cdot 10^{-2}$ | 0.303 |
| *Banks* | $9.103 \cdot 10^{-3}$ | 0.021 | $-8.501 \cdot 10^{-2}$ | −0.191 | $7.535 \cdot 10^{-1}$ | 1.968** | $5.389 \cdot 10^{-1}$ | 1.570 | $2.980 \cdot 10^{-1}$ | 0.632 |
| *Government* | $1.767 \cdot 10^{-1}$ | 0.416 | $4.605 \cdot 10^{-1}$ | 1.106 | $6.367 \cdot 10^{-1}$ | 1.147 | $7.763 \cdot 10^{-1}$ | 1.247 | 1.228 | 1.805* |
| *ECR25* | 1.375 | 2.854*** | $9.290 \cdot 10^{-1}$ | 1.827* | 1.573 | 3.151*** | 1.092 | 1.974** | $5.422 \cdot 10^{-1}$ | 0.998 |
| *ECR50* | $3.165 \cdot 10^{-1}$ | 0.954 | $1.359 \cdot 10^{-1}$ | 0.367 | $5.845 \cdot 10^{-1}$ | 1.508 | $1.220 \cdot 10^{-1}$ | 0.364 | $-4.085 \cdot 10^{-2}$ | −0.133 |
| *ECR75* | $7.056 \cdot 10^{-1}$ | 3.422*** | $4.242 \cdot 10^{-1}$ | 1.801* | $7.992 \cdot 10^{-1}$ | 3.502*** | $5.836 \cdot 10^{-1}$ | 2.675*** | $3.934 \cdot 10^{-1}$ | 1.877* |
| *ISIC A* | $-1.457 \cdot 10^{-2}$ | −0.075 | $-1.843 \cdot 10^{-2}$ | −0.098 | $-2.253 \cdot 10^{-1}$ | −1.323 | $-1.305 \cdot 10^{-1}$ | −0.727 | $3.541 \cdot 10^{-1}$ | 1.704* |
| *ISIC C* | −1.518 | −3.632*** | −1.360 | −2.977*** | $-9.703 \cdot 10^{-1}$ | −1.502 | −1.097 | −1.248 | −2.555 | −3.478*** |
| *ISIC E* | $1.588 \cdot 10^{-1}$ | 0.811 | $8.079 \cdot 10^{-2}$ | 0.423 | $-8.085 \cdot 10^{-2}$ | −0.379 | $-3.284 \cdot 10^{-1}$ | −1.282 | $-4.354 \cdot 10^{-1}$ | −1.543 |
| *ISIC F* | 1.022 | 4.103*** | $7.220 \cdot 10^{-1}$ | 2.238** | $6.944 \cdot 10^{-1}$ | 2.120** | $7.769 \cdot 10^{-1}$ | 3.080*** | $9.418 \cdot 10^{-1}$ | 5.192*** |
| *ISIC G* | $3.087 \cdot 10^{-1}$ | 1.492 | $4.773 \cdot 10^{-1}$ | 2.137** | $4.868 \cdot 10^{-1}$ | 2.153** | $6.120 \cdot 10^{-1}$ | 2.852*** | $7.434 \cdot 10^{-1}$ | 4.334*** |
| *ISIC H* | $-2.045 \cdot 10^{-1}$ | −0.896 | $1.113 \cdot 10^{-1}$ | 0.471 | $-1.825 \cdot 10^{-1}$ | −0.732 | 2.016 | 6.674*** | 2.245 | 6.887*** |
| *ISIC I* | $5.759 \cdot 10^{-1}$ | 2.436** | $1.365 \cdot 10^{-1}$ | 0.342 | $4.496 \cdot 10^{-1}$ | 0.976 | $5.162 \cdot 10^{-1}$ | 0.989 | $5.232 \cdot 10^{-1}$ | 1.211 |
| *ISIC K* | $6.405 \cdot 10^{-2}$ | 0.120 | $-4.643 \cdot 10^{-1}$ | −0.714 | $1.375 \cdot 10^{-1}$ | 0.181 | −2.448 | −8.485*** | −1.661 | −6.366*** |
| *ISIC N* | — | — | — | — | — | — | $-4.966 \cdot 10^{-1}$ | −2.587*** | $-7.703 \cdot 10^{-2}$ | −0.369 |
| $R^2$ | 0.367 | | 0.241 | | 0.282 | | 0.336 | | 0.383 | |
| Effect of *Equal Rep.* | 0.700 | | 0.807 | | 0.703 | | 0.474 | | 0.504 | |
| Number of observations | 150 | | 158 | | 158 | | 161 | | 156 | |

Notes: The regression model is semiparametric. The nonparametric component comprises the firm size variable—*Stock Market Capitalization*—and the intercept. The standard errors of the regression coefficients of the parametric component (shown in the table) are corrected following White (1980); *t*-statistics significance levels (in two-tailed tests): * denotes 10% level, ** denotes 5% level, and *** denotes 1% level. The $R^2$ is the ratio of regression sum of squares and the sum of regression sum of squares and error sum of squares. The effect of equal representation on *Leverage* is calculated following Halvorsen and Palmquist (1980): $e^{\beta} - 1$, where $\beta$ is the regression coefficient of the respective indicator variable. For the year 1991, for instance, we find that equal representation increased the debt-to-equity ratio by 70% (not percentage points, that is).

- public transportation operators;
- real estate businesses;
- companies of benefit to the public or with cooperative character;
- companies that are in liquidation or that have filed a petition for bankruptcy.

From the list of 250 corporations we drop companies if any of the following three conditions holds:

- The company is subject to *Montan* codetermination, follows special codetermination arrangements, or is not subject to codetermination at all.
- The company is in financial distress in at least one of the five sample years. Financial distress is defined as a state where the absolute value of the firm's loss exceeds the reserves.
- The company underwent postmerger restructuring during the sample period.

If companies transform to stock corporations, the observations of the transformation year and the years prior to it are discarded. Further, we drop observations where the number of employees and sales are not reported or where the reported numbers are zero. We analyze the first fiscal year that ends in a given calendar year. (If there are incomplete fiscal years, there may be two fiscal years ending in one calendar year.) We analyze the unconsolidated reports. When we have incomplete fiscal years, we scale the flows to 12-month values. The number of observations varies by the regression approach. This is because some of the sample companies transformed from partnerships to stock corporations during the analyzed period. Another reason is missing observations for sales or board compensation. Sometimes, board compensation is not published. On other occasions, board compensation includes undisclosed payments for previous years or excludes undisclosed payments delayed to later years. The data on equity ownership structure are from the annually published *Saling Aktienführer* (Darmstadt; Verlag Hoppenstedt & Co.); the information is based on September 30 of the respective year. Annual reports are taken from the respective annual volumes of *Handbuch der deutschen Aktiengesellschaften* (Darmstadt; Verlag Hoppenstedt & Co.). In a few instances we had to resort to the company's financial reports to complete the data. Also, we used company information as published in *Bundesanzeiger*, a gazette issued by the German Ministry of Justice.

## Appendix B: Definitions of Variables

This appendix details the definitions of the variables and explains how their values are calculated. For details on German accounting and disclosure rules for the pertinent time period, see, for instance, Ordelheide and Pfaff (1994).

***Definition of Dependent Variables***

1. *MTB*. Market-to-book ratio of equity, used in logarithmic form where indicated. The numerator is the end-of-calendar-year market value of equity, aggregated over all categories of stock. There are a few companies for which not all categories of stock are traded. Non-traded shares are either standard voting stock (when only nonvoting stock is traded) or stock with multiple votes (when stocks with single votes are traded). In these instances, we price non-traded shares the same as traded shares. This is because there is no straightforward way of pricing such non-traded shares, which differ both in liquidity and voting rights endowment.

The numerator of *MTB* is the end-of-calendar year book value of equity. For companies with other than calendar fiscal years, the book value is linearly interpolated.

The book value of equity is calculated as follows:

= *Gezeichnetes Kapital* (subscribed capital)
- − *Ausstehende Einlagen auf das Kapital* (unpaid contributions on subscribed capital)
- + *Rücklagen* (reserves)
- − *Rücklagen für eigene Anteile* (reserves held against own shares)
- + *Genußscheinkapital* (participation certificates), if payments to these securities are included in the result of ordinary business activity
- + 0.5 × *Sonderposten mit Rücklageanteil* (special item with a reserve component).

The "special item with a reserve component" is a pretax item and is thus part equity, part tax liability. The effective tax rate depends on future income and the way the company smoothes future income over time through contributions to provisions. We follow the usual academic and practitioner procedure at the time and use 0.5 as a proxy for the actual tax rate.

Participation certificates are securities that show in many different specifications. In some cases, these securities are very similar to preferred stock, whereas in other cases they are close to bonds with fixed interest payments. We define them as equity if the payments to these securities are made from residual income. Otherwise they are considered debt.

2. *Q Ratio*. Used in logarithmic form where indicated. The numerator—the market value of total liabilities—is approximated by the sum of the market value of equity—the numerator of *MTB*—and the book value of debt. The book value of debt is measured by the difference between the end-of-calendar year book values of total liabilities and equity, the latter being the denominator of *MTB*. (For companies with other than calendar fiscal years, the book values are linearly interpolated.) The denominator of *Q Ratio*—the replacement costs of assets—is

approximated by the book value of assets, which, by accounting identity, equals the book value of total liabilities; the latter is calculated as follows:

= *Bilanzsumme* (balance sheet total)
- − *Ausstehende Einlagen auf das Kapital* (unpaid contributions on subscribed capital)
- − *Rücklagen für eigene Anteile* (reserves held against own shares)
- − *Disagio* (loan redemption premium)
- − *Nicht durch Eigenkapital gedeckter Fehlbetrag* (position that indicates negative equity; distressed companies were eliminated).

3. *Wage Bill-to-Employees Ratio*. Used in logarithmic form. The wage bill is measured in units of 1,000 German marks and scaled to 12-month values where fiscal years are incomplete. Generally, the number of employees refers to the end of the fiscal year; less frequently, published employee numbers are fiscal-year averages, where part-time employees are weighted according to their nominal work hours.

4. *Employees-to-Sales Ratio*. Used in logarithmic form. For number of employees, see above. Sales are measured in units of 1,000 German marks and scaled to 12-month values where fiscal years are incomplete.

5. *Wage Bill-to-Sales Ratio*. Used in logarithmic form. Wage bill and sales numbers are calculated as described previously.

6. *Leverage*. Logarithmic debt-to-equity ratio, based on end-of-fiscal-year values. Debt is liabilities with stated maturity. Equity is calculated as detailed above.

7. *Board Compensation*. Management board and supervisory board compensations are measured on a per-capita basis in units of 1,000 German marks and scaled to 12-month values where fiscal years are incomplete. Compensation data for individual board members are not publicly available for the analyzed time period. Members of the management board (and, less frequently, members of the supervisory board) of large companies tend to hold board seats in subsidiaries. Because we analyze unconsolidated reports, we subtract compensation received from subsidiaries. We subtract license fees and severance pay to management board members. We subtract compensation paid for previous years and add it to the years in question.

### *Definition of Explanatory Variables*

1. *Equal Representation*. Equal to one if the firm is subject to equal representation on the supervisory board, and zero otherwise.

2. *Leverage*. Serves as a dependent variable in a recursive model. For a description of this variable see preceding.

3. *Stock Market Capitalization*. Numerator of market-to-book ratio of equity (described above), in units of 1 German mark. Used in logarithmic form. Measure of firm size.

4. *Insiders*. Fraction of equity control rights held by management, other employees, or (domestic or foreign) families. If families hold equity stakes indirectly (through other nonfinancial companies) in companies in which they are represented on the supervisory board, the stakes are categorized as family controlled. Otherwise, the stakes are categorized as controlled by nonfinancial companies.

5. *Banks*. Fraction of equity control rights held by domestic banks. Government-controlled special-purpose banks (e.g., Kreditanstalt für Wiederaufbau; Bayerische Landesanstalt für Aufbaufinanzierung) are not included; instead, they are categorized as government entities.

6. *Government*. Fraction of equity control rights held by domestic government entities, including government-controlled special-purpose banks.

7. *ECR25*. Largest fraction of equity control rights held by a single investor; zero if this fraction is either 0.25 or less or more than 0.5.

8. *ECR50*. Largest fraction of equity control rights held by a single investor; zero if this fraction is either 0.5 or less or 0.75 or more.

9. *ECR75*. Largest fraction of equity control rights held by a single investor; zero if this fraction is less than 0.75.

10. *ISIC*. Industry affiliation based on International Standard Industrial Classification (United Nations 1990).

## Appendix C: Econometric Methodology

For each year in our data set, we estimate a semiparametric regression equation of the type

$$y_i = f(z_i) + \boldsymbol{x}_i\boldsymbol{\beta} + \varepsilon_i, \tag{C.1}$$

where $y_i$ denotes an observation of firm $i$ of the dependent variable. The scalar $z_i$ represents the size of firm $i$ and, along with the intercept, makes up the nonparametric component of the regression equation. The (row) vector $\boldsymbol{x}_i$ comprises the observations of firm $i$ of the variables in the parametric component, and $\varepsilon_i$ is an error term.

We estimate equation (*C*.1) following Speckman (1988). In the first step, we smooth the dependent variable vector, $\boldsymbol{y}$, on firm size, $\boldsymbol{z}$. The smoother matrix, $\boldsymbol{S}$, establishes a linear relationship between $\boldsymbol{y}$ and the estimate $\bar{\boldsymbol{y}}$:

$$\bar{\boldsymbol{y}} = \boldsymbol{S} \cdot \boldsymbol{y}. \tag{C.2}$$

We apply the smoother LOESS (locally weighted regression) as developed by Cleveland and Devlin (1988) and Cleveland, Devlin, and Grosse (1988). LOESS

estimates the functional form in each observation by defining a neighborhood of $q$ data points around the observation in question. These data points are chosen and weighted based on the Euclidean distance. We use a tricube weight function with quadratic fitting as suggested by Cleveland and Devlin. The fraction of data points that are comprised in the neighborhood $g = q/n$ is called the smoothing parameter. We chose a smoothing parameter of 0.7. We also estimated the model with alternative smoothing parameters ($g = 0.4$ and $g = 1$) without obtaining qualitatively different results on the influence of codetermination.

In the second step, we "purge" the dependent variable and the explanatory variables of the parametric component from the influence of firm size, which is contained in the nonparametric component:

$$\tilde{\boldsymbol{y}} = (\boldsymbol{I} - \boldsymbol{S}) \cdot \boldsymbol{y} \tag{C.3}$$

$$\tilde{\boldsymbol{X}} = (\boldsymbol{I} - \boldsymbol{S}) \cdot \boldsymbol{X}, \tag{C.4}$$

where $\boldsymbol{I}$ is the identity matrix.

In the third step, the vector $\boldsymbol{\beta}$ is estimated using ordinary least squares:

$$\hat{\boldsymbol{\beta}} = (\tilde{\boldsymbol{X}}'\tilde{\boldsymbol{X}})^{-1} \cdot \tilde{\boldsymbol{X}}'\tilde{\boldsymbol{y}}. \tag{C.5}$$

As Speckman (1988) has shown, the bias of the estimator $\hat{\boldsymbol{\beta}}$ is asymptotically negligible for sufficiently low values of the smoothing parameter, $g$.

The estimated impact of the explanatory variables in the partially linear model is

$$\hat{\boldsymbol{f}} = \boldsymbol{S} \cdot (\boldsymbol{y} - X\hat{\boldsymbol{\beta}}). \tag{C.6}$$

Thus, we can write for the estimated vector of the dependent variable:

$$\hat{\boldsymbol{y}} = X\hat{\boldsymbol{\beta}} + \hat{\boldsymbol{f}}. \tag{C.7}$$

It is straightforward to show that $\hat{\boldsymbol{y}}$ is a linear function in $\boldsymbol{y}$:

$$\hat{\boldsymbol{y}} = \boldsymbol{L}_{\boldsymbol{S}} \cdot \boldsymbol{y}, \tag{C.8}$$

where

$$\boldsymbol{L}_{\boldsymbol{S}} = \boldsymbol{X}(\tilde{\boldsymbol{X}}'\tilde{\boldsymbol{X}})^{-1}\tilde{\boldsymbol{X}}'(\boldsymbol{I} - \boldsymbol{S}) + S_{\boldsymbol{F}} \tag{C.9}$$

$$\boldsymbol{S}_{\boldsymbol{F}} = \boldsymbol{S}[\boldsymbol{I} - \boldsymbol{X}(\tilde{\boldsymbol{X}}'\tilde{\boldsymbol{X}})^{-1}\tilde{\boldsymbol{X}}'(\boldsymbol{I} - \boldsymbol{S})]. \tag{C.10}$$

Based on this linearity property, we use results from Cleveland and Devlin (1988, p. 599) on the distribution of the residuals of LOESS regressions to estimate standard errors for $\hat{\boldsymbol{\beta}}$, as proposed by Speckman (1988, p. 421).

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