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**“CAUSES AND CONSEQUENCES
OF BOARD COMPOSITION”**

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THESIS

**Submitted in partial fulfillment of the requirements
for the degree of Doctoral of Philosophy in Human Resources and Industrial Relations
in the Graduate College of the
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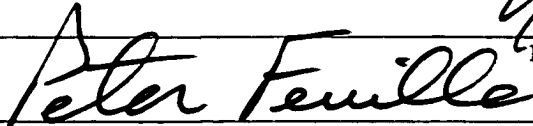
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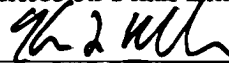

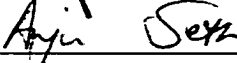
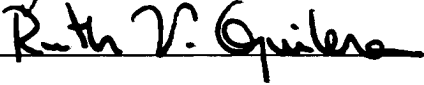
ENTITLED "CAUSES AND CONSEQUENCES OF BOARD COMPOSITION"

BE ACCEPTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR

THE DEGREE OF DOCTOR OF PHILOSOPHY


Director of Thesis Research
Head of Department

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ABSTRACT

This dissertation examines the causes and consequences of patterns in the composition of American boards of directors. The three papers each focus on one type of corporate director: outsiders, women, and workers. The results from the outside director paper suggest that companies employing more female directors tend to employ more outside directors, and that the increase in board independence from employing female directors results in improved firm performance. This supports normative agency theory models of board composition and recent policy changes; increasing board independence will improve corporate financial outcomes. The female director paper tests whether human or social capital theories explain patterns in female director employment. It posits a trade-off between the development of human and social capital in female directors, such that companies requiring high director-level human capital tend to employ more male directors and companies requiring high director-level social capital tend to employ more female directors. The empirical results support this model. Finally, the worker director paper analyzes the appropriate role of employees on boards of directors using real options theory. The predictions suggest that employee governance is desirable in some labor contracts, but would worsen efficiency and labor market outcomes in other settings.

To my generous wife, Miwako

ACKNOWLEDGMENTS

There are a number of people who contributed to this thesis. Through his advice, humor, and advocacy, Kevin Hallock had a positive, significant, and causal effect on the quality of this dissertation. Anju Seth patiently taught me about corporate governance and contract economics and encouraged this research. Discussions with Craig Olson immeasurably strengthened the empirical analyses in these papers and my research skills. Ruth Aguilera provided extensive and insightful advice and comments. John Johnson successfully proselytized the use of instrumental variable and fixed effects techniques in empirical research. Although they still wonder what exactly I do, my parents and Miwako's parents always encouraged my work. Finally, Miwako selflessly encouraged graduate school and the completion of this thesis.

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CHAPTER 1 INTRODUCTION

Agency theorists define the firm as a nexus of contracts, and the central activity in any firm is contracting, or the management of relationships that result in actions being performed for the firm by agents (Jensen and Meckling 1976). In publicly-traded corporations, a primary contracting problem is how a dispersed group of equity owners can motivate a small group of managers to invest cash in efficient projects or dividends instead of wasteful organizational inefficiencies (Jensen 1986). The owners have a number of tools that can improve the efficiency of agents' actions, including incentive compensation, the use of reputation markets, and direct monitoring by supervisors. This dissertation focuses on those supervisors, who are called directors and serve for fixed terms on corporate boards. The directors have a fiduciary responsibility to represent the interests of the owners in all contracting with internal executives and outside parties. Like any group, the composition of a board of directors may determine its effectiveness, which in turn affects the quality of executive decision-making and, ultimately, firm performance.

The three chapters in this dissertation examines the causes and consequences of three recent trends in board composition, focusing on actual or recommended increases in the number of outside, female, and worker directors. I analyze the effect of outside directors on firm performance and the rationales for patterns in female director employment and the lack of worker participation on boards. This research crosses the fields of labor economics and corporate governance: the essays on female and employee directors are grounded in labor economics theories (social and human capital for the former and contract economics for the latter), and the two empirical papers rely on methodologies from labor economics to identify causal relationships.

OUTSIDE DIRECTORS AND FIRM PERFORMANCE

One trend in board composition is that companies are hiring more outside directors, defined as individuals with no employment or other material relationship with an organization. The Enron collapse and subsequent corporate crises prompted a series of institutional and regulatory reforms that forced companies to hire more outside directors. Specifically, the New York Stock Exchange and NASDAQ adopted policies in 2002 that require listed companies to employ a majority of outside directors, and the Sarbanes-Oxley Act of 2002 requires corporations to employ only outside directors on audit committees that monitor the accounting firms hired to review financial statements. Even before these reforms, the effect of outside directors on firm performance was a central research question in corporate governance. Most empirical work on this relationship posits that outside directors will improve firm performance because they have less incentive to approve decisions that benefit executives at the expense of owners -- an agency theory argument (Jensen and Meckling 1976, Fama 1980, Fama and Jensen 1983). However, empirical research generally does not support this hypothesis. Employing more outside directors is associated with lower firm performance in many studies and a meta-analysis shows no evidence of a positive relationship between outside directors and firm performance (Dalton, Daily, Ellstrand and Johnson 1998).

The chapter in this dissertation finds that results from many past empirical studies are biased by unobserved heterogeneity, because there is a negative correlation between residual firm performance and the employment of outside directors. Poorly performing firms may add outside directors to improve performance, or highly performing firms may choose to hire fewer outside directors because of the quality and reputation of the executive team. Controlling for unobserved heterogeneity with instrumental variable and firm-level fixed-effects research designs, the analyses presented in this chapter show that outside directors

have a positive and generally significant effect on firm performance.

FEMALE DIRECTOR EMPLOYMENT

More visible than the shift toward outside directors is that companies have diversified their boards by adding female directors. The number of female directors has risen from fewer than 50 in the late 1960s to more than 800 today, while the total number of directors serving on large company boards has fallen over the same period (Catalyst 1984, Catalyst 1999). The annual growth in female directors has averaged 11% over the last thirty years, and this trend has continued in recent years. Despite this growth, female participation on boards varies significantly across companies. Some companies employ no female directors, others employ one or two, and a small number employ three or more. The average board would require five or six female directors for proportional gender representation.

Examining female participation in senior leadership positions is important in its own right, but it also is part of a broader literature on the effects of diversity on team performance. This chapter approaches diversity differently than many of these studies. Rather than examine the effects of gender diversity on performance, the analyses in this dissertation examine which companies select to have diverse boards. I posit that female directors bring unique social capital to boards, while male directors tend to have high levels of human capital. Companies that value social capital more than human capital should be more likely to add female directors and have diverse boards.

The empirical results broadly support the social capital model; companies with high revenue and large boards are most likely to employ female directors, and these effects are moderated by industry discretion and CEO tenure. There is no evidence that companies with more female directors pay their directors more than other companies, controlling for firm and board size and other variables, so women

do not appear to be sorting into only the “best” directorships. There is weak evidence supporting a negative relationship between past firm performance and female director employment -- female directors tend to be employed by companies that have performed poorly in prior periods.

REAL OPTIONS AND EMPLOYEE GOVERNANCE

Finally, recent policy-oriented research associated with the Brookings Institution has focused attention on non-executive employee participation on corporate boards. Margaret Blair and colleagues have highlighted an important phenomenon: workers often invest capital in a company in the form of relationship-specific assets, but they rarely receive any rights to participate in decisions that affect returns on those assets (Blair 1995, Blair 1996, Blair and Roe 1999, Blair and Kochan 2000). While very few companies offer board seats to non-executive employees, Blair makes a forceful policy recommendation that the federal government or another institution mandate employee participation as directors. This chapter analyzes why workers do not participate in corporate governance in the United States, despite their investments in relationship-specific capital.

The work in this chapter makes two theoretical contributions. First, it considers the issue of employee participation in governance using a real options framework. Labor contracts usually are implicit, so both parties receive real options to cancel the contract at any time. These options have values that will vary predictably -- similar to financial options -- so it possible to model when the parties will face the largest contractual problems. Workers may demand involvement in corporate governance when they expect the company to renege on the implicit contract, when the company has a valuable option. The workers face the largest contractual costs when there is large downside risk to the capital investment, when the investment is large in magnitude, when the company has no reputation or when

reputation markets are inefficient, when interest rates are low, and when the time period is long. In those cases, the workers may receive corporate governance rights if their involvement in governance is the lowest-cost solution to the contractual problems. The parties also can agree to transfer wealth at the beginning or end of the contract or to commit themselves to the relationship, rather than divide governance rights, to reduce contractual frictions. Second, the model can be used to show who pays for specific human capital investments, a theoretical problem since Becker's original work on human capital theory (Becker 1964).

SUMMARY

This dissertation on board composition makes contributions to corporate governance theories, research methods, and results. First, I propose a fundamental trade-off between the development of director-level social capital and human capital, because the value of social capital is rooted in its uniqueness, while the value of human capital is rooted in its sameness. This also may have implications for other occupations and employment patterns of in-group and out-group members. Second, I show that the theoretical question "who pays for specific human capital investments" can be formally modeled using a real options analysis. Because this relationship-specific asset with no external market creates options for either party to cancel the implicit contract, the party receiving the most valuable option will pay for the specific human capital investment. Finally, I apply techniques to control for unobserved heterogeneity, which arises from self-selection of the treatment variables. These techniques can estimate causal relationships instead of simple associations if properly designed. In the outside directors chapter, these techniques result in findings that differ from most existing research -- outsiders improve firm performance. In the female directors chapter, these techniques show that the simple cross-sectional analyses produce unbiased estimates.

CHAPTER 2 OUTSIDE DIRECTORS AND FIRM PERFORMANCE

In response to the corporate governance scandals of 2001 and 2002, a number of institutions in the United States -- stock exchanges, pension funds, government agencies, and newspapers -- responded with proposals to empower corporate boards. These recommendations require companies to hire more independent directors, defined as individuals with no recent financial or employment ties to companies' executives, for their boards of directors and to ensure that only these outside directors serve on the executive, audit, and compensation committees (NYSE 2002, NASDAQ 2002). The NYSE adopted new standards in August 2002 to require that "listed companies must have a majority of independent directors" and "no director qualifies as 'independent' unless the board of directors affirmatively determines that the director has no material relationship with the listed company" (NYSE 2002, p. 5). The NASDAQ board of directors proposed similar changes that "require a majority of independent directors on the board" (NASDAQ 2002, p.1). Corporate governance research, in contrast, typically finds that boards with fewer independent directors perform better. In three frequently cited works, the authors find that outside directors worsen performance (Agrawal and Knoeber 1996), close director-executive relationships improve performance (Westphal 1999), and outside directors have an insignificant effect on firm performance (Weisbach and Hermalin 1991). A recent examination of 54 empirical studies in finance and management journals finds no consistent evidence that companies with more independent directors perform better than companies with fewer (Dalton, Daily, Ellstrand, and Johnson 1998). This research in corporate governance suggests that policies to increase board independence are unlikely to improve firm performance.

This paper posits that the negative relationship between firm performance and outside director employment in past studies reflects unobserved heterogeneity, rather

than a causal relationship. Most research on corporate governance does not consider that companies self-select board independence simultaneously with decisions about strategies, capital budgets, corporate cultures, and many other factors (Hermalin and Weisbach 2000, Bhagat and Jeffris 2002). Researchers cannot randomly assign board characteristics to actual companies, but most previous empirical studies implicitly assume that board independence is a randomly assigned treatment. This paper attempts to identify the causal effects of board independence on financial performance using female director employment as an instrument for outside directors.

THEORETICAL BACKGROUND

In the United States, shareholders own the decision rights and property rights for corporations, while a mostly non-overlapping group of executives manage day-to-day operations. Agency theory predicts that the contractual frictions resulting from the separation of company ownership and management causes a deviation of actual managerial behavior from owner-optimal managerial behavior (Jensen and Meckling 1975, Williamson 1975). To lessen these frictions, shareholders of publicly-traded companies develop agency controls to align manager behavior with their interests. One control required by state incorporation laws is a board of directors, which exists when diffuse shareholders hire individuals to monitor managers (Fama and Jensen 1983, Mace 1971). In the agency model, directors improve firm performance by reducing managerial waste or improving managerial performance via monitoring and incentives. Normative agency theory predicts that increasing board independence results in executive decisions that increase shareholder value.

The model for this paper begins with two types of directors. Inside directors are either past or former employees and suppliers of a company or family members of the company's executives. Outside directors have no material relationships to the managers except for their joint service on the company's board. The company's

managers propose actions to directors, who in turn vote to approve or reject the proposal. Shareholders have two preferences: all value-destroying proposals should be rejected and all value-enhancing proposals should be accepted. Executives, on the other hand, may propose value-destroying actions that enhance managerial wealth or status or make the work easier or less risky.

Insider directors are assumed to always vote for any proposal, whether it is value-destroying or value-enhancing, because they benefit either directly from proposals to increase their wealth or status or because they want to appease more senior executives for career advancement. The important question is whether outside directors vote for or against value-destroying proposals.¹ This question is trivial in a setting with perfect information and costless information processing, but director-level decisions are likely characterized bounded rationality and decision-making biases (Cyert and March 1963, Simon 1945). It is possible that an unbiased independent director would vote in support of a value-destroying action if that director actually thought that the action was value-enhancing or value-neutral. One way to resolve this evaluation problem is to increase the number of evaluators. Shareholders cannot add inside directors because they will vote in support of every proposal, but they should benefit from improved decision-making by adding outside directors. Assuming that some outside directors overestimate an action's value and

¹ Two details are worth mentioning here. Research has suggested that almost all board votes are unanimous (Lorsch and MacIver 1993). If all inside directors will vote for a value-destroying proposal, does this mean that all outside directors do the same to maintain unanimity? There are two possible models to explain unanimous voting. First, all directors may reveal their votes before the actual voting occurs, so the losing side is able to vote in the same direction as the winning side. This may reduce the appearance of divisions on the board by making it more difficult to quantify and observe such differences. Second, inside directors may avoid proposing value-destroying actions if they know that the outside directors will not approve it. This second effect is magnified by the role outside directors have in reviewing executive performance and making retention, promotion, and compensation decisions.

others underestimate it, an increase in the number of directors will both reduce the effect of any single director's judgment error and, as board size increases, the estimated value of the proposal will more closely approach its actual value. This assumes implicitly that the evaluation error of any single director has no effect on the evaluation error of other directors. The more outside directors on the board, the less likely that errors in evaluating projects will result in value-destroying actions being approved. This paper does not consider any evaluation errors or biases except this random variation inherent in determining whether a project is good or bad. Adding outside directors will result in better operating decisions and improved firm performance.

PRIOR EMPIRICAL WORK

There is a large empirical literature on the causes and consequences of board composition (see Dalton et al. 1998 for a recent survey of the literature). Studies on the effects of outside directors have shown inconsistent, but generally negative, results. Agrawal and Knoeber (1996) find a significant negative effect of outside directors on Tobin's q . Weisbach and Hermalin (1991) find no evidence that outside directors have any relationship to Tobin's q using both OLS and IV analyses. The effect of outside directors on firm performance is moderated by how closely a firm conforms to common industry strategies (Geletkanyc and Hambrick 1997) and appears to be nonlinear (Wagner, Stimpert, and Fubara 1998). At the operations-spending level, firms with more outside directors spend less on salaries, wages, and building rent (Mayers, Shivdasani, and Smith 1997) and on research and development (Baysinger, Kosnik, and Turk 1991). Even in periods of crisis, the results are mixed. Firms with outside directors are more likely to be takeover targets (Shivrasani 1993), although they also are less likely to go bankrupt (Daily and Dalton 1994a, Daily and Dalton 1994b, Daily and Dalton 1995) and are more likely to emerge successfully

from a short-term financial decline (Mueller and Barker 1997).

The social and business relationships between directors and executives, which helps to measure how independent outside directors really are, have been shown to have an insignificant or positive relationship to performance. Whether a firm has a reciprocally-interlocked directorship with another firm has no relationship to firm performance (Hallock 1997). Another study finds that close social relationships between the CEO and directors may improve financial performance (Westphal 1999), as dependent directors are worse at monitoring managers but better at providing advice.

These empirical results suggest no consistent relationship between board independence and firm performance. Some empirical studies find a positive or neutral relationship, while other estimates are negative. The “true” relationship may be intractable because of the difficulty of conducting randomized experiments, poorly understood selection processes, and reverse causality. Like most macro-level research, one cannot randomly assign treatments (board characteristics) to actual companies: the potential negative effects of receiving a “non-optimal” set of directors makes any true experiment too costly and risky to perform. Behavioral researchers overcome this limitation through specifically constructed laboratory experiments, but this approach has low ecological validity for board research. Artificial experiments cannot create board-like conditions, given the importance of board duties and the financial and social consequences of ineffective board service. Most concerning, the complexity of this phenomenon also has limited the internal validity of statistics-based research designs. For example, most studies cannot distinguish the direction of causality. That is to say, board demographics may determine performance or firm performance may determine demographics.

The prior empirical research relies mostly on cross-sectional data and ordinary least squares regressions or related techniques. There frequently are important

omitted variables that could bias the coefficients, especially when companies “self-select” board composition simultaneously with decisions about strategies, firm performance, culture, executive characteristics, and other factors (Hermalin and Weisbach 2000, Bhagat and Jeffris 2002). The range of empirical findings, from negative to positive, could mirror biases in the analytical technique and therefore may not reflect the true underlying relationship between outside directors and firm performance. This paper uses an instrumental variable research design to estimate the causal effect of outside director employment on firm performance. In the labor economics literature, this approach has been used to analyze issues like returns to a college education, returns to military service, and the policy effects of immigration, grade school class sizes, and college financial aid (Angrist and Krueger 2001). This approach promises to isolate the causal relationship between outside directors and firm performance by eliminating biases caused by omitted variables correlated with firm performance and the outside director ratio.

EMPIRICAL DESIGN

The primary contribution of this paper is the application of instrumental variable estimation to corporate governance. Economists have used IV estimation since the 1920s to estimate supply and demand equations (Angrist and Krueger 2001), and other social scientists have used instrumental variables to reduce measurement error in key independent variables (Neter, Kutner, Nachtsheim, and Wasserman 1996). Over the last decade, instrumental variable estimation has been used to identify causal relationships between variables where there is substantial potential for omitted variable bias. Angrist (1990) addressed the relationship between years of military service and subsequent earnings. He used randomization in military service introduced by the Vietnam-era draft to estimate returns to military service. Men with low draft numbers were more likely to serve in the military, but -- because

the draft order was based on birth dates -- there was no other relationship between draft order and future earnings except through the impact of draft order on the probability of military service. Angrist used the random variation in military service caused by the person's draft order to estimate the causal relationship of service on future earnings. This paper applies this estimation strategy to the relationship between outside directors and firm performance using female director employment as the instrumental variable.

Instrumental Variable Strategy

The prior research on outside directors and firm performance typically uses OLS estimation, represented by equation 1.

$$(1) \quad Y_i = X_i' B + O_i C + e_i.$$

OLS can produce unbiased estimates when the covariance of the error term (e_i) and treatment variable (O_i) is zero. However, the covariance may not equal zero. If the analysis omits one or more variables correlated with both the independent variables and firm performance (Y_i), then the coefficients will be biased. The potential for omitting variables in corporate governance research is significant. Researchers usually do not measure all relevant company, board, and individual-level governance practices (Rediker and Seth 1995), and random assignment obviously cannot be used to ensure that the covariance of the error term and outside director percentage is zero. The empirical problem specifically is that companies self-selecting high levels of outside directors may vary in some unmeasured way from companies selecting low levels of outside directors.

The instrumental variable technique starts with the same equation as the OLS design. Because the empirical problem is in the self-selection of the outside director variable, it is useful to consider an equation describing the determinants of O_i , the outside director ratio:

$$(2) \quad O_i = X_i'A + Z_iD + u_i.$$

Equation 2 shows that the choice of outside directors depends on the control variables from the original equation and an unique instrument variable (Z_i), plus the unobserved portion of the selection process (u_i). The self-selection problem discussed above is that the error term u_i can be decomposed into a truly random term (g_i) and a term that is correlated with the error term in the original OLS equation (denoted by e_2).

Unobserved heterogeneity, or self-selection bias, describes the situation when the covariance of e_1 and e_2 is not zero. In this case, there is a correlation between companies choosing to employ more outside directors and the unexplained variation in firm performance. A negative correlation between those variables, such as when companies more likely to employ outside directors also tend to have lower firm performance, would make it appear that outside directors cause lower performance, although this effect is only due to self-selection. When the covariance of e_1 and e_2 is not zero, using variation in O_i that arises from variation in the instrumental variables (Z_i) can produce a better estimate of the true coefficient C than can a simple OLS regression. This IV equation can be written as:

$$(3) \quad Y_i = X_i'B + (X_i'A + Z_iD)C + e_i, \text{ or}$$

$$(4) \quad Y_i = X_i'E + Z_iG + e_i.$$

In this model, the coefficient G is an unbiased estimate of the effect of outside directors on firm performance, through the effect of the instrumental variable on outside director employment.

There are two important conditions for instrumental variable estimation to be effective. First, there must be a significant correlation between the outside director ratio and the instrumental variable. When there is no relationship between these variables, then the IV analysis is the equivalent of adding an extraneous variable to any regression equation. It is possible to use weak instruments -- variables that have a low correlation with the treatment variable -- but the results will be more efficient

with strong instruments (Angrist and Krueger 2001). The second condition is that the covariance of the instrumental variable and the error term in equation 4 must equal zero. The initial empirical problem in equation 1 was the non-zero covariance of the outside director variable and error term. If the instrument is also correlated with that error term, then the IV analysis only substitutes one problematic variable for another.

This paper relies on female director employment as an instrument for outside director employment. This instrument meets the two conditions for an effective instrument: female director employment is strongly correlated with outside director employment and female director employment appears to be independent of firm performance except through its effect on outside directors.

Women on Boards

In 1986, the term “glass ceiling” was created to describe an unobserved barrier keeping women from executive jobs in large corporations. A survey conducted around that time found that women held only 4% of senior executive jobs (Catalyst 2000). Even today, the number of female executives remains so low that organizations continue to seek higher female representation in corporate leadership positions (Catalyst 2000, Daily Certo and Dalton 2000). Key stakeholders have encouraged companies to increase female director and executive employment, and one organization, Catalyst, publishes reports that explicitly notes firms with high female participation in senior management and encourage firms to improve gender diversity (Catalyst 2000). While female director employment is still low, there is a growing number of women serving on boards. Female directors held twice the number of directorships in the late 1990s as the late 1980s (Catalyst 2000). More directly, seventy-two percent of surveyed CEOs in 1995 indicated that recruiting a female director was a top priority or priority while only 14% indicated that gender was not a relevant criterion, and eighty-six percent of CEOs identified that increasing

female representation on boards is an important general principle (Mattis 2000).

When CEOs seek female directors for their boards, they usually hire an outsider. Women now hold 11% of directorships, but they represent only 2% of inside directors. In a 1998 survey, equal numbers of female directors worked in corporate and non-profit/academic fields (roughly one-third each), and a large number of women (18%) had unidentified or entrepreneurial backgrounds (Mattis 2000). My own data from 1998 show that only 3% of male directors held positions in education and 1% were classified as private investors or unknown. Female directors are more likely to be outsiders and from non-corporate fields (Hillman Cannella and Harris 2002). Directors tend to be older and have extensive work experience, and men typically gain this experience in corporations, including those for which they serve as directors. As the glass ceiling report shows, most women did not have the opportunity to pursue senior executive careers in corporations until the 1970s and 1980s. Even today, twenty five years later, that vanguard of women has roughly ten to fifteen years less experience than the typical corporate board member. Leadership opportunities in academia, government, and non-profit agencies existed for women, and many women rose to executive positions in these organizations.

The increase of female director employment in recent years has had an unintended consequence; it has increased the number of outside directors serving on boards. Board size has increased steadily through the 1980s and 1990s and the percentage of outsiders has risen at the same time (Zajac and Westphal 1996), so there is no evidence that women are replacing men on boards. Also, there is no evidence that firms that performed better in the past are more likely to hire female directors. In the next chapter, I show that past stock price performance, if anything, has an insignificant negative effect on female director employment, suggesting that firms with historically good performance tend to employ fewer female directors.

DATA

The sample is based on the 1998 Forbes survey that lists the 500 largest American companies by market value, revenue, profits, and assets. I collected archival data on boards of directors from annual reports and proxy statements published in 1999 and 2002 for the 1998 and 2000 fiscal years. There were 815 firms on one or more list, and I collected a complete set of information on 636 companies. The most common reason for excluding firms was that I could not identify the primary employer or occupation of the directors, which companies are not required to publish in annual reports and proxy statements. I then collected the same data using the Forbes list in 2000. Finally, I matched the data to Compustat and ExecuComp for performance and control variables. There are 611 observations in 1998 and 574 in 2000, forming a panel of 546 companies with complete data for both years.

Key Variables

Dependent variable. Consistent with other studies of the effect of corporate governance on firm performance, this paper uses a version of Tobin's q as its dependent variable (Weisbach and Hermalin 1991, Agrawal and Knoeber 1996, Yermack 1996, Bhagat and Black 2002). Tobin's q measures the market value of a company compared to the replacement value of its assets. This represents the premium that investors pay for the company's assets, which can be described as the value added by a company's managers. There are a number of ways to calculate Tobin's q, varying in complexity (Lewelen and Badrinath 1997, Chung and Pruitt 1994). Various methods have been shown to have high levels of consistency (Lee and Tompkins 1999). I first add the market value of the company (its stock price multiplied by its shares outstanding) at the final market close of its fiscal year to the total market value of the company's long-term debt, to generate the total enterprise value of the organization. I then divide the total enterprise value by the book value

of the company's assets, as recorded in its annual report. Finally, this variable is logged.

Treatment and instrumental variable. The key independent variable is the log outside director percentage. This variable was constructed by first dividing the number of outside directors on the board by the number of total directors and then taking the natural log of this number. Using a logged variable is appropriate because it reduces skewness in the dependent variable, to approximate a normal distribution. Outside director status, in this study, measures whether the director's primary employer is different from the firm on which he or she serves as a director. I classified as an insider any director employed by the firm on which he or she serves or employed by a foundation or other organization primarily affiliated with or supported by the firm. I also classified family members of the Chairperson or CEO as inside directors, as well as any director who was an employee of the company in a prior year. While the measurement of the outside director ratio has been shown to be an important issue (Daily Dalton and Johnson 1999), this paper does not consider other measures like an unaffiliated director ratio or independent director ratio. Improved measurement is a future extension of this paper, as it will strengthen the empirical results, which you will see are already significant. The instrumental variable is the log number of female directors. To calculate this variable, I first classified gender based the first or middle name of the director and then summed the number of female directors for each board.

Control variables. Performance equations using Tobin's q as the dependent variable typically control for firm size, industry, and some measure of financial risk. In studies similar to this paper, Bhagat and Black (2002) regress Tobin's q on firm size, board size, industry, and executive, director, and blockholder share ownership.

Agrawal and Knoeber (1996) control for firm and board size, industry, and research and advertising expenditures. Yermack (1996) focuses on the effect of board size on firm performance and finds that the effect is not sensitive to specification; adding control variables for research expenditures, depreciation, price-to-earnings ratio, and stock price variance did not change the coefficient on board size.

The analyses in this paper are consistent with these prior governance studies. I control for firm size, financial leverage and risk, board size, industry, year and company in one or more analyses. Firm size is the log annual revenue from the annual report. Financial leverage is the ratio of a company's long-term debt to its stock market value. Companies with more debt may have a lower Tobin's q due to the risk of bankruptcy. Financial risk is the standard deviation of stock prices calculated over the prior five years. Board size is a categorical variable equal to one if the company employs a greater-than-average number of directors. I use this discrete measure for board size, rather than a continuous one, because the continuous measure would be correlated with the outside director percentage. Industry is a set of 55 categorical variables that control for 2-digit SIC codes. Year measures whether the observation is from 2000. The company controls, used in one analysis, represent firm-level fixed effects.

Descriptive statistics. Table 1 shows the descriptive statistics and pairwise correlation coefficients for the data in this sample. The mean Tobin's q is 2.3 for both years, although the second and third columns show that this fell from 2.5 to 2.1 between 1998 and 2000. Tobin's q declined when median assets increased by 26% from 1998 to 2000, while the median market value increased by 21% and long-term debt by only 9%. The mean changes are greater as the largest companies grew significantly larger over this period. Companies increased asset levels behind new capital investment and mergers and acquisitions, but growth in financial market

values did not match that growth in assets. Board composition also changed over this period. Board size fell from 11.15 to 10.58 directors on average, while the outside director ratio fell from 78% to 75% and the number of female directors increased from 1.08 to 1.13. The correlation matrix shows that there is a positive significant correlation between the outside director percentage and the number of female directors ($p=.207$, significant at .001 level) and a significant negative correlation between the outside directors and Tobin's q ($p=-.113$, significant at the .001 level).

Insert Table 1 about here

EMPIRICAL RESULTS

Ordinary Least Squares Analyses

The first two columns on Table 2a show the OLS regressions for the effects of outside directors on firm performance. The first regression controls only for the log outside director percentage, industry, and year, while the second adds controls for firm size, financial structure, and board size. The results typify corporate governance research: outside directors are negatively associated with firm performance. A one percent increase in the outside director percentage is associated with a .5 to .6% decline in Tobin's q , depending on the control variables. Most of the remaining variables are significant at the .10 level. Companies with more debt relative to equity and with large boards tend to have a lower Tobin's q , while companies with more variable stock prices tend to have a higher Tobin's q . These results are based on robust standard errors computed using the Huber/White estimator of variance, which corrects the correlation between any firm's residual error in 1998 and 2000. I also use the same process to estimate robust standard errors in the following analyses.

Insert Table 2 about here

Instrumental Variable Analyses

The third and fourth columns on Table 2a represent the instrumental variable analyses. Recall that these analyses use female directors as an instrument for the outside director percentage. In Table 3, I show the first-stage regression of outside directors on the number of females (and the dummy variable for female director employment) and the control variables. In each model, there is a positive relationship between female director employment and outside director employment, significant at the .05 level or better. The first condition for the instrumental variables to be effective -- that variation in female directors must be significantly correlated with variation in outside directors -- is met.

Insert Table 3 about here

The third column on Table 2a shows the reduced form equation, which is identical to the OLS regression with the full set of control variables, except for the addition of the female director variable. The log number of female directors has a positive effect on Tobin's q , significant at the .10 level. If the second condition for the instrumental variable -- that there is no correlation between female directors and firm performance except through the outside director variable -- is valid, then there is some evidence that increased outside director employment increases Tobin's q .²

²The results in this and the other regressions is robust to the inclusion of the board size dummy variable. Without the board size control, the coefficients are virtually unchanged in size and significance compared to the fully specified model.

It does not appear that the female directors variable simply captures the effects of board size (as larger boards employ more women) or firm size (as larger firms employ more women). Adding the female director variable causes the board size coefficient to fall from $-.091$ to $-.115$ and the firm size coefficient to fall from $-.024$ to $-.033$. Although both become significant, both remain negative and relatively small.

The two-stage least squares IV regression, in column four, first regresses the outside director on the independent variables and then regresses firm performance on the predicted outside director variable. The first stage uses female director employment as an instrument, so the second-stage analysis does not control for that variable. The coefficient on the outside director percentage rises from $-.614$ in column two to 1.62 in column four, suggesting that the OLS results may be biased. This difference may reflect the unobserved heterogeneity in the OLS regressions. Consistent with the reduced form results, the coefficient on outside directors switches from negative to highly positive, although it is not significant. There are two explanations for why this coefficient is not significant. First, the actual effect of outside directors on firm performance may be zero. Second, the instrument may be ineffective, especially if there is a negative correlation between female director employment and firm performance. In that case, the coefficient on outside directors would be understated in the instrumental variable regression. There is some evidence to support the latter explanation. Female director employment is negatively associated with prior-period firm performance; if that performance disadvantage persists across time, then current-period firm performance would be negatively related to female director employment, biasing the IV results.

Overall, the instrumental variable analyses provide some support that outside directors actually improve firm performance and that unobserved heterogeneity is confounding the results in OLS regressions. However, alternative explanations remain. Female directors may simply sort into the best-performing companies,

causing a positive correlation between female director employment and Tobin's q and violating the second condition for the IV analysis. Alternatively, female directors may actually improve firm performance by bring diverse knowledge and relationships to the board. In both cases, the positive coefficient of female directors would not reflect the benefits of outside directors, but rather an effect unique to female directors. The next section attempts to control for these explanations.

Firm-Level Controls

The rationale for using the instrumental variable analysis is to control for unobserved company-level heterogeneity. This heterogeneity is one or more firm-level variables that are correlated with both the percentage of outside directors and firm performance, which, if measured in the model, would cause the coefficient on outside directors to change. If these factors are constant across multiple periods, then controlling for the firm itself can eliminate biases due to unobserved heterogeneity. The results, then, should show that employing outside directors is correlated with firm performance and that female director employment has a much smaller relationship to firm performance, controlling for the unobserved firm-level heterogeneity.

The results in columns five and six on Table 2a support the finding that outside directors improve firm performance. Controlling for the company, firm size, financial leverage and risk, and relative board size, a 1% increase in the percentage of outside directors is associated with a .2% increase in Tobin's q, significant at the .05 level. Adding the female director variable, in column six, barely changes the coefficients, and the coefficient on female directors is not significant. Within a single company over time, employing more outside directors is associated with better performance, but employing more female directors has no relationship with performance.

Different Specifications and Instruments

On Table 2b, I show the OLS, IV, and fixed effects regressions using a different set of board measures and different instruments. In column 1, the OLS regression of the effect of the log total number of outside directors on Tobin's q, controlling for log board size, produces results that are similar to the previous OLS analyses. Outside directors appear to have a strong negative effect on firm performance. The results in column 2 are from the instrumental variable analysis, using the log number of female directors as the instrument. The coefficient is negative and insignificant. The fixed-effects regression in column 3 includes both the log number of outside directors, which is positive and significant, and the log number of female directors, which is not. The results in columns 4, 5, and 6 are similar to the original analysis and the analysis using the total number of outside directors as the measure of board composition: the OLS coefficient is negative and significant, the IV coefficient is positive and insignificant, and the fixed effects coefficient is positive and significant.³

DISCUSSION

In OLS regressions, outside directors appear to have a negative effect on firm performance. These results would suggest that a 1% increase in the percentage of outside directors would reduce Tobin's q by .6% by reducing the market value of the

³An alternative fixed-effects specification is to regress the change in Tobin's q on changes in outside director and female director employment. This method differs from the fixed-effects by examining how changes in key variables are related to the changes in the dependent variable, which is the causal relationship of interest. In results not reported in this paper, there is a strong correlation between the change in the number of female directors and change in the number of outside directors (Pearson correlation coefficient equal to .41, significant at .0001). However, there is no relationship between changes in the key variables and changes in Tobin's q in the performance regression.

firm. This paper proposes that this result may reflect unobserved heterogeneity and not a causal relationship. Two methods to control for unobserved heterogeneity are instrumental variable and fixed effects analysis. The first attempts to model exogenous variation in outside director employment, using variation in female director employment as the instrument, and estimate the coefficient using that part of the variation that is unrelated to the residual. The accuracy of the instrumental variable depends entirely on whether the instrument is correlated with the error term. The second method attempts to control for fixed firm-level heterogeneity using a dummy variable for each company, and its accuracy depends entirely on whether firm-level heterogeneity is fixed across two periods. The results in this paper are inconsistent across these methods. The coefficients in the instrumental variable analyses are positive, but not significantly different from zero, while the coefficients in the fixed effects analyses are positive and significant. This implies that the instrument is negatively correlated with firm performance or that company-level variables changed with outside director employment between 1998 and 2000. The evidence suggests that outside directors do not have a negative effect on firm performance, as the OLS regressions show, but the methods produce inconsistent predictions about the effect is positive or zero.

This difference in results across research designs arises from unobserved heterogeneity. The results suggest at least one unobserved variable is correlated with both employing more outside directors and having lower firm performance. There are a number of possible causes. First, Agrawal and Knoeber (1996) and Denis and Sarin (1999) find that the percentage of outsiders on the board is lower when the founder sits on the top management team, which could lead to lower firm performance if the founder wastes corporate resources. Also, unexpected deaths of CEOs who are company founders tends to send stock prices higher. In a related study, Pearce and Zahra (1991) generate a four-part Board of Directors typology

based on CEO power and Board power: caretaker (low, low), statutory (high, low), proactive (low, high), and participative (high, high). They find that participative boards are the biggest and most dominated by outsiders, while proactive boards are the smallest and have the fewest outsiders. If CEO or founder power are negatively related to firm performance, then this could explain my results. Second, Myers et al. (1997) find evidence that customer market pressures can substitute for outside directors, as insurance companies facing stronger market pressures employed fewer outside directors. Similarly, Kole and Lehn (1999) analyze a natural experiment to measure the effects of market competition on board size and the percentage of outsiders. They compare airline firms, before and after deregulation, to a control group of similar companies, including electric utilities. After deregulation, the percentage of outside directors decreased in airline firms relative to the control firms, suggesting that firms in more competitive markets employ fewer outside directors. An increase in competition also should reduce financial returns (Porter 1985). Finally, Vafeas (1999) finds a negative relationship between board meeting frequency and firm performance, which is as unexpected as the negative effect of outside directors on firm performance. However, he finds that this effect is caused by an increasing frequency of board meetings in poorly performing firms. If those poorly performing firms also add outside directors, then this selection effect could explain my results.

In any case, the difference between the instrumental variable, firm-level controlled, and OLS results supports the assertion that omitted variables and simultaneity are problems in corporate governance research (Hermalin and Weisbach 2000, Bhagat and Jeffris 2002). A more complete specification of the firm performance relationship would include measures of alternative governance mechanisms, including incentives in executive compensation contracts, external equity blockholders, and the degree of network interlocks. Those variables are likely

positively correlated with firm performance and negatively correlated with the presence of outside directors (Rediker and Seth 1995). Including the variables would reduce the problem of unobserved heterogeneity, some of which represents these relationships, and it also would highlight whether female directors employment is an instrument for outside director employment or an instrument for effective corporate governance systems. However, this may not be a major concern because the coefficient from the instrumental variable regression is not significant.

Although this study finds that recent proposals to increase board independence are likely to improve firm performance, it is not apparent why investors would not demand increased board independence in the absence of institutional reforms. What is the barrier preventing companies from adding outside directors? One possibility is that powerful CEOs or founders use their authority to limit board independence and improve personal outcomes at the expense of firm performance. Another possibility is that outside directors do not improve performance at all companies, as this study only shows that outside directors are associated with better firm performance in companies that have added female directors. Another study has suggested that non-independent director-executive relationships improve firm performance in some companies (Westphal 1999). The effects in this paper may only apply to a subset of companies and not to all firms, while the effects of other studies apply to different firms.

CHAPTER 3 FEMALE DIRECTOR EMPLOYMENT

A major demographic shift on American boards of directors, since the 1960s, has been the increasing gender diversity of corporate directors. In 1969, there were fewer than fifty women serving on large American boards of directors (Catalyst 1984). Today, that number has risen to almost 800, while board size has declined over the same period (Catalyst 1999). Over the past thirty years, female representation on boards has increased at an 11% compound annual rate, and the percentage of corporate director seats held by women doubled from 5% in 1987 to 11% in the late 1990s (Catalyst 2000, Daily Certo and Dalton 2000). Women now hold between 5% and 15% of director positions in English-speaking industrialized economies: 5% in Great Britain (FTSE 100), 6% in Canada (FP500), 10% in Australia, 11% in the United States (S&P 500), and 14% in New Zealand (Catalyst 1998, 1999). The pace has not slowed: the female director ratio in my sample of 499 boards of directors rose by 14% between 1998 and 2000.

There is some evidence that gender is an important characteristic of directors. Research has shown that men and women differ in board committee service (Bilimoria and Piderit 1994, Kesner 1988), attitudes about board services (Talmud and Izraeli 1999), and employment and education (Hillman, Cannella, and Harris 2002). Executives also differ in their attitudes toward gender diversity on boards. At one extreme, almost three in four executives surveyed in 1993 indicated that recruiting a female director was a top priority, and almost nine in ten executives expressed that increasing female representation on boards is an important general principle (Mattis 2000). On the other extreme, the CEO of Cypress Semiconductor wrote in a letter explaining his company's board composition, "Bluntly stated, a 'woman's view' on how to run our semiconductor company does not help us, unless that woman has an advanced technical degree and experience as a CEO" (Pfeffer and

O'Reilly 2000). Clearly, the shift to hiring more female directors has not affected all companies.

While the female director ratio has increased dramatically from the 1960s to today, little research has analyzed why companies have started to hire women for their boards. The increase in female directors appears to be a change in the willingness to hire women with expertise in non-corporate or non-executive positions, as there has been little progress in female representation as senior corporate executives and female directors tend to work in non-corporate organizations (Daily, Certo and Dalton 2000, Hillman, Cannella and Harris 2002). This director-level labor market has special importance for the roles of women in broader managerial and executive labor markets. Director positions are an important development opportunity for future CEOs, and outside directors often shape the characteristics of future outside CEOs (Borokhovich Parrino and Trapani 1996, Boeker and Goodstein 1993, Zajac and Westphal 1996). With more women serving as directors, there are more women with power in the CEO selection process. These female directors also may be role models for female managers and may pay special attention to the selection, training, and promotion of female executives.

Women also may improve board outcomes. Boards of directors represent shareholders in all dealings with day-to-day executives, and corporate directors have a fiduciary responsibility to represent shareholder interests in approving or rejecting actions proposed by corporate managers (Fama and Jensen 1983). Directors add value through their knowledge and information, their ability to influence strategies and tactics, and their external relationships. Directorships represent a high-level occupation that is essential to organizational success, but also part-time and separate from other employees of the company. Directors are required to process large amounts of information, under time pressure, to make critical business decisions. This suggests that directors should have high levels of operating expertise,

particularly a successful record of making similar decisions under similar circumstances. Still, companies often hire directors from specific industries or occupations that are not related to their markets. For example, a number of boards employ retired United States cabinet secretaries, retired military generals and admirals, bankers, lawyers, doctors, and University presidents and faculty member, who do not bring direct operating expertise, but may bring unique perspectives, information, relationships, and prestige.

This paper proposes a fundamental trade-off between the development of operating expertise, also called human capital, and unique information and relationships, or social capital. While this model may be applicable to all employees, this analysis focuses only on corporate directors. Although women have not had as much access to opportunities to develop operating executive-level expertise when compared to men, they have had careers in government, education, and smaller businesses that build a different set of information compared to corporate positions. Some companies and boards are more likely to benefit from the unique information that women offer as directors, so those companies will employ more female directors. Companies and boards that are likely to value operating expertise more will tend to employ more male directors.

The empirical results support these predictions. As hypothesized, large companies and large boards are much more likely to employ female directors, and these results are robust to measurement and specification issues. This effect is particularly strong in companies in high discretion industries and with low tenure CEOs. There is little evidence that female directors sort into companies with superior financial performance or that female directors are paid more or less than male directors.

THEORY AND HYPOTHESES

Group Outcomes and Diversity

There is a large literature on the effect of individual-level diversity on group-level outcomes. Empirical research has shown that individual-level heterogeneity generally increases group-level outcomes like creativity and the quality of decision-making (Bantel and Jackson 1989, Milliken and Martins 1996, Guzzo and Dickson 1996, Magjuka and Baldwin 1996, Thomas and Ely 1996, Jehn, Northcraft, and Neale 1999). Heterogeneity may affect either the quantity and quality of information used by the group or improve group processes and may produce significant value on teams (Nemeth 1986, Morrison 1992, Cox Lobel and McLeod 1991). Heterogeneous teams tend to consider more perspectives, which may arise from the minority group members who consistently voice alternative hypotheses and analyses (McLeod and Lobel 1992, Watson Kumar and Michaelson 1993, Nemeth 1986). That cognitive conflict between the majority and minority groups may also improve the quality of the arguments, causing group members to more carefully reason and support their suggestions. Ethnically diverse groups are more cooperative than groups of all Caucasians (Cox Lobel and McLeod 1991), although other evidence suggests that diverse teams adopt group norms that de-emphasize cooperation (Chatman and Flynn 2001). In an early model of how group composition and other variables effect group outcomes, Gladstein (1984) proposed that group performance depends on six key group processes: open communication, supportiveness, conflict, and effective discussion of strategy, weighting of inputs, and boundary management. Campion and colleagues connected group effectiveness to group processes, including potency perceptions, social interactions, and communication and coordination (Campion Medsker and Higgs 1993). In their model, diversity improves outcomes if it increases potency, social interaction, and communication and coordination. This research

suggests that gender diversity on teams results in better group outcomes in many business and group settings.

However, diversity in groups may create significant costs and impair group-level outcomes in other settings (Campion et al 1993, Williams and O’Reilly 1998). There is evidence that group heterogeneity negatively affects individual identification with the group and job satisfaction, causing lower group commitment and higher turnover for minority group members (Tsui Egan and O’Reilly 1992, Tsui and O’Reilly 1989, Pfeffer 1983, 1991, Jackson Brett Sessa Cooper Julin and Peyronnin 1991). At the same time, diverse group members may have difficulty communicating with each other, causing an increase in coordination costs (Lang 1986; Zenger and Lawrence 1989). There also is evidence that the net gains from diversity depend largely on whether new group norms have developed to mitigate its negative consequences (Chatman and Flynn 2001). Overall, research has shown that diversity in groups both enhances and degrades outcomes.

This paper posits that the costs and benefits of gender diversity arise from a fundamental trade off between task-centered operating expertise and unique information and relationships. One major benefit of diverse groups is that they provide superior information to use for decision-making. Practically, this means that women bring unique and valuable information, developed through past experiences, that men either do not or can not have. Information must be heterogeneously distributed by gender, such that having single-gender groups results in less than perfect information and inefficient decision making. A heterogeneous distribution of information suggests a social network with structural holes, in which some information is contained solely within a social group that is largely disconnected from other social groups (Burt 1997). In this structural holes model, an individual who can bridge the gap between the disconnected social groups can distribute the information across boundaries. If the minority group introduces special information to the

majority group, then group outcomes will be stronger when the new information set is superior and is accepted by the group. The uniqueness of information arises from this particular type of social network with pockets of disconnected groups. Using this line of reasoning, some researchers have proposed that companies serving diverse customers should reflect that diversity in their line and staff positions to ensure a match between customer needs and company capabilities (Morrison 1992, Fernandez 1993, Burke 1994), although the empirical evidence provides mixed results (Leonard and Levine 2002).

Trade Off between Operating Expertise and Unique Information

Directors with high levels direct operating expertise have information about immediate company activities and executive tasks. Companies hire these experienced executives because higher levels of human capital allow more productivity in delivering important board outcomes. These traits are likely to be developed by analyzing similar problems under similar time and economic conditions. Because directors with shared past experiences are able to make better or faster decisions than directors without that experience, companies prefer to hire directors with relevant and extensive past experience. Because directors meet and communicate only infrequently through board meetings, committee meetings, and informal conversations, there is a need for directors to make quick decisions under conditions of uncertainty. Compounding this effect, directors are responsible for making complex, high-level decisions affecting large companies where there may be little information, no external reference points, and high variability. Director positions require a uniquely high level of intelligence, prior experience making similar decisions in similar settings, and high levels of personal credibility developed through past successes, in part because of the level of importance and difficulty in these position, as well as the trust that directors must have for each other and the executives in these part-time positions with

infrequent contact.

Human capital and operating expertise are related constructs. Human capital is the past education, training, and experience and personal traits that allow a person to produce output in an occupation. Applying a traditional human capital framework, board-level outputs will be higher when directors have greater levels of education, training, and personal development or higher intelligence or willingness to work (Becker 1964, Mincer 1958, 1962, Leonard 1990). One dimension of human capital is building a base of knowledge through work experience and training, which increases a person's experience-based information.

In contrast, unique information is closely related to social capital, an asset imbedded in relationships between two or more individuals that leads one of those individuals to have access to unique information or valuable relationships (Coleman 1998). Social capital forms through past interactions in social settings - schools, workplaces, other organizations - that result in trust, obligations and expectations, and directors with social capital have access to unique information and data and can influence others using their network of past obligations (Coleman 1998).

There is a trade-off between operating expertise and unique information and relationships, as the first emphasizes consistency and shared knowledge and the second emphasizes unique and even singular information and relationships. Some individuals may have high levels of both operating expertise and unique information, but, on average, higher levels of one will preclude high levels of the other. Workers develop director-level operating expertise by successfully addressing high-level business issues over a number of years. A set of directors with equivalent operating expertise have handled a related set of business issues. Therefore, there is a correlation among the directors in their past experiences, simply because the company seeks out individuals who have addressed the same problems or questions in the past. The value of an individual's operating expertise is related to its similarities to the

board's needs and, by extension, the other directors' expertise. In contrast, unique information has value for its rarity.

The presence of director-level operating expertise implies a career as a top executive in a large company. Directors in my sample of large company boards tend to be older and have high-level executive experience in large corporations. Almost three in four male directors in my sample work or have worked as a corporate CEO, Chair, or top manager (CFO, COO, President). In a similar sample of more than 15,000 directors on large American boards (corporatelibrary.net, 2002), almost three-fourths of the directors were between 50 and 69 years old, with 37% between 50 and 59 and 37% between 60 and 69. Assuming that most directors started their professional careers after graduating from college at age 21, this implies that most directors have between 30 and 40 years of work experience. A few directors have experience as government officials, military generals and admirals, and college professors, but the most common development path is through high-level corporate executive positions. In many ways, this is a closed network, where the strongest social relationships are among individuals with similar backgrounds and experiences. The only way to have valuable, unique social relationships is to build those relationships through unique social settings (schools, workplaces, organizations), which hinders the development of high levels of sameness in human capital. The only way for a director to develop unique and strong social capital, via relationship bonds, is to pursue a different development path than most corporate directors. There is a trade-off between developing human and social capital in directors, and this trade-off has gender implications.

With low female participation rates in senior executive positions, the pool of individuals with director-level operating expertise is disproportionately male (Daily Dalton and Certo 2000). While female labor market participation had risen to over 50% as early as 1980 and women today hold almost half of all managerial and

professional position, there are very few women with CEO or Chairperson-level experience in large corporations. In my sample of 612 large companies in 1998, only two women served as corporate CEOs and inside directors, while one additional woman in the sample became CEO after 1998. Among male directors, almost 50% held a CEO, Chair or both positions in a corporation. For most large corporations, choosing a director with what I have defined as high levels of human capital means hiring a male director. This creates a connection between unique information and gender. Women are far more likely to hold valuable, unique, and rare information because they have been excluded in large part from the traditional development paths for corporate directorships, but this information may be useful only in specific contexts. An increase in emphasis on unique information, via an increased value to new demographic-based information and external relationships, will result in an increased number of female directors serving on those boards.

When Diversity is Worth It: Specific Contexts

Diversity improves board decision-making when the gains from additional unique information are higher than the losses from less operating expertise. The model in this paper is based on Gladstein's model of task group effectiveness, in which group size and group demography are key determinants of group processes (Gladstein 1984). In his model, environmental factors like complexity, environmental uncertainty, and interdependence moderate the effects of changes in group processes on group outcomes, suggesting that optimal group outcome require an optimal group demography, conditional on a given group size and set of environmental moderating variables. Choosing the demographic characteristics of a group, such as a Board of Directors, will depend both on the group size and environmental factors that shape the complexity and uncertainty faced by corporate directors. This section models which companies will benefit most from gender

diversity on their boards, and therefore will increase female director employment. I first consider three key determinants of the value of gender diversity -- firm size, board size, and asset intensity -- before considering four important moderating variables.

Firm size and asset intensity. Firm size has direct and indirect effects on board processes. Larger firms have higher revenue than smaller firms, so they produce, market and ship more products, work with more suppliers and customers, and handle a greater flow of transactions and contracts. The direct effect of any increase in firm size, then, is to increase demand for operating expertise to make decisions about a more complicated business. An increase in firm size would directly result in an increase in demand for operating expertise on the board, resulting in fewer female directors.

However, firm size affects more than just the complexity of the decisions made by directors. It may be more difficult to make decisions about a diverse range of businesses and customers, leading to a premium for unique information and relationships (Pfeffer and Salanick 1983). Also, unique information can be leveraged to a greater extent in large firms, because the company may use the information across multiple business and a large volume base. Finally, large and small firms likely differ in management quality and corporate governance systems. Large firms typically have multiple governance controls outside of the board, including large and powerful blockholders, media coverage, higher reputation stakes, and more pay-for-performance contracting. Large firms may not require directors with high levels of operating expertise to take an active role in monitoring executives and controlling their behavior. Smaller firms are less visible and less transparent, leading to an emphasize on directors capable of understand the business details. Large companies also have ample recruiting and consulting budgets to hire human capital at lower

levels in the organization, so they may rely less on their directors for strategic operating advice, and large companies can attract superior executive-level talent with superior compensation contracts. The indirect effect of firm size is to reduce demand for operating expertise, thereby increasing the employment of female directors.

Hypothesis 1: Firm size is positively associated with female director employment if the indirect effects are larger than the direct effects.

Asset intensity, or the importance of a company's physical assets relative to its revenue, increases the complexity of board decision-making without the indirect effects that increase the value of unique information. A company with higher asset intensity has a greater need to focus on operating efficiency, because physical assets are a part of its business and financial structure. The additional complexity of having a large physical base increases the difficulty of decision-making, compounding the operating expertise effect. Companies with a higher asset intensity will emphasize operating expertise on their boards, leading to less demand for unique information and female directors.

Hypothesis 2: Asset intensity is negatively associated with female director employment.

Board size. On larger boards, the potential benefits from unique information will exceed the losses from lower operating expertise. All else equal, a large board will be able to process more information than a small board, due to an increased number of individuals in the group, and each individual director will have less opportunity to speak in meetings and influence executive behavior. Also, large groups can have problems with communication and coordination (Gladstein 1984, O'Reilly Caldwell and Bennett 1989), which could limit participation in strategy formulation (Finklestein and Hambrick 1996). If directors are not involved in strategy on large boards, it becomes less important that the directors have operating expertise. Finally,

it is likely that returns to operating expertise fall as a company adds more directors, because homogenous directors generally have the same information and will make similar decisions. However, returns to unique information do not decline as board size increases. Any improvement in information has the potential to improve firm outcomes, if it improves decision-making. On a small board, it is critical that each director be capable of providing high levels of advice and monitoring, so the company must employ enough directors with high levels of operating expertise to be effective. Large boards, then, will be more likely to emphasize unique information, while small boards are more likely to emphasize operating expertise.

Hypothesis 3: Board size is positively associated with female director employment.

Moderating variables. Firm size, asset intensity, and board size directly affect board decision-making and will shape the employment patterns of female directors. The moderating variables are unlikely to have direct effects on board decision-making, but they may indirectly affect how responsive companies and boards are to the effects of board size, asset intensity, and firm size.

CEO Tenure. Firm size has direct and indirect effects on the relative value of unique information through increasing decision complexity on the board and through changing the quality of executives and the substitute governance systems. Firm size only has a positive effect on female director employment if the indirect effects are larger than the direct effects. What if the indirect effects approach zero, such as when the board selects a new CEO? When a CEO has a longer tenure, it can be inferred that the board has approved his performance over prior periods, and the CEO is able to perform the job well. If a higher tenure CEO is also a higher ability executive, then boards with high-tenure CEOs will have large, positive indirect firm size effects that result in higher female director employment. Boards with new CEOs

will require relatively more operating expertise on the board, so the firm size effect will be more muted. Asset intensity increases demand for operating expertise by increasing decision complexity. CEO tenure is unlikely to affect its relationship to female director employment.

Hypothesis 4: CEO tenure has a positive moderating effect on the coefficient on firm size.

CEO tenure also should be a positive moderating variable in the relationship between board size and female director employment. Board size was assumed to reduce the benefits from adding directors with operating expertise, while having no effect on the benefits of adding directors with unique information. CEO tenure may impact this result in two ways. A long tenure CEO may require even less operating expertise from the board because the executive team is highly able and stable. This would increase the effect of board size on female director employment in these companies. In contrast, a long tenure CEO also may be a signal that operating expertise, developed through many years of related work experience, is very valuable for that company, so it would emphasize operating expertise both in its executives and directors. This would reduce the effect of board size on female director employment in companies with long-tenure CEOs.

Hypothesis 5a: CEO tenure has a positive moderating effect on the coefficient on board size.

Hypothesis 5b: CEO tenure has a negative moderating effect on the coefficient on board size.

Discretion. The relative value of operating expertise and unique information will depend in the amount of decision space directors have in particular industries. In high discretion industries, there is more information for individuals to process and less certainty about future actions, but the direction of the overall effects of environmental uncertainty are uncertain (Finklestein and Hambrick 1996). Increasing

uncertainty may increase the value of operating expertise, as experienced directors can better advise executives on strategies in industries with high levels of executive discretion. However, increasing uncertainty also increases the value of unique information and unique relationships, as creativity may become more valuable and external resource providers become more important to the success of the firm (Pfeffer and Salancik 1983). An uncertain environment, by definition, has some random variability that cannot easily be modeled or analyzed. Companies, then, in high discretion industries face the choice of adding directors with high levels of directly-related work experience, who may be better able to process information and positively effect strategy, or directors with unique information or relationships, who have a positive effect by improving decision quality or outside relationships. The increase complexity that arises from an increase in firm size is magnified by the increase in industry discretion, although it is not clear whether discretion will have a positive or negative effect on the firm size coefficient. Discretion always will increase the value of unique information as board size increases. Conditional on being in a high discretion industry, companies that increase board size will still have an incentive to add directors with unique information or relationships, because it helps them to manage environmental uncertainty.

Hypothesis 6a: Industry discretion has a positive moderating effect on the coefficient on firm size.

Hypothesis 6b: Industry discretion has a negative moderating effect on the coefficient on firm size.

Hypothesis 7: Industry discretion has a positive moderating effect on the coefficient on board size.

Compensation Plans. The behavior of executives should depend on the structure of their incentives and, specifically, whether their pay varies with their

performance (Jensen and Meckling 1976; Fama 1980; Fama and Jensen 1983, Jensen and Murphy 1990, Baker and Hall 1998). If adding female directors adds the most value in large companies and on large boards, then executives who are compensated for their performance will have a strong incentive to add women to their boards in those contexts. Executives who receive more fixed compensation have less incentive to add diversity to the board, so they will be less responsive to firm size and board size.

Hypothesis 8: The level of executive pay-for-performance has a positive moderating effect on firm size.

Hypothesis 9: The level of executive pay-for-performance has a positive moderating effect on board size.

Board Human Capital. Related to the board size argument, there may be a moderating effect from board human capital. On boards with a large number of corporate chairpersons and CEOs, the potential value-added to the board's operating expertise from adding a director is very small, but directors with unique information can still produce positive value. When a board is both large and filled with CEO and Chair directors, it is especially likely that additional directors will bring unique information. Likewise, in large companies with high board human capital, additional directors will tend to bring high levels of unique information, rather than operating expertise.

Hypothesis 10: The level of board human capital has a positive moderating effect on firm size.

Hypothesis 11: The level of board human capital has a positive moderating effect on board size.

RESEARCH DESIGN

Sample

I sampled the entire population of companies listed on the 1998 Forbes survey of the largest American corporations, ranked by market value, revenue, profits, and assets. I chose this sample of a number of reasons. First, only publicly traded companies are required to publish data on board composition and financial performance, and a criteria for listing any company on the Forbes list is that it is publicly traded. Second, large companies control a disproportionate share of the American economy, so the importance of understanding female directors in these organization is potentially greater than if I had examined small firms. Third, the Forbes list is based on quantitative criteria as companies are ranked by revenue, income, assets, and market value, while other lists, such as the S&P 500, are selected using subjective criteria. I collected the panel data for the same sample of companies in 2000.

Data Collection

This paper is based on board composition data I collected from annual reports and proxy statements in 1998 and 2000. Through corporate websites and requests to investor relations, I collected each director's full name, company, occupation, and gender for 706 companies. I was unable to collect director-level information for a remaining 109 companies on one or more Forbes' lists. Some companies did not list directors' primary employers and occupations, so they were excluded from the sample. In 1998, the final sample included 8049 director-level observations, representing 4881 individuals and 706 boards of directors.

I then matched the board composition data to ExecuComp and Compustat, resulting in a final sample of 611 companies for most of the analyses. This is lower than the 706 firms from above because not all of the companies were included in

ExecuComp. I also classified the gender of each director based on the first and middle name, and non-Western names were identified by natives of Japan and China. For ambiguous names, I consulted the annual reports and other sources to identify the gender through photographs.

To create the panel, I collected data in 2000 for the 611 companies with a complete set of data in 1998. A number of companies were acquired, merged, and bankrupted during this period, so I could only collect board and financial data on 499 companies from that original sample. I followed the same process to identify the gender of directors in 2000. To ensure consistency, I coded the gender the same for all directors included in both 1998 and 2000, to reduce measurement errors in the fixed effects models.

Dependent Variables

Among the many ways to measure female representation on corporate boards, I want to concentrate on two -- the number of female directors and the percentage of female directors -- and each analysis in this paper uses both measures as dependent variables. The first measure is absolute, so it represents the total level of female involvement on a board. A board with three female directors would have 50% greater female participation than a board with two female directors, regardless of board size. Because this number is skewed toward zero, I convert the number of female directors into natural logs to improve the efficiency of the estimates. An alternative specification considers the relative presence of women on boards by dividing the number of female directors by the total board size. In this specification, a company with one women on a six-person board would have greater female representation than a company with three women serving on a twenty-person board. Theoretically, these measures may appear to represent different constructs. Empirically, the results are similar across the two measures. Later in the paper, in the discussion section, I also

analyze patterns in director compensation, measuring director pay as natural log of the annual retainer plus the total expected meeting fees per year.

Independent and Moderating Variables

The primary control variables are the log number of directors, log revenue, asset intensity, and 2-digit SIC industry code. Log revenue measures the revenue of the firm in 1998 or 2000, which is then converted into natural logs. The log number of directors is a count of board size in 1998 and 2000, converted into natural logs. Asset intensity is the firm's assets divided by its revenue and is a measure of the business' complexity. Industry is based on the company's primary industry as listed in ExecuComp and is a set of 51 indicator variables.

The regressions also rely on four variables to identify the moderating relationships. First, CEO tenure is a measure of the number of the years the current CEO has held that position. It measures the relative power of the CEO, as high-tenure CEOs are more likely to have higher levels of power by appointing similar directors over time (Westphal and Zajac 1995). Second, industry discretion matches Hambrick and Abrahamson's (1995) industry-level discretion estimates to my sample at the 4-digit SIC industry level. Some 2-digit industries in my sample contain more than one 4-digit industry, so it is appropriate to control for industry and discretion. Third, the salary-to-total pay ratio compares the salary received by a firm's CEO to his or her total compensation, including the present value of options, equity grants, and bonuses. A CEO with a high salary-to-total pay ratio receives most of his or her pay in the form of a fixed salary, not performance incentives. Finally, the fourth variable measures the number of directors on the board with a primary occupation as CEO or Chair. It is a measure of the total human capital, and possibly prestige, of the board of directors.

DESCRIPTIVE STATISTICS FOR MALE AND FEMALE DIRECTORS

Before discussing the analyses and results of the hypothesis testing, it is useful to understand the differences in background and experiences between male and female directors. This paper is based on the assumption that gender is highly correlated with the background and experiences of directors, and this section provides empirical support for that assumption. The data are from 1998 and includes all directors serving on the entire sample of 706 boards, including some firms which are not used in subsequent analyses due to a lack of accounting and financial data. These data are at the individual director level, rather than the board or company level for the other analyses, and include twenty variables measured for each individual.

Insert Table 4 about here

Table 4 compares the entire sample of male and female directors. The t-statistic for the difference in means compares the variables for the male and female groups. Of the twenty variables, only six have t-statistics lower than two, suggesting that female directors differ from male directors for almost every measured variable. Overall, there are 7267 male directors and 782 female directors in this sample. The most striking difference between male and female directors is in the occupational distribution. Female directors are significantly less likely to be both an employee and director for the same firm (an inside director). For every female director, there are nine male directors. For every female inside director, there are forty-two male inside directors. Female directors also are less likely to hold a Chair or CEO title in their primary occupation: men are twice as likely to hold a CEO position and three times more likely to hold a Chair position than women, even classifying non-profit CEO positions as the same as for-profit CEO positions (which would tend to increase female representation in these occupations). Female directors are much more likely

to have primary occupations as managers outside of the top management team (general managers, division heads), in government, and in education. Female directors are three times more likely to be employed in education, and two times more likely to be employed in local, state or federal government jobs. Interestingly, female directors hold more directorships on average than male directors, despite being less likely to have senior-level executive positions.⁴ The average male director serves on 1.63 boards in my sample, while the average female director serves on 1.85 boards. This difference is not particularly large, but it is interesting that women and men hold different numbers of directorships.

Despite the consistently large demographic differences between male and female directors, there are few differences in the characteristics of boards on which they serve. Female directors serve on the same size boards as male directors and with the same numbers of outside directors. Women tend to serve on boards with other women: the average female director sits on a board with 1.8 female directors, while the average male director sits on a board with 1.2 female directors.

Generally, the comparison of all directors supports the assertion from above that female directors have substantively different backgrounds and experiences than male directors. However, this simple analysis does not control for anything but gender, so these descriptive statistics could overstate (or understate) the actual differences. The next two sections control for director-level independence and for the holding of multiple directorships to better understand these descriptive statistics.

Insert Table 5 about here

Directors employed outside of the company on which they serve on the board

⁴This could be since male directors are more likely to have extreme time demands in their primary jobs, especially those holding CEO and Chair positions.

have a special importance in both agency theory and resource dependence views of the firm. They have no employment ties to the firm's managers, so outside directors have less incentive to allow manager entrenchment and waste (Jensen and Meckling 1976). These directors are relied on to monitor managers and to provide expert, external advice. The results on Table 5, controlling for director independence, are almost identical to the descriptive statistics for the entire sample. Female outside directors differ significantly from male outside directors. Women remain half as likely to hold CEO positions, one-third as likely to hold Chair positions, and three times more likely to hold position in education. Controlling for director independence reduces the magnitude of the difference in the number of directorships held by each individual, but the difference remains statistically significant.

Insert Table 6 about here

Individuals holding multiple Forbes 500 directorships may be the elites in the directorship network, and their descriptive statistics are shown on Table 6. Women represent 10% of all directors, but 12% of directors holding multiple directorships. Among these elite directors, women remain one-half as likely to be CEOs, but are only one-fourth as likely to be Chairs. These women disproportionately hold positions as top managers, as lower-level managers, and in education. While a higher percentage of women hold multiple directorships, there is no significant difference between the number of directorships held by those two groups.

The simple answer to "Who are female directors?" is "Unlike male directors". Women are significantly more likely to have non-profit jobs, especially in education, or positions as low-level corporate executives. Very few women are inside directors, and only two women are both board members and chair/chief executive of the firm. Despite these differences, female directors are much more likely to serve on multiple

boards than male directors, and women on multiple boards hold a slightly greater number of directorships.

RESULTS

This section reports the results of the hypotheses tests. Table 7 shows the results for pooled cross-section analyses on the 1998 and 2000 data with the two measures of female director employment as dependent variables. Table 8 shows the fixed- and random-effects models on female director employment. Table 9 shows the effects of the moderating variables. The primary results are robust across specification and measurement: larger firms and larger boards employ more female directors, although the effects are very sensitive to the context in which they occur. Overall, there is some evidence that OLS estimates are biased by unobserved heterogeneity, although the magnitude of this bias is not large.

Insert Table 7 about here

Pooled Cross-Sectional Analysis

Table 7 shows the results for regressions with the log number of female directors and the percentage of female directors as dependent variables. The results are similar in the two sets of regressions, suggesting that both female director employment variables are measuring a similar construct. The results show that the female participation on boards varies predictably with board size and firm size. On average, a 10% increase in the number of directors is associated with a 22-24% increase in the number of female directors and a .1-.2% increase in the female director ratio, while a 10% increase in firm size is associated with 3-4% and .1-.2% increases respectively. Board size has a stronger relationship to female director employment than does firm size, but size also is more closely related to actual board

processes, so the result is not surprising. Asset intensity, the log book value of assets relative to firm size, is marginally significant for one dependent variable, but insignificant for the other, and it has a consistently negative coefficient.

For each dependent variable, I also include past performance controls to ensure that female directors are not just being hired by firms that perform well, or that those firms are the only ones that can attract female directors. For the number of female directors, performance is marginally significant at the .10 level, but the coefficient implies that firms with better past financial performance are less likely to employ female directors. The performance measures are negative, but are only significant in half the regressions. Including the past financial performance as explanatory variables does not affect the coefficients on the three primary variables (firm size, board size, asset intensity). Industry also is an important control variable. While few of the industry-level controls are statistically significant, the entire set of industry variables is. The inclusion of industry controls increases the adjusted R-squared from .252 to .290 for the number of female directors and from .082 to .129 for the percentage of female directors. In tests not reported in this paper, I tested the assumption of linearity by including squared terms in the regression for firm size and board size. Neither squared term was statistically significant, so there is no evidence that the effect of board size or firm size on female director employment changes as board size or firm size increases.

Overall, firm size and board size have a significant, positive effect of female director employment, while asset intensity and past financial performance have negative, but generally insignificant relationships. It is worth noting that these variables, at best, explain only 29% of the variation in the number of female directors and 13% of the variation in the female director ratio. While the variables included in this analysis (firm size, industry, board size, asset intensity, past financial performance) are important explanatory variables, one or more omitted variables are

causing the majority of the variation in board gender diversity.

Insert Table 8 about here

Fixed and Random Effects Model

Table 8 shows the results from fixed- and random-effects models. While pooled cross-sectional regression techniques can identify the effect of firm and board size on female representation under some assumptions, the estimates could be biased by unobserved correlations between omitted variables, the dependent variable, and the controls. For example, it is possible that a company's commitment-based human resource system both causes it to employ female directors and to grow revenue at an accelerated pace. In this case, firm size may have no effect on female director employment, as both vary consistently with an unmeasured variable. This section's analyses control for this unobserved heterogeneity using simple panel data methods.

A fixed-effect model, while similar in many ways to the OLS regressions used earlier, has greater internal validity because it measures period-to-period changes in the independent and dependent variables. If firm size and board size have causal effects on female director employment, then companies with an increase in their firm or board size from 1998 to 2000 should have a corresponding increase in female director employment over the same period. The treatments are still not randomly assigned, but this model can control for unobserved heterogeneity than is fixed across the two periods. The panel in this study includes 499 companies with an observation in 1998 and a second observation in 2000. Assuming that the unobserved constructs are stable across time, the fixed-effects model essentially uses the first observation as a firm-level control variable for the second observation.

It is possible to test the appropriateness of the random effects model with the Hausman test. This procedure tests the null hypotheses that differences in the

coefficients in the random and fixed effects are not systematic. In this paper, the Hausman test generated a chi-squared statistic of 14.68, which is significant at the .01 level. It is possible to reject the null hypothesis that differences in the coefficients are not systematic, so the fixed effects model appears to be more appropriate.

Insert Figure 1 about here

Figure 1 plots the female director ratio for companies in 1998 and 2000. There is a strong positive association between female director employment in both periods, and the Pearson correlation coefficient is .78. A small number of companies that had female directors in 1998 employed none in 2000, although twice that number employed no female directors in 1998 and added one or more by 2000. While there is a high correlation across the years, there is enough variation to analyze which companies add or drop female directors.

Insert Table 8 about here

The first column in Table 8 shows the regression for the log number of female directors, controlling for firm-level fixed effects. Interestingly, log firm size is no longer a significant predictor in the first specification, although its coefficient is still positive. Board size remains strongly, positively related to female participation. I cannot control for industry effects in this model, because industry is captured by the firm-level fixed effect. In this model, a 10% increase in the number of directors is associated with a 17% increase in the number of female directors. Controlling for the unobserved variables at the firm-level, the result from the pooled cross-section is partially supported: larger boards tend to employ a disproportionately large number of female directors.

The second column shows the regression using the percentage of female directors as a dependent variable. The results are the reverse of the first regression. Firm size is positively correlated with female participation, but board size is not. On average, a 10% increase in firm size is associated with a .1% increase in the percentage of female directors, which is similar to the magnitude in the pooled cross-sectional regression.

In both models, the results suggest a strong positive correlation between the error term in a single year and the control variables. The hypothesis that the error terms are independent of the independent variables can be rejected at the .0001 level (the F-statistics are 5.88 and 6.84, respectively). Companies that have high revenue and a large board tend to have a larger positive error term than companies with low revenue and a small board. This introduces an upward bias in the relationships between firm and board size and female director representation in the pooled cross-sectional analysis.

An alternative specification is a random effects model. In this specification, the firm-level effects are not fixed, but vary predictably with the independent variables. Any residual error term, controlling for the independent variables, is assumed to be truly random. This model is less restrictive than the fixed effects model in some ways, but more restrictive in others. It is not necessary to assume that omitted variables are constant across two periods, but it is necessary to assume that all non-random variation in the error term can be modeled using the existing control variables. If the assumptions are true, then the model can identify both the coefficient and the effect of the independent variables on the error term.

The third and fourth columns in Table 8 shows the random effects regression for the log number of female directors and the percentage of female directors. Unlike in the fixed effects model, the results are similar across the measurement of female participation, and each independent variable is significant. The coefficients are

similar to magnitude to the pooled cross-sectional regressions. In these models, each independent variable is significant.

Overall, the fixed effects model provides mixed support for the hypotheses and the random effects model provides strong support. In the fixed effects model, the coefficient on asset intensity remains negative and insignificant, although the coefficients on firm size and board size are similar to those in the OLS regressions. In the random effects model, all coefficients are significant and are the same sign and order of magnitude as the OLS coefficients. The assumptions about the error terms are critical, although the OLS regression is not a bad approximation of the panel models.

Insert Table 9 about here

Moderating Variables

In Table 9, I compute eight additional regressions. These analyses are cross-section regressions on the 1998 data, including the moderator variables. I have a set of moderating variables for only 1998, and at least one moderating variables would not change from 1998 to 2000 (industry discretion). Also, the cross-sectional regressions closely approximate the fixed and random effects models, so it is no evidence that the cross-sectional regressions produce significantly biased estimates. For these reasons, the moderated regressions are only on the observations in 1998. In these analyses, I control for industry discretion, CEO tenure, the salary-to-total pay ratio, and the number of Chairs and CEOs on the board. Table 9 shows the regressions with moderator variables using the female director ratio as the key dependent variable.

The first two columns show the results controlling for industry discretion. High discretion industries are those in which executives have a wide range of possible

strategies and tactics, while low discretion industries are those in which executives face a constrained set of behaviors. The first column computes the cross-section regression for the companies with a full set of discretion variables. The results are similar to those from the full pooled cross-section analysis. Adding industry discretion significantly changes the coefficients on all variables. The board size effect becomes significantly negative, instead of significantly positive, and the firm size effect goes to zero. Discretion is negatively associated with female director employment, but it has a positive moderating effect on the board size coefficient. Large boards in high discretion industries tend to employ more female directors. Discretion does not have a moderating effect on the firm size or asset intensity coefficients.

Columns 3 and 4 in Table 9 use the CEO tenure variable as a moderator. Again, the coefficients in column 3 replicate the cross-section regression for this different sample of companies with a full set of tenure variables. CEO tenure has a negatively moderating effect on board size, such that companies with long-tenure CEOs and large boards tend to employ female director directors. CEO tenure does not have a moderating effect on the firm size or asset intensity coefficients.

Columns 5 and 6 in Table 9 use the salary-to-total CEO pay variable as a moderator and columns 7 and 8 use the number of CEOs and Chairs on the board, following the same pattern as above. Neither of these two moderating variable has any effect on female director employment.

Insert Table 10 about here

The results in Table 10 use the log number of female directors as the dependent variable. The coefficients, especially on the moderator variables, are almost identical to those in Table 9. Only two variables are significant in this table

and not in the previous one. First, CEO tenure has a positive moderating effect on the firm size coefficient, so large companies with long-tenure CEOs tend to employ fewer female directors. Second, board human capital -- the number of CEOs and Chairs on the board -- is associated with the log number of female directors. This is not surprising, as board human capital is highly correlated with board size and board size is highly correlated with the number of female directors.

Overall, the moderating variables have little effect on the coefficients on firm size and board size. Industry discretion does have a strong effect on these coefficients, but most of that effect is primary and not a moderating relationship. CEO tenure also has some effect on female director employment. Executive compensation and board human capital have insignificant effects on female director employment.

DISCUSSION

This paper analyzes whether companies and boards that value unique information more than operating expertise hire more female directors. The results suggest that they do. Whether the measure of female directors is a percentage or a total number and whether the empirical technique controls for unobserved heterogeneity or not, the results suggest that large companies and large boards consistently hire more female directors. This paper posits that there are necessary trade-offs between developing human capital through directly-related executive experiences and developing social capital through unique and rare experiences. Interestingly, the lack of female participation in senior corporate positions has created the opportunity for women with work experience outside of business or outside of top management teams to serve on corporate boards.

The discussion about increasing gender diversity on boards actually should have two distinct themes. First, companies can increase gender diversity on boards

by increasing the number of women on executive development paths and in senior executive positions. This will cause more women to enter the pool of directors with operating expertise. Second, companies may be already increasing gender diversity in response to an increase in the value of unique information, arising from increases in firm size and, possibly, board size. As the economy continues to concentrate into larger and larger firms, more companies will seek female directors, and other individuals with unique information and relationships, to serve on their boards.

This paper suggests that female directors add value through the uniqueness of their information and relationships, but this is entirely contingent on having a large pool of women capable of serving as directors due to significant work experience as professors, administrators, government officials, and non-profit executives. The United States is unique in having a pool of women with long careers in non-corporate institutions, which other countries may not have. However, this social capital/human capital model is not unique to female directors. Other groups that have not participated in typical director development paths, such as racial minorities and non-Western citizens, can also offer unique relationships and information.

The empirical results strongly support this explanation for patterns in female director participation on boards. Female directors tend to serve with the largest companies and on the largest boards, in support of hypotheses 1 and 2. This result is robust to measurement of female employment, to including past financial performance into the specification, and to the inclusion of a non-linear interaction term. This effect is robust across the moderating relationships. Industry discretion has a positive moderating effect on the board size coefficient, suggesting that board size is more strongly associated with female director employment in high-discretion industries. This supports hypothesis 7. CEO tenure has a negative moderating effect on the board size coefficient -- board size is less strongly associated with female director employment when the CEO has held his position for a long time, supporting

hypothesis 5b. Executives with a long tenure may tend to employ directors from prior years with high board stability from year-to-year, while newly hired executives may try to create a more modern board once they become established in a year or two. Generally, there is little support for the other hypotheses are moderating relationships.

This paper also compares the results for pooled cross sectional and panel analyses. While there is strong evidence that some omitted variable is causing both an increase in women on the board and an increase in firm size and board size, the magnitude of these effects are not large. Using an OLS regression to analyze female director employment only introduces a small upward bias on the coefficients of firm size and board size.

Limitations

One criticism is that this paper simply shows a model in which the relatively small number of females, who are otherwise similar to male directors, sorting into the companies that offer the best director experiences. Two measures of the quality of director positions are past financial performance and director pay levels. From the analyses in Table 7, there is little evidence that past financial performance is an important determinant of female director employment. Actually, if there is a relationship, it is that the companies that performed better over the past one, three, and five year periods are less likely, not more likely, to employ female directors. There is no consistently strong evidence that prior financial performance predicts whether a company employs female directors.

I also analyze whether companies that employ more female directors also pay their directors more. Table 11 shows the pooled cross-sectional and fixed effects regressions for director pay. Director pay is the logged sum of the annual retainer and expected meetings fees, assuming the director attends all meetings. For director pay,

the only significant variable is firm size, consistent with many studies of executive compensation that show firm size as a critical determinant of pay levels. A 10% increase in firm size is associated with a 1.5% increase in director pay, which is approximately half of the pay premium for executives. All else equal, boards that employ a large number of women do not compensate directors at a higher level than boards that do not employ female directors. Controlling for firm fixed effects, an increase in the number of female directors is not associated with an increase in pay. Overall, there is almost no evidence that companies with more female directors pay their directors more than other companies. If women are sorting into the most desirable companies, they would be likely to sort into prestigious companies with superior past financial performance and higher director pay, but they do not.

Extensions

This paper can be strengthened with two extensions. First, the theory predicts that increases in firm size and board size will result in greater female director employment, but the empirical test is only for the period in the late 1990s. Collecting data on these companies in the mid-1980s and early-1990s would strengthen the empirical results. Second, I include little detail about the relative operating expertise and unique information, such as past work experiences, age, education, board interlocks, and other relevant variables. If this model is accurate, the human capital variables should be strongly correlated with being male, while the social capital variables should be strongly correlated with being female.

CHAPTER 4 REAL OPTIONS AND EMPLOYEE GOVERNANCE

Many well-known relational contracts have come under substantial stress (and sometimes failed) when the world has changed important parameters, such as the expected profit for the firm. For example, for several decades IBM made a “no layoffs” pledge to its employees. This was not a formal contract, enforceable by a court, but it was part of “the deal” at IBM: a shared understanding between the firm and its employees about how employment would proceed.... Eventually, IBM abandoned the policy (Gibbons 1998, pg. 122).

Contracts are inherently bilateral negotiations between partners that are disciplined from external opportunities, making analysis of the labor market more akin to the marriage market than to the bourse (Rosen 1985, pg. 1145).

A significant trend in pre-Enron corporate governance research was Margaret Blair and colleagues focusing attention on the employee governance puzzle: although workers in the United States invest in firm-specific assets for future cash flows, they receive no decision or property rights to control those investments (Blair 1995, Blair 1996, Blair and Roe 1999, Blair and Kochan 2000). The lack of governance rights is perplexing because workers consistently lose returns on those investments after firm-initiated layoffs (Fallick 1996). Those losses have an average present value of \$115,000 for workers with six or more years of firm tenure and \$155,000 for workers with eleven to twenty years of firm tenure (Schultze 2000), and estimates of percentage wages losses after layoffs range from 14% to 36%, depending on the sample and measure of displacement (Kletzer 1998). In the United States, layoffs are not an insignificant labor market phenomenon: just the twenty-five largest

layoffs affected more than 550,000 individuals in 2001 (CBS 2002). Workers make large investments in firm-specific assets, but employment relationships frequently end with the workers losing their investments. Investing in firm-specific human capital may be a very poor decision for workers.

Why would workers continue to make these investments? One reason is that companies sometimes offer payments to workers after layoffs or other involuntary separations. Companies can offer early retirement packages, severance pay or placement assistance to displaced employees, and some employment contract include explicit guarantees that the company will make payments when displacing covered employees, called golden parachutes (Singh and Harianto 1989). Still, the evidence on wage losses suggests that most workers face a real wealth loss upon displacement. Do employees rationally choose to invest in firm-specific human capital despite the lack of governance rights and the risk of losing the investment?

Labor market contracts with specific human capital create small numbers bargaining negotiations in which a range of efficient outcomes exist (Williamson 1985). This paper, based on options pricing theory, posits that employment relationships with implicit contracts in the United States are actually explicit contracts plus options for both parties to break the contract at any time. While the company receives the option to dismiss employees, the workers also receive an option to demand higher wages from the company. Any evaluation of employee involvement in corporate governance must consider a wide range of labor market institutions and outcomes, including the form of contracts, labor laws, the efficiency of labor and corporate reputation markets, variability in labor productivity, labor unions, wages, and, of course, specific human capital and layoffs. Employee involvement in corporate governance is efficient in one scenario, but other labor market mechanisms are more efficient in others. Using the Black-Scholes options valuation model, this paper shows that the company and worker options are likely to be valuable when the

specific investment is large, when the productivity returns are variable, when the costs to exercising the options are low, and when the interest rates are low and time periods long. In that scenario, the parties will develop contractual mechanisms to reduce underinvestment, and the choice of specific mechanisms will depend on the signaling value of human capital, worker homogeneity, and the bundling of specific capital with other human resource practices or human capital investments.

LABOR MARKETS AND CONTRACTS

Before discussing our contribution to this literature -- a real options approach to explaining solutions to the natural underinvestment in firm specific human capital - it is useful to describe our understanding of labor contracts. Workers sell effort to the firm in return for wages and benefits, and workers who produce more output can be paid higher wages than workers who produce less output. Productivity depends on past investments in education, training, and work experience, as well as the context in which the worker provides effort (Mincer 1958, 1962, Becker 1964). The underlying terms of the transaction are some exchange of wages for productivity; research in labor economics traditionally has been based on a competitive model, in which wages are assumed to equal the marginal productivity of labor (Baker and Holmstrom 1995).⁵ Workers choose the company that offers the highest utility (a function of wages, hours, and conditions of employment), while companies choose the highest productivity employees conditional on wages paid.

Spot market exchanges of productivity for wages are one type of transaction. The parties do not incur the costs of writing or enforcing a contract or creating and nurturing a long-term relationship, but these spot exchanges also have potentially

⁵Researchers using the competitive models have explained a number of cases in which productivity and wages may diverge. I discuss a number of these later in the paper.

high costs. Most employment relationships are characterized by hidden action, when the effort of employees is costly or difficult to observe, and hidden information, when one party knows something that the other party does not and uses that information to advantage, which creates inefficiencies (Arrow 1985). Work on agency costs (Alchian and Demsetz 1972, Jensen and Meckling 1976), transaction costs (Williamson 1971, 1975, 1979), and property rights (Grossman and Hart 1986, Hart and Moore 1990) has developed an alternative framework to understand labor relationships by focusing on the incentive and governance effects of labor market contracts (Williamson 2002). In the contracting models, workers and companies face an environment of incomplete contracts, bounded rationality, and asymmetric information, so both parties agree to costly incentive and governance mechanisms to maximize the total surplus from the labor relationship.

Labor Market Frictions

Unlike competitive market exchanges, such as in financial or commodity factor markets, labor relationships frequently have small numbers bargaining, non-transferability of property rights, asymmetric information, asymmetric enforcement of contract terms, and costly contractual negotiation and enforcement (Malcolmson 1997, Dow 1993). These problems are caused, in part, by the presence of firm-specific human capital (Becker 1964). This resource raises a worker's productivity in only one company, so it necessarily creates a small-numbers bargaining scenario. In a competitive market, any single buyer has no power to set prices, because suppliers have no incentive to lower their prices when other buyers will pay the higher, market price. In labor markets with specific human capital, the buyer has some power to set prices, because the supplier -- the worker -- cannot find another buyer who values the specific human capital as much as the current employer. Simultaneously, the worker with specific capital can produce more value for the company than alternative

workers, so the worker can demand higher wages from the firm. Investments in specific capital, whether human or not, are not normal financial transactions (Williamson 1975). There is no market for these investments, unlike most other assets, so specific human capital becomes an ex post sunk cost immediately after investment. Moreover, there is an infinite range of ex post efficient outcomes: from the worker to the company receiving all of the returns.

The small-numbers problem is not a major friction if the parties can write complete contracts. However, it is difficult to create comprehensive labor contracts (Grossman and Hart 1986). Because the property rights to use specific human capital cannot be separated from the human being owning that capital, labor contracts are subject to asymmetric enforcement (Becker 1964). A company can be required to meet its explicit contractual obligations, but it is illegal to force workers to provide effort, as part of prohibitions against slavery. Even in cases where the parties write contracts, such as in collective bargaining agreements, labor contracts generally cover a short time period with contract fill-in over time and allow open-ended contingency clauses to cover terms not in the contract (Baron and Kreps 1998). Incomplete contracting reduces enforceability of contract terms and forces the parties to renegotiate contractual terms over time.

Implicit Contracts and Options to Abandon

We use the term implicit contract to refer to unwritten agreements that leave some contract terms open for ex post negotiation.⁶ Many contracts on financial and hard assets are completely explicit, meaning that all key contractual obligations are written and legally binding. Except for the simplest spot market exchanges of effort

⁶ Incompleteness is a sufficient condition for implicitness, though it is not necessary. Two parties could completely negotiate all contractual terms and still not write the contract terms explicitly.

for wages, labor market contracts are never completely explicit (Rosen 1985, Dow 1993). Unions bargain over partially-explicit written labor contracts that detail obligations about work hours, compensation and benefits, and conditions of employment, but employers almost always maintain a reserve clause that gives them the right to make changes to the employment relationship for any items not covered in the collective bargaining agreement (Cox et al 1996). Moreover, the contract is only binding in certain circumstances. Workers cannot be forced to provide effort, so they are free to exit the firm and void the labor contract at any time. Companies can close an operation or reduce headcount, which voids the labor contract for at least the affected employees. Even among the most explicit collective bargaining agreements, the two sides must agree to negotiate in the future when the present contract ends. Also, the collective bargaining process divides topics of bargaining into three categories: mandatory, permissive, and illegal (Cox et al 1996). The mandatory topics include wages, benefits, outsourcing, and other conditions of employment, while the permissive topics include business decisions like promotion and marketing and expanding or shutting down business operations. This means that, even in a formal collective bargaining contract, the company and workers will make implicit agreements about a number of non-mandatory bargaining issues.

We specifically define an implicit contract as one in which two parties agree to some set of general terms, while the actual exchange of cash and effort is agreed to at a later date through some formal or informal negotiating process. In the context of the implicit contracts governing investment in specific human capital, the general terms at a minimum include the amount of specific human capital invested and the expected future payments. The specific human capital investment is the cash value of time, effort, and direct costs related to a worker gaining the knowledge, skills or abilities that constitute the specific human capital. The expected future payments are the additional wages that a worker will receive for investing in the specific human

capital. Because the contract is implicit, these terms are not written, so they are more difficult to enforce than explicit contracts. However, the term contract implies that both parties have reached agreement, regardless of whether the agreement's terms are written or communicated in other ways.

The frictions inherent in labor market contracts, we argue, can be summarized conceptually as two variables: options for both the company and employees to abandon the contract. The worker and company each receive the right, but not the obligation, to unilaterally cancel the contract when canceling provides higher returns than the contract itself. Uncertainty, combined with unenforceability, makes it likely that one party will exercise their options under certain scenarios, thereby reneging on the contract. However, neither side wants to bear the risk of the other side reneging. Their awareness of the option held by the other contracting party may cause both the company and worker to underinvest or fail to invest in an otherwise attractive asset:

Because specific training is only productive in the current firm, it would be unwise for workers to behave as they do with general training: that is, to bear the full cost of training and then receive a wage equal to the value of post-training marginal productivity. To behave in this way is to risk a capital loss from employer-initiated layoffs. (Hutchens 1989, p. 51)

Specific Human Capital and Implicit Contracts

Since the late 1970s, researchers have studied specific human capital in the context of implicit contracts (see Rosen 1985 for a review of this early literature). Research shows that specific human capital investments are an important part of labor relationships, affecting wages, training and layoff decisions (Hammermesh 1987, Topel 1991, Parent 1999, Neumark and Stock 1999). Specifically, workers typically face large wage losses after being displaced from their employer and these losses persist over time (Fallick 1996). Estimates of wage losses for displaced workers vary

with the time period, sample, and measure of displacement, including estimates of 14% (Ruhm 1991), 15% (Stevens 1997), 25% (Jacobson, LaLonde, and Sullivan 1993), and 27 to 36% (Ong and Mar 1992).

Despite the contractual difficulties associated with specific human capital investment, it appears to be a major determinant of labor market outcomes. Its value arises for two reasons: first, it is a valuable strategic resource; second, it may be a necessary, complementary input for investments in specific physical capital or technologies. First, specific human capital is an ideal form of the value-creating resource, defined as an input that is inimitable, rare, without substitute, and valuable (Barney 1991, Lepak and Snell 1999). Specific human capital, by definition, increases employee productivity in only a single company-employee dyad, so other firms cannot attempt to hire away this input with higher prices. It also may be difficult for other firms to invest in firm-specific human capital. In internal labor markets, the specific capital develops over a multi-year employment relationship, making it difficult for competitors to duplicate in the short-term. Second, specific human capital may be necessary and valuable because it complements investments in specific physical or intellectual capital (Topel 1991). Without firm specific training or skills development, it may be impossible for the company to invest in other strategic resources that create value.

Our analysis seeks to understand why specific human capital investments occur and how the parties reduce the costs associated with options to abandon the contract. Because our analysis is based on finance theory, we can assign precise values to the options created by labor contracts.⁷ Our work is entirely consistent with previous work, but we can offer additional rigor and flexibility in analyzing firm

⁷While assigning precise values to the options is feasible, this paper only presents the conceptual framework, not a quantitative analysis of real options values in labor contracts.

specific human capital investments. The remainder of this paper discusses what these options are, how the options are valued, and how the parties can reduce the underinvestment problem that arises in the presence of these options.

STYLIZED SCENARIO

Consider the following scenario. A large pulp and paper company has changed the way it converts wood pulp into consumer paper products.⁸ By improving the drying process, the company can produce stronger and softer paper using fewer raw materials and less energy. This drying process is patented and the company will not license the technology to competitors. The machine requires workers to operate a complex new software package unique to this process and to service multiple new parts on a regular basis. Clearly, the company cannot hire employees who have learned elsewhere how to operate the software and maintain the parts, so it must train employees internally.

The firm and its employees have an existing explicit or implicit employment contract that covers wages, hours, and conditions of employment.⁹ The parties now must change the terms of this contract to incorporate decisions about how much to

⁸ The company is the residual claimant of the net revenue from the production process. Because the company receives all residual profits, it will initially receive any positive or negative economic rents arising from the implicit contract. The company is assumed to act unilaterally as a collective whole, despite its actual composition as a potentially large number of owners and managers. The company achieves optimal utility when it minimizes wage costs conditional on achieving a certain level of output and revenue.

⁹ Workers are defined as any group of employees investing in similar levels of human capital, under similar contract terms, and with similar variability in expected returns to the investment. This group could be as small as one individual or as large as an entire workforce. This model assumes that workers have similar utility functions, preferences, and external job opportunities, so they can act collectively as a unified whole. The workers achieve optimal utility by maximizing wages conditional on work hours, risk, and other conditions of employment.

invest in firm specific training and who will finance this training. The optimal level of training exists where the marginal productivity returns from training equal the cost of training. In a scenario with frictionless contracting, the parties simply need to decide how much to invest in training, as either party could finance the investment and receive the returns. Therefore, determining the optimal level of training is a trivial problem.

In the actual world of imperfect labor market contracting, an important question is who pays for the training. At one extreme, workers could quit their current jobs, pay out-of-pocket for training courses, and then receive higher wages when they return to their jobs. At the other extreme, the company could pay employees their full wages and benefits while they enroll in formal training courses to learn the new skills. The employees then would transfer to the new machine and earn the same wage as before, presumably indifferent between the old and new job, but aware that they now have unique skills. Clearly, there is an infinite range of financing possibilities between these two extremes, although, for ease of exposition, we first examine the nature of the contracting problem under these two extreme financing arrangements.

The company prefers that workers pay for the specific human capital investment, because it wants to have the option of withholding payments for past specific human capital investments should those investments become less valuable in the future. This option would imply that if the new machine becomes obsolete in a few years or if consumer demand for the output falls, the company could dismiss workers who would then bear the full cost of dismissal. Depending on how wages are adjusted and when there is a decline in returns, employees would lose the financial returns gained from the prior-period specific human capital investment. Workers cannot contest the dismissal because the contract is implicit, and there are no formal, written contract terms. We call this a company's option to withhold payment.

Employees prefer that the company pay for the specific human capital investment, so they will have the option to withhold effort to negotiate for higher wages if the past specific human capital investments become more valuable. If the new machine adds greater value than expected ex-ante (perhaps because consumer demand is stronger than expected or the new technology produces more output than expected), then the employees can demand higher wages from the company. The workers have nothing to lose by withholding effort -- the company alone has financed the past investment and owns the current returns. In that case, the company must choose whether to hire and train new employees or to give the existing workers a wage increase. This is the workers' option to withhold effort.

OPTIONS TO WITHHOLD PAYMENT AND WITHHOLD EFFORT

The options to withhold payment and to withhold effort arise when the investment in specific human capital is governed by an implicit contract. The joint values of the workers' option to abandon effort and the company's option to withhold payment will be highest when actual productivity gains from a specific human capital investment deviate or are expected to deviate from the expected gains. We intentionally use the term option, because we can value these choices the same way as financial options:

The common element for using options-pricing here is the same as in the preceding examples [of financial options]: the future is uncertain (if it were not, there would be no need to create options because we know now what we will do later) and in an uncertain environment, having the flexibility to decide what to do after some that uncertainty is resolved definitely has value.

(Merton 1998, pg. 339)

It is important to note that workers and companies almost always have these options in an employment relationship, unless there is perfect certainty and information and

contracts are completely enforceable. The options arise when there are implicit contracts that govern ex post division of quasi-rents. The two parties initially agree to a division of the gains from a specific human capital investment, but the actual productivity gains may be higher or lower than expected. If contracts were enforceable, the company as the residual claimant would receive both the unexpected gains and losses from the investment, as the company does with investments in physical assets or intellectual property. However, there is nothing in an implicit contract to prevent the company from voiding the contract when the gains are less than the additional wages paid to employers or to stop workers from voiding the contract to demand a larger share of the gains.

What are the Options?

The options to withhold payment or withhold effort represent a wide range of behaviors and activities. For workers, the essential components are to have a way to withhold effort and a way to negotiate with the company. Withholding effort could be through an official union strike, in which a group of workers receive some legal protection if they withhold effort as part of the collective bargaining process, or through less formal actions. Workers can threaten to quit, can reduce effort on the job, increase absences from work, or intentionally sabotage key outcomes. In each case, the company's productivity would fall, and there is little the company can do except fire or dismiss the worker. The worker's option to withhold effort exists only because every individual has a legal right to not work (Becker 1964). The second component is some way of negotiating with the company. This can be a labor union, in which a group of workers elect representatives to bargain for them, employee advisory or participatory groups, or individual employee-manager negotiations (Freeman and Rogers 1993). The worker, at any time and for any reason, can withhold effort to demand higher wages in an at will employment relationship. The

company then has the choice to meet the demand, propose a compromise, dismiss the worker, or allow the worker to quit.

At will employment relationships also mean that companies can dismiss workers or reduce wages for almost any reason (Malcolmson 1997).¹⁰ The company also must have a way to withhold payments and negotiate with workers. In the absence of a formal labor contract explicitly limited management rights, companies in the United States are free to dismiss workers without compensation. Even when a contract exists, companies have the option to close operations entirely, relocate operations to a foreign country, or preemptively replace unionized workers with permanent replacements in a lock-out (Cox et al. 1996). Alternatively, the company could eliminate future wage increases (allowing inflation to reduce the real wages over time) or reduce nominal wages, although the latter is very rare.

It is not uncommon for workers and companies to exercise these options. While the incidence of strikes has fallen over time, there were between 21 and 45 major work stoppages, each involving more than 1,000 employees, each year from 1992 to 2001 (Bureau of Labor Statistics). In 2000, more than 394,000 employees withheld effort for at least some time during a work stoppage, and work stoppages affected organizations as diverse as teachers in Hawaii, Seattle, Los Angeles, and Detroit; workers at United Technologies, Boeing, Verizon, and Newport News Shipbuilding; and television and film actors, Atlantic City casino workers, and maintenance workers in Los Angeles and Chicago from 1999 to 2001 (Bureau of Labor Statistics). There is less data on worker options exercise within firms. In a sample of establishments from 1997, the median establishment reported that 7% of its

¹⁰Generally, companies cannot dismiss members of protected classes, including women, racial minorities, veterans, the disabled, and older workers, for discriminatory reasons. Workers also may be protected from dismissal if they have received explicit tenure guarantees (as for teachers, federal judges, and some others) or if they are covered by a formal labor contract with seniority rules (as for labor union members).

workforce voluntarily quit in the previous year (NES 1997). Not every quit is the result of a worker opting to withhold effort, but there is evidence that separations occur. Companies also have been active in dismissing employees: the twenty-five largest layoffs affected more than 550,000 individuals in 2001 (CBS 2002). These layoffs seem especially common after acquisitions, in which dismissing unionized employees to cut costs is one way that acquisitions create value (Fallick and Hassett 1996, Becker 1995). In the establishment sample from 1997, more than 35% of companies reported a decline in workforce size over the past two years (NES 1997). While strikes, worker quits, and layoffs have a number of causes, these are all equivalent to exercising the option to void the implicit contract.

When are the Options Exercised?

The evidence that some workers and companies exercise their options to withhold effort and payments must be contrasted against the majority of employment relationships that do not result in strikes, quits, wage reductions or layoffs. Many workers and firms choose not to exercise their options. When options are exercised is conceptually straightforward, assuming perfect information. First, an individual only exercises an option that has positive value, when the benefits exceed the costs. Second, an individual exercises an option when its present value is maximized. Individuals with a high discount rate, who tend to value future cash flows very low, will exercise earlier than those with lower discount rates. For other individuals, they will determine how the value of the option is likely to change in the future and exercise it when the present value is maximized. Of course, this problem is trivial for financial options, because the market price is the present value of the option. With the options to withhold payment and effort, there is no market price, so the parties must consider the present and anticipated future gains from exercise. It generally costs something to exercise the option, so the workers and company must weigh the

present value of the gains against the present value of the costs.

For workers, trying to withhold effort could result in dismissal from the firm, causing the worker to lose relationship-specific investments in signaling and human capital. In a spot-market labor contract, such as that for low-skilled workers, the threat to withhold effort has no cost to the company -- it could dismiss the worker and immediately hire a comparable replacement. The worker only withholds effort when it costs the company something if the worker leaves. That loss includes the cost of finding and hiring a replacement, training costs, lost productivity during hiring and training, and similar effects, which could be a one-time cost as high as one-third of annual wages (Campbell 1993). Workers, then, need to weigh the possible wage increases against the risk of dismissal. In many cases, the present value of the gains are unlikely to exceed the present value of the costs. Unless the worker is certain of receiving the gains, or the gains are very large, it is not value-maximizing to exercise the option. The company also incurs costs upon exercising its option. Eliminating future wage increases or reducing current wage levels may prompt employees to exit the company. Dismissing workers may reduce morale and productivity among surviving employees (Wanberg Bunce and Gavin 1999), and the loss in reputation may make contracting more difficult with other parties (Carmichael 1984). In many cases, the benefits from firing workers may not exceed the costs of hiring and training new employees, motivating and compensating the remaining employees, and losing reputational capital in the broader market.

Underinvestment

When options are exercised, it shifts wealth from one party to another. The same is true when options are created; if one party receives a valuable option, it is at the expense of the other party. The crux of the problem with specific human capital investment is that the company receives a valuable option at the expense of the

workers and vice versa. This reduces the value of the specific human capital investment for the party writing the option. If workers have granted the company an option to withhold payment, the workers have created a scenario in which they lose their returns to the investment when the option is valuable to the firm, which makes their investment less likely. The same is true for the company. The presence of a valuable option, *ceterus paribus*, results in underinvestment in specific human capital, as the affected party reduces its investment until the returns are proportionate to the investment. In some cases, this could result in no investment.

In the absence of contracting costs, these specific investments would benefit all parties. Companies would have higher output and lower costs, workers would have higher wages, and the government would benefit from increased tax revenue. However, workers will not invest in specific human capital when the value of the firm's option to withhold payment is high and the firm will not invest in specific human capital when the value of the workers' option to withhold effort is high. Although specific human capital investment would yield positive economic returns, those returns are lost because of the contracting issues. Even more critical, our options model in the next section highlights that the underinvestment problem will be most severe in emerging industries that fuel future wage and output growth. As you will see, these contracting problems also affect the youngest employees who have the most years to benefit from the human capital investments.

We propose that the underinvestment problem will be greatest when the joint value of the options is very high: when either the company or the workers hold a valuable option. Figure 2 outlines the first set of necessary conditions. Underinvestment will only occur in the upper right box, representing high uncertainty and high potential value from firm specific human capital investments. The next sections detail exactly when the options are valuable and how the parties contract to reduce underinvestment.

Value of Options and Use of Contractual Mechanisms

Financial and real options have two values.¹¹ First, there are the cash flows that accrue from exercising the option. In a labor contract, this is the amount that one party can appropriate from the other, and it can be positive, negative, or zero. Second, there is the price at which someone would purchase the option today -- its current market value -- that must be non-negative. As for financial options, real options values can be priced using the Black-Scholes model. The five primary factors in valuing an option in the Black-Scholes model are the exercise price, the current asset price, the underlying variability of returns, the time period, and the interest rate (Brealey and Myers 2000). Prices, in the context of labor market contracts, are represented by productivity and wages. For companies, the largest option value exists when an investment in relationship-specific assets is producing minimal productivity returns, but the workers are paid as though the investment was successfully raising productivity. The wage premium paid to these workers would be much greater than their productivity premium over the next best workers. For workers, the largest option value exists when that investment has resulted in extremely large productivity gains, while the workers are paid the same wages as they could receive elsewhere. In both cases, the parties have an incentive to exercise their option and break the contract, reducing the cash flows of the counterparty. The bargaining relationship, after an investment, is zero sum.

The parties can anticipate when options may be valuable, before they make an investment in relationship-specific assets. We will discuss five variables that affect the value of these options: the magnitude of the initial investment, the variability in

¹¹This paper does not describe financial options in depth. There are a number of excellent references that do. We recommend Brealey and Myers (2000) for anyone unfamiliar with corporate finance.

returns, the cost to exercise, the interest rate and the time period. The options will be most valuable in settings with large investments in relationship-specific capital, high variability in consumer demand and production technologies, weak reputation markets, low-friction labor markets, long time periods, and low interest rates. When the options are valuable, neither party initially agrees to invest in specific capital. The party granting the valuable option would have lower returns, causing them to avoid investing. When the investment is economically efficient (when the present value of the productivity gains exceeds the investment cost), there is an opportunity for the two parties to improve their outcomes if they can negotiate a satisfactory contract. We propose that, when the options are valuable, the parties develop explicit contractual solutions that either compensate the counterparty for the value of the option or prevent the option from being exercised. We later explain what form these solutions take.

Magnitude of the investment. If we define the option to withhold effort or payment as an option on an arbitrary dollar value of specific investments, X , then an otherwise equivalent option on a $2X$ investment would be worth twice as much. An option on $12X$ of specific human capital would be worth twelve times as much. This is similar to the value of financial options: an option to purchase \$200,000 in stock will be worth ten times more than the option to purchase \$20,000 in stock, *ceteris paribus*. An option on a more valuable asset is worth more than an option on a less valuable asset, holding all other variables constant. This implies that the parties will develop mechanisms to prevent underinvestment when the returns to and investments in specific human capital are large in magnitude. Within a single company-worker contract, the magnitude of the investment can vary for the two parties. Both are affected by an increase in the total size of the investment, but the parties may finance different shares of that investment. When one party finances a larger share of the

specific investment, it increases the value of the counterparty's option, not its own option.

Specific capital investments likely vary by employee level, industry, and country. Executives make larger specific human capital investments in knowledge of a company's systems, businesses, and people than front-line production or customer service employees (Singh and Harianto 1989). In industries with high levels of corporate differentiation and unique resources, workers need to invest in more specific human capital than in industries with standard resources and high levels of technological similarity (Barney and Arıkan 2001). Likewise, employees in poorer economies may need to invest a larger portion of their assets in specific human capital than employees in richer economies, so the options value would represent a greater portion of their net worth. In each case, for executives, for differentiated companies, for emerging economies, the parties have a greater incentive to develop explicit solutions to underinvestment.

Proposition 1: There is a positive relationship between the value of the specific human capital investment and the use of contracting mechanisms to reduce underinvestment, *ceteris paribus*.

Variability of the returns. In the Black-Scholes model, an option on a more variable asset is worth more than an option on a less variable asset, where variability represents the range of possible gains to exercise. If there is no variability in the returns to specific human capital, then both parties know *ex ante* how valuable the investment will be and can design an explicit contract at low cost (Merton 1998). When returns have a wide range of possible values, perhaps due to changes in consumer demand, the emergence of new technologies, and organizational learning, the option for both parties will have a higher value. If the variability has a symmetric distribution, the two parties face identical variability in returns, but there is no reason

to expect that the distribution is symmetric. The company will hold a more valuable option if there is greater downside risk in technological changes or consumer demand. The opposite is true for workers: their option is worth the most when there is greater upside potential from the investment.

For the company, the worst case scenario under the initial contract is when changes to production technology equalize the productivity of workers who invested in specific human capital with the next best workers who did not. In an explicit contract, the company would bear the full cost of the initial contract. With an implicit contract, the company can dismiss employees and eliminate the contract costs. There would be no productivity advantage to employing the workers with specific human capital and, in fact, there would be a large disadvantage because the company is paying them higher wages as part of the implicit contract. This effect is magnified if consumer demand drops, causing each additional unit of productivity to be worth less. Because the source of value in specific human capital investments are future productivity gains, the returns to investment are sensitive to innovations in production technology that reduce the value of prior-period investments. The variability is the dispersion of the future difference between the marginal productivity of a worker with the specific human capital and the marginal productivity of a worker without the investment. Consumer demand also varies across time. The willingness and ability of consumers to purchase something produced with specific human capital as an input can increase if they value the product more or decline if they value the product less. An increase in demand for the product, with all else equal, will normally result in higher market prices. Consumer demand variability is the dispersion of the future product prices for the output produced with specific human capital.

We think that variability is likely to be a major problem in certain industries and companies. In turbulent industries with high levels of uncertainty, there will be high levels of variability in returns. These include industries with technological

uncertainty (computer software, computer hardware, pharmaceuticals), consumer uncertainty (apparel retail, toys, entertainment), or business uncertainty (health care, insurance, defense and aerospace). In each case, the nature of the industry creates uncertainty for any investment, including firm-specific human capital. Not all uncertainty is at the industry level. Companies with differentiation strategies, especially those investing heavily in firm-specific assets, likely face more uncertainty than companies with simple price-cost competition strategies. Differentiation works well if the company is leading the industry, but can be costly when a competitor has superior products or technology. For example, we expect that Dell Computer has less variability in productivity returns than Apple Computer and that Wal-Mart has less than Target. Overall, the options have no value in any environment with stable and predictable returns to firm specific human capital, and the options value increase monotonically with an increase in variability.

Proposition 2: There is a positive relationship between variability in productivity gains from firm specific human capital and the use of contracting mechanisms to reduce underinvestment, *ceteris paribus*.

Cost to exercise. An increase in the exercise price reduces the value of the option. For workers, the exercise price is the cost incurred by withholding effort and risking job loss. For companies, this is the cost of abandoning payments and risking reputation losses and employee turnover. The costs to exercising the option can differ significantly for the two parties. Workers incur a large cost in exercising their option to withhold effort, as the company could fire or demote them, causing them to incur the high costs of finding and beginning a new job (including the losses they occur by losing their past productive investments in specific human capital). Workers also may lose pension plan benefits and built-up vacation days and other benefits upon dismissal. Pension plans appear to increase tenure in a company, suggesting that

workers in these plans have an incentive to remain with the firm (Ippolito 1991, Dorsey 1995). In Canada, a law requiring severance payments and advanced notice of layoffs resulted in higher employment for protected than unprotected workers, although non-union workers paid for these protections with lower wages (Friesen 1996). A large source of costs for workers is labor market frictions. In a frictionless labor market, workers could easily move from one job to another without incurring high job search and relocation costs. With labor market frictions, there are costs to being dismissed from a current employer: direct costs for lost income, job search, and moving to a new area and information costs. If the new employer cannot judge employee quality, then the worker may have to accept lower wages until his or her quality is revealed (Chang and Wang 1996).

As labor market frictions increase, it becomes more costly for workers to reduce or withhold effort. Workers have particularly high costs when they have a valuable bundle of specific human capital investments. A worker can threaten to withhold effort to raise returns for any single investment in specific human capital, but they risk losing their returns to all the other investments they have made. If the worker commits to quit the firm and the company allows this, then the worker will be forced to abandon all her past investments in firm specific human capital, resulting in significantly lower wages in the future position.

If a company exercises its option and withholds payments to worker, it may have a loss in reputation capital, making it difficult for the company to make future implicit contracts (Lazear 1979, Carmichael 1984, Kreps 1990). When reputation markets are efficient, the company faces significantly higher reputation costs from dismissing employees, especially without remuneration. If reputation markets have significant frictions (when reputation is noisy or cannot be observed and “priced”), the cost of exercising the option falls. In the extreme case with no reputation markets, there are no reputation costs for any option, even the most severe.

Reputation costs affect the company by making future implicit contracts more difficult (Carmichael 1984, Kreps 1990). Future counterparties will not trust the company to pay future obligations, so they will insist on explicit contracts or more favorable terms in implicit contracts or the two parties will fail to reach agreements, causing higher contracting costs. The factors that underlie the cost of exercise for the company include adverse reputation consequences as well as any payments made to employees upon involuntary separation. The value of the option to abandon is negatively associated with the adverse reputation consequences of abandoning payment and with the magnitude of guaranteed separation payments.

The cost of the reputation consequences will depend on a number of firm-level characteristics. Emerging companies, with little past transactional history, will have little-to-no reputation capital, so they may have little to lose from exercising the options. Likewise, companies in commodity or price-based industries, such as steel or farm products, have relatively simple transactions and contracts that can be mostly explicit, so reputation capital may matter less. In large, established companies with prominent brand names, such as Coca-Cola, Procter & Gamble or Ford, the company's reputation may be so valuable that would not exercise an option at almost any price unless they fairly compensate the workers.

Overall, options have no value unless the parties exercise them by withholding effort or abandoning payments. If the cost to exercise the option is higher than the gains to exercise, then the option will not be exercised. At a very high cost to exercise, the options will have no value. Conversely, reducing the cost to exercise will result in higher values for the options. Options have the most value in environments with no reputation consequences for companies and no labor market frictions for workers.

Proposition 3: There is a negative relationship between the efficiency of corporate reputation markets and the use of contracting mechanisms to reduce

underinvestment, *ceteris paribus*.

Proposition 4: There is a negative relationship between the level of job market frictions and the use of contracting mechanisms to reduce underinvestment, *ceteris paribus*.

Interest rate and time period. From the Black-Scholes model of options valuation, the exercise price (the cost to exercise the option) and the possible market prices (the gains from exercising the option, which is a function of variability in returns) are critical determinants of an option's value and are dependent on the terms of a specific options contract, the investment in firm-specific human capital. Two other factors are also important determinants of an option's value: the interest rate and time period. An increase in the interest rate will reduce the value of the options. The interest rate relates to the future value of cash flows to present values; when the interest rate is very high, even large cash flows gains in the future have a very low value today. Likewise, as the interest rate approaches zero, the present value increases. For contracts in an economy or organization with high interest rates, such as an emerging economy or new business venture, the options values will be minimal even when there is substantial underlying variability.

Proposition 5: There is a negative relationship between the interest rate and the use of contracting mechanisms to reduce underinvestment, *ceteris paribus*.

Options covering a longer time period are always worth more. When the contract covers a long period, it is more likely that gains to exercising will exist during at least one period. We define the time period above as the expected company tenure of employees making the investment. The time period will be longer for young workers who expect to remain at the company for their entire careers. When the time period is long, it is likely that one party will have a valuable option in at least one year, leading to exercise.

Proposition 6: There is a positive relationship between the expected tenure of the employee in the firm and the use of contracting mechanisms to reduce underinvestment, ceteris paribus.

SPECIFIC MECHANISMS TO REDUCE UNDERINVESTMENT

Other research has analyzed the contracting problems with specific human capital and suggested a number of contractual solutions. Williamson (1975) uses the small-numbers bargaining problems associated with firm-specific human capital to explain the rise of multi-division corporations: companies develop internal markets to reduce transaction costs. In a similar analysis, Doeringer and Piore (1971) link the existence of internal labor markets to one form of specific human capital, on-the-job training. In these cases, companies develop internal systems to train employees and allocate labor and commit themselves to long-term employment relationships, and employees respond by investing more in specific human capital. Carmichael (1984) proposes that companies use their reputations to bond themselves in implicit contracts, and Crawford (1988) suggests that reversible specific investments would not create the contractual problems. Booth and Chatterji (1989) submit that workers should receive severance pay if they are dismissed from a job after making a specific human capital investment, especially when returns to that capital investment are variable. Cantor (1990) shows that the parties have the optimal incentives to invest in specific human capital when the labor contract is intermediate in length and pays a fixed wage. During the contract, the company receives all rents from the investment, and the workers try to negotiate to gain any positive rents after the initial contract expires. Our analysis integrates these proposed mechanisms into a single model: when should the parties consider internal labor markets, reputation, severance pay or wage-based mechanisms to reduce underinvestment?

In financial markets, these mechanisms do not exist, because the two parties

can adjust market prices until both buyers and sellers are willing to transact. Changing prices in labor market exchanges is equivalent to adjusting wages: if the workers grant a valuable option to withhold payment to the company, then the company could simply increase wages until the worker is willing to make the investment. This has the benefits of simplicity and low costs, as the parties would not need to make any other contractual agreements. However, an increase in wages paid to workers has the effect of increasing the value of the company's option, as it becomes more attractive to break the contract when workers are paid higher wages. If the company elects to pay higher wages to employees, its option value would increase, which would prompt the employees to demand even higher wages.

Wage payments are implicit mechanisms that increase options values, so adjusting wages is not a viable mechanism to reduce underinvestment. More generally, any implicit guarantee simply creates new options or makes existing options more valuable. Only explicit mechanisms will solve the underinvestment problem. We next detail three explicit mechanisms, including wealth transfers, employee decision-rights, and credible bonding, that are also shown on Figure 3. These mechanisms reduce underinvestment by transferring wealth or preventing the options from being exercised.

Wealth Transfers and Signaling

One explicit guarantee is to transfer wealth upon agreeing to the contract. If the workers have the valuable option to withhold effort, they could agree to accept significantly lower wages for a short-period to compensate the company for the option, which frequently occurs in apprenticeships, training programs, and internal labor markets. Similarly, if the workers grant the company a valuable option, the company would offer a signing bonus, one-time payment, or higher wages for a short period. The benefit of an initial wealth transfer is its simplicity and transparency.

Interestingly, when there is a very large cash transfer, both parties expect *ex ante* that the contract will be broken and that the option holder will exercise the option. This must be true because the option creates value for the holder only when it is exercised, so a high-value option indicates that either the option is likely to be exercised, or the returns upon exercise would be very significant, or both. The initial wealth transfer is necessary to convince the other party to invest in specific human capital, knowing that the relationship is unlikely to last for multiple periods.

More broadly, transferring wealth can be interpreted as determining who pays for specific human capital investments. When the company owns a valuable option, it will transfer cash to the employees, which implies that the company finances more of the initial specific human capital investment. When the workers own a valuable option (when they are likely to withhold effort in return to a *ex post* wealth transfer), they must finance more of the investment in specific human capital. Who pays depends in large part on who is expected to break the contract. This also answers the question of who pays for firm specific human capital investments. The simplest method to balance economic rents is for the parties to transfer cash until the expected returns are zero. In the extreme case when the company has a valuable option and the workers have a valueless option, the company would transfer cash to the employees in the amount of the expected value of the option. The opposite cash flow occurs when the workers have a valuable option.

Alternatively, the parties could agree to transfer wealth when the contract ends. Workers can promise a wealth transfer, such as losing pension and other retirement benefits, losing equity in the firm, losing seniority benefits, or agreeing to no-compete clauses, when they exit the firm after withholding effort. There is evidence that workers investing in specific human capital are more likely to receive pension benefits and tend to receive high pension benefits (Johnson 1996).

Companies can make credible commitments to transfer wealth upon exercising their

options to withhold payment, either through severance packages, early retirement plans, vesting of retirement or equity-sharing plans, or golden parachutes (Jensen 1988).

The rationale for an ex post wealth transfer is that it connects realized gains for one party with realized gains for the other party. With an initial cash transfer, one party will benefit ex post. If the company fails to exercise its option, it will have paid cash to workers, but will have received nothing in return (in hindsight only, of course, as the option initially had a positive expected value). Of course, the opposite is true if the party exercises the option. If the company exercises its option, the initial cash payment to workers will not sufficiently compensate the workers ex post for the break in the contract. When the parties agree to make payments upon breaking the contract, whomever loses economic rents will receive some cash transfer in compensation. If the contract is not broken, neither party receives a cash transfer. The problem with the wealth transfer on exercise is that it must be explicitly guaranteed. If the payment is only implicit, then it merely creates another valuable option to break the contract. The parties will demand an explicit agreement, such as when workers lose pension benefits or equity ownership if they voluntarily leave the company or when a firm agrees to make severance payments to displaced employees.

While transferring wealth ex ante or ex post is a simple and transparent mechanism to reduce underinvestment, it may have undesirable side effects. Investments in firm-specific human capital have a signaling value when it is otherwise difficult to measure productivity (Lazear 1995). A person willing to invest in specific human capital signals that he or she will remain with the firm for a long period to recoup the investment cost. Firms can require workers to make this investment to screen out workers who are not willing to commit to a long tenure with the company, potentially reducing its total human resource costs. Because specific human capital investments increase worker wages in a single firm relative to all other

firms, workers who have made these investments in the past have an incentive to provide high effort on the job to eliminate almost any chance of dismissal or other termination. Past investments in specific human capital, then, can act as an incentive for workers to provide more effort than they otherwise would (Lazear 1981, Lazear and Rosen 1981, Rosen 1986). There is evidence that the probability of turnover is negatively related to training investments (Royalty 1996).

If specific human capital investments signal worker attributes, then any company financing of that investment is likely to distort the value of the signal. In the extreme case of total company-financing of specific human capital, there can be no signaling value. Both the signaling and incentive effects would be diminished if the company finances firm-specific human capital investments. For example, company-provided specific training makes probationary screening periods less attractive (Bac 2000), and companies try to delay investments in specific human capital until they can learn which employees are less likely to change jobs in the future (Lowenstein and Spletzer 1997).

Even if the company agrees to make a wealth transfer at the end of the contract, this reduces the cost to the worker of being dismissed from the firm. This too causes less productive workers to sort into the firm, reducing the signaling benefits of the specific capital investment, because the entire signaling and incentive effect is based on workers losing wages if they voluntarily or involuntarily exit the company early in their careers. For example, if the company pays a severance package for anyone terminated from their position, then there may be little incentive for workers to provide higher effort to ensure they receive a return on their specific investment.

We posit that initial wealth transfers and ex post wealth transfers are only useful when there is a low signaling value to firm specific human capital investments. Ex post wealth transfers will be relatively more attractive when the parties want the

relationship to continue for multiple periods (such as when they have other relationship-specific assets), while initial wealth transfers will be preferable when the parties have no preference for a short or long-term relationship. However, for companies for which human capital investments have an important signaling value, credible commitments to prevent the exercise of options, either through employee governance, employee ownership, human resource systems, or multiple investments in specific assets by workers, may be more efficient than wealth transfers.

Preventing the option from being exercised preserves the signaling and incentives value from the investments, as it neither subsidizes the initial investment nor reduces termination costs to the workers. This may seem counterintuitive, as these mechanisms must increase returns to investing in human capital to be effective. The difference is the scope of the increasing returns. The ex ante and ex post wealth transfers affect each worker: if a person is fired, he or she receives the severance package, early retirement, or other wealth transfer. On the other hand, the other mechanisms only protect broad groups of employees; employee decision rights govern broad labor decisions (layoffs, outsourcing, downsizing, international expansion), but not individual human resource decisions. If a person is fired under these broad protections, there is no guarantee that the employee decision rights can prevent that firing. The value of signaling remains in this latter scenario, as an individual worker bears the full cost of investing in specific human capital and the subsequent losses from early dismissal. Wealth transfers affect each worker, while the decision rights and credible commitments only protect groups of workers.

Proposition 7: There is a negative relationship between the signaling value of human capital and the use of wealth transfers to reduce underinvestment, *ceteris paribus*.

Proposition 8: There is a positive relationship between the signaling value of human capital and the use of employee governance/ownership and credible commitments to reduce underinvestment, ceteris paribus.

Worker Homogeneity and Employee Decision Rights

Labor unions have been shown to be effective at increasing worker wages by shifting rents and quasi-rents from the company to workers (Becker and Olson 1992, Hirsch 1991, Freeman and Medoff 1984) and in punishing companies for breach of contract (Hogan 2001). Unions represent a shifting of decision rights from the company to the workers, although these rights generally cover specific business operations and the terms and conditions of employment. Unions may make it more difficult for a company to withhold effort because of superior bargaining power compared to workers negotiating individually. However, as discussed early in this paper, unions and firms typically do not bargain over corporate and business strategy, which have a major effect on the decision to exercise the company's option.

One way that workers could reduce the likelihood of the options being exercised is to receive an explicit set of decision rights through involvement in corporate governance or an ownership stake in the company (Blair 1995, 1996, 1999). Employee governance is the transfer of voting rights over corporate decisions from shareholders to employees. This could occur by placing one or more employee-directors on the board of directors with full voting rights and information privileges. The employees receive rights over all the firm's decisions in proportion to the number of employee directors. Employee representation on boards, though, has a number of significant costs. First, a typical board has eleven to twelve directors, so the board would need to have at least six employee-directors to give workers a majority vote over future decisions. If there are only one or two employee-directors, and if board decisions are decided by majority vote, the workers will have no additional control

over decisions than they would have without representation. Second, the interests of workers, unrelated to specific human capital investments, may be different from the interests of shareholders. Participation on the board may result in better specific human capital contracts, but it could reduce returns to investors and make the company less efficient in its operations. This is particularly a problem when an employee has access to information that even his or her direct supervisors and managers do not have. It might be difficult to keep information private if the worker has an incentive to share it with other employees.

An alternative to board representation is that workers could receive exclusive decision rights over a narrower set of issues most important to them, as in a works council in Germany (Addison, Kraft and Wagner 1993, Pistor 1999, Roe 1999). Rather than have limited rights to participate in all the company's decisions, this option gives workers nearly complete ownership of a limited number of decisions. These decisions could include the terms and conditions of employment, changes to overall employment systems, and perhaps even corporate strategies that affect workers. Employee governance can make it extremely difficult for the employer to reduce wages or eliminate workers when returns to specific human capital fall. A works council format could block these actions or negotiate with the company for remuneration. If the majority of directors represent employees, then the board would not consider wage reductions or other costs. If there are only one or two employee-directors, then they might be able to prevent the action, but it would be less certain and would depend on the culture of the board.

In case of employee decision rights, the political form is typically more republican than democratic. Workers rarely have uniform, direct involvement in corporate governance, except in some small employee-owned enterprises (such as co-ops), so the workers generally elect representatives to protect their interests. This solution to the underinvestment problem is efficient if the representatives -- directors

either privately selected by workers or chosen through the proxy voting in the usual director selection process -- can prevent the company from exercising its option. However, this implies that workers must be able to agree on a single set of issues that its representatives will address. This is simple in the case of completely homogenous workers with identical preferences. In a workplace with a diverse set of workers, it is unlikely that they will agree on a single set of goals for their representatives. For example, consider the case of individuals selected by workers to serve on the board of directors. These individuals are elected to maintain the asset price of past worker investments in specific human capital. This goal could mean preventing corporate layoffs, limiting the use of overseas labor, ensuring worker compensation upon termination, developing early retirement plans, or increasing wages or benefits. The worker director is unlikely to be seen as effective by all workers in the case of heterogeneous preferences.

Proposition 9: There is a positive relationship between worker homogeneity and the use of employee decision rights to reduce underinvestment, *ceteris paribus*.

Proposition 10: There is a positive relationship between worker homogeneity and the use of employee involvement in governance and labor unions to reduce underinvestment, *ceteris paribus*.

Bundling and Credible Bonding

High performance human resource practices include incentive pay, flexible staffing, teams, high levels of employment security, and high training investments (Ichniowski, Shaw, and Prennushi 1997). Research consistently shows that high-performance human resource practices have a strong positive effect on firm performance and employee productivity (Huselid 1995, Delery and Doty 1996, Delaney and Huselid 1996, Ichniowski, Shaw, and Prennushi 1997). These practices

seem to increase employee wages in at least some industries (Bailey, Berg, and Sandy 2001) and to reduce employee turnover (Huselid 1995). Why this effect exists is a puzzle. Lepak and Snell suggest that firms rely on high performance human resource systems to develop unique, valuable human capital in employees, a conclusion similar to early work that connected unique human capital to the existence of internal labor markets (Lepak and Snell 1999, Doeringer and Piore 1971, Williamson 1975).

Our analysis suggests a different mechanism linking high performance human resource systems and human capital acquisition. An investment in a commitment-based human resource system locks the company into a bundle of management practices, with firm-specific human capital as a critical part of that bundle. This “lock-in” represents a credible commitment by the firm not to exercise its option to abandon payments in the future. If the company chooses to exercise its option, it would need to simultaneously change its entire human resource system, as it would lose the specific human capital part of that system. By linking its broader management practices to specific human capital, the company is bonding itself to employees and signaling credibly that it will not exercise its option. This increases the returns to specific human capital investment to employees, reducing any underinvestment problem from the company holding a valuable option. In this model, the additional investments in specific human capital increase employee wages, reduce turnover, and improve corporate financial performance. Importantly, the commitment-based human resource practices themselves do not have any necessary effect on firm performance (although they may), as the company chooses them to send a credible signal to workers.

Bundling resources reduces the options value by making it harder to exercise. If specific human capital is an integral part of a broader system (for the company, its human resource or production system; for workers, a set of relationship-specific investments), neither party may choose to exercise their options. When human

capital is integrated with other investments, withholding effort or withholding payments can result in losses on those other investments, making it prohibitively costly to exercise the option. Companies can create credible commitments not to exercise by developing an entire corporate architecture than relies on specific human capital, such that the gains to abandoning payments would be outweighed by the losses from switching its entire human resource management system. This helps companies to commit to not abandoning payments for firm-specific investments, if the firm does not want to sacrifice the entire management system for those gains. Workers also create credible commitments not to exercise their options by investing in bundles of firm-specific assets. The gains to withholding effort on any single investment would be balanced by the potential losses of the remaining specific assets.

Proposition 11: There is a negative relationship between the bundling of specific human capital with other company or worker investments and the use of mechanisms to reduce underinvestment, *ceteris paribus*.

IMPLICATIONS

Model and Systems

This paper outlines a contractual path that the parties follow, shown in Figure 4. Entering into a firm-specific human capital investment, the first point (A) is the determination of whether the contract can be explicit, based on environmental uncertainty and the cost of writing the contract. If explicit, the parties move to point B where they exchange labor for wages with a completely specified contract, which is likely to be short-term agreements or unskilled labor completing simple tasks. Point B is basically a spot market for which the choice theories of labor economics are appropriate.

As this paper argues, most contracts will be implicit. Point C represents the

next determination of whether relationship-specific assets are likely to be valuable. If not, the parties move to Point E -- workers are covered by an implicit contract, but there are no mechanisms to reduce underinvestment because specific investments are not valuable. This includes professions with high levels of general human capital and easily observed output, including accountants, research professors, and computer programmers, as well as unskilled labor completing simple tasks.

If specific assets are likely to be the valuable and the contract is implicit, the parties at point D face one or more valuable options that will cause underinvestment unless the party granting the option is compensated for it. The simplest mechanisms to reduce underinvestment is to transfer wealth, represented by point G, unless there is a substantial signaling value to the specific investment, which leads the parties to point F. Assuming that no signaling value exists, such as when the workers and company have symmetric information, the parties simply need to decide whether to transfer wealth at the start of the contract or the end. As we argued above, transferring wealth at the contract's end actually makes it less probable that the option will be exercised, so this option is attractive if the parties are investing in other relationship-specific assets and do not want the employment relationship to end prematurely. If the wealth transfer occurs at inception, it has no effect on the probability of exercising the option, although a large wealth transfer *ceteris paribus* suggests that the option is likely to be exercised. Workers at points J and K (the wealth transfer points) will have easily observed output or effort, which includes senior executives with demonstrated past success, athletes, and some factory workers.

If there is a value to signaling, the final determination, at point F, is whether the workers are homogenous enough to elect effective representatives. If the workers are homogenous, employee governance can be very effective, as the representatives on the works council or board of directors can easily make decisions consistent with all worker's preferences. If workers are heterogeneous, it is likely to be difficult to

agree on a set of priorities: some workers may prefer compensation for layoffs, others may prefer a continued work relationships, and still others may have attractive outside opportunities that make them indifferent. Worker heterogeneity makes employee governance, whether through seats on the board, a workers council, or employee ownership, less effective than in a homogeneous workplace. The parties are left with point I, in which they must invest in bundling to bond themselves to the relationship for the contract to be effective.

Figure 2 suggests a number of implications. First, the United States economy has shifted in recent years to increased knowledge work, increased employee diversity, and increased economic and technological uncertainty. It is likely more difficult to measure productivity in knowledge positions, leading to an increased signaling value to specific human capital investments. At the same time, the increase in diversity is making employee governance, including unions, less effective at representing the wide range of employee interests. The parties respond by investing in a credible commitment not to exercise the option through additional employee and company investments in relationship-specific assets, including the rise of the high performance work systems/ commitment-based work systems. Second, the German and Japanese workforces are far more homogeneous than the American workforce, so employee governance is likely more effective in those countries than it would be in the United States. Finally, employee governance is unique in that it reduces the value of the company's option, but it is counterproductive at reducing the value of worker's option (it would actually increase that value). Employee governance is likely very effective in contracts when the company has a high options value, but it will cause severe underinvestment in cases when the workers receive the valuable option. In that latter case, the workers would need to transfer significant wealth (through reduced wages) at the inception of the contract or would need to invest a large amount in other relationship-specific assets to bond themselves to the firm. The workers

would have temporarily worse outcomes to pay for a governance mechanisms that they do not need.

Summary

This paper complements previous research on specific human capital by applying real options analysis to this investment. The parties receive valuable options to exit the contract when information becomes revealed in the future, but these options may be more valuable for one party than the other. Companies and workers then attempt to reduce the value of the options through contractual mechanisms that either shift wealth to the party granting the option or prevent the option from being exercised. In both cases, the mechanisms cause the parties to invest in specific capital, resulting in higher output and higher wages. This analysis has three primary advantages over prior analyses. First, the paper provides a framework to model who pays for specific human capital investments. In the forty years since Gary Becker introduced the concepts of general and specific human capital, some researchers have examined his assertion that workers finance all investments in general human capital and companies finance all investments in specific human capital (Becker 1964). The current consensus is the company and workers will share investments in firm-specific human capital because it binds both parties to the relationship (Hashimoto 1981, Parsons 1986, Becker and Lindsay 1994, Leuven and Oosterbroek 2001, Hashimoto 2001). Using options valuations techniques, we can estimate the magnitude of the options to abandon the contract, so we can determine which party will transfer wealth and how much wealth they will shift. The real options model allows for a precise determination of who pays for specific human capital investments. In this model, "who pays" is equivalent to "who makes an initial wealth transfer". Second, the paper shows that the various solutions to underinvestment (internal labor markets, high performance work systems, severance packages, pension plans, efficiency

wages, golden parachutes, employee governance, unions) should be modeled as a continuum of solutions to the same problem. It may be efficient for one firm to encourage employee unionization and ownership of the company, while another firm simply pays its workers a signing bonus to pay for the risks associated with specific human capital investments. Third, the options model is parsimonious. All relevant variables -- the value of training, the value of signaling, the external labor market forces, the reputation markets, and others -- can be summarized by two values: the options granted to the worker and company. The labor contract, then, can be modeled as an explicit contract plus two options to abandon the contract.

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APPENDIX TABLES/FIGURES

Table 1: Descriptive Statistics and Correlation Matrix

	Descriptive Statistics			Correlations								
	All Years	1998	2000	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
(1) Tobin's q	2.3 (5.1)	2.5 (6.5)	2.1 (2.9)	1.000								
(2) Debt (\$mm)	3,165 (10,588)	2,903 (11,500)	3,475 (9,390)	-0.078 0.007	1.000							
(3) Market Value (\$mm)	17,262 (42,734)	14,247 (31,483)	20,875 (52,977)	0.177 0.000	0.250 0.000	1.000						
(4) Total Number Directors	10.88 (3.58)	11.15 (3.67)	10.58 (3.45)	-0.204 0.000	0.228 0.000	0.134 0.000	1.000					
(5) Outside Director %	0.76 (0.13)	0.78 (0.11)	0.75 (0.15)	-0.113 0.000	0.073 0.010	-0.034 0.222	0.142 0.000	1.000				
(6) Number Female Directors	1.10 (0.91)	1.08 (0.88)	1.13 (0.94)	-0.073 0.012	0.178 0.000	0.204 0.000	0.453 0.000	0.207 0.000	1.000			
(7) Revenue (\$mm)	8,540 (16,999)	7,369 (13,889)	9,934 (20,007)	-0.041 0.160	0.493 0.000	0.530 0.000	0.210 0.000	0.060 0.036	0.248 0.000	1.000		
(8) Debt as % of Market Value	0.53 (2.90)	0.39 (0.93)	0.70 (4.18)	-0.057 0.049	0.073 0.011	-0.048 0.095	-0.038 0.185	-0.026 0.362	0.017 0.565	-0.004 0.885	1.000	
(9) Stock Price Variability	0.36 (0.15)	0.33 (0.14)	0.41 (0.15)	0.340 0.000	-0.096 0.001	-0.049 0.098	-0.387 0.000	-0.176 0.000	-0.311 0.000	-0.123 0.000	0.148 0.000	1.000

Notes: Data from 1998 and 2000 annual reports, Compustat, and ExecuComp

Descriptive numbers are means with standard errors below in parentheses; Correlation coefficients shown with p-values below

Table 2a: Effects of Outside Directors on Tobin's q

	OLS		Instrumental Variable		Firm-Controls	
	Industry and Time Controls (1)	All Controls (2)	Reduced Form (3)	2SLS (4)	All Controls (5)	Reduced Form (6)
Log Outside Director %	-0.512 ** (0.236)	-0.614 *** (0.232)	-0.640 *** (0.231)	1.619 (1.295)	.227 ** (0.096)	0.221 ** (0.096)
Log Number Female Directors			0.113 * (0.051)			0.066 (0.075)
Log Revenue		-0.024 (0.027)	-0.035 (0.027)	-0.082 ** (0.042)	.060 ** (0.028)	0.061 ** (0.028)
Debt-to-Market Value %		-0.033 * (0.018)	-0.034 * (0.017)	-0.026 *** (0.009)	0.004 (0.005)	0.005 (0.248)
Stock Price Volatility		0.840 *** (0.326)	0.887 *** (0.331)	0.665 *** (0.245)	-1.26 *** (0.21)	-1.259 *** (0.215)
Directors > Mean		-0.091 (0.070)	-0.115 (0.073)	-0.091 (0.057)	-.028 (0.045)	-0.040 (0.046)
Industry Effects (55)	Yes	Yes	Yes	Yes	No	No
Company Effects (546)	No	No	No	No	Yes	Yes
Year	Yes	Yes	Yes	Yes	No	No
n	1092	1092	1092	1092	1092	1092
R-squared	0.5348	0.5674	0.5691	0.4183	0.9583	0.9584

Notes: Pooled OLS regression with robust standard errors, ExecuComp and Board data in 1998 and 2000

Year variable controls for 1998; Industry controls at the 2-digit SIC level

Coefficients show with standard errors in parentheses

***=significant at .01 level, **=significant at .05 level; *=significant at .10 level

Table 2b: Effects of Outside Directors on Tobin's q

	Instrument: Log Number Female Directors plus One			Instrument: One or More Female Directors (I=yes)		
	OLS	IV	Firm-Controls	OLS	IV	Firm-Controls
	(1)	2SLS (2)	All Controls (3)	(4)	2SLS (5)	All Controls (6)
Log Number Outside Directors	-613 *** (.119)	1.518 (1.301)	.239 ** (.096)			
Log Outside Director %				-0.614 *** (0.232)	1.415 (1.803)	.229 ** (0.096)
Log Number Female Directors			-.047 (.092)			
One or More Female Directors						-.039 (0.071)
Log Revenue	-0.029 (0.021)	-0.083 ** (0.040)	0.057 ** (0.028)	-0.024 (0.027)	-0.077 (0.053)	.060 ** (0.028)
Debt-to-Market Value %	-0.033 *** (0.007)	-0.026 *** (0.009)	0.005 (0.005)	-0.033 * (0.018)	-0.027 *** (0.010)	0.005 (0.005)
Stock Price Volatility	0.862 *** (0.194)	0.689 *** (0.246)	-1.223 *** (0.211)	0.840 *** (0.326)	0.681 *** (0.260)	-1.25 *** (0.21)
Log Number of Directors	0.556 *** (0.144)	-1.597 (1.318)	-0.161 (0.120)			
Directors > Mean				-0.091 (0.070)	-0.091 (0.056)	-.024 (0.046)
Industry Effects (55)	Yes	Yes	No	Yes	Yes	No
Company Effects (546)	No	No	Yes	No	No	Yes
Year	Yes	Yes	No	Yes	Yes	No
n	1092	1092	1092	1092	1092	1092
R-squared	0.5414	0.3979	0.9091	0.5674	0.4125	0.9089

Notes: Pooled OLS regression with robust standard errors. ExecuComp and Board data in 1998 and 2000

Year variable controls for 1998; Industry controls at the 2-digit SIC level

Coefficients show with standard errors in parentheses

***=significant at .01 level, **=significant at .05 level; *=significant at .10 level

Table Three: Effects of Female Directors on Outside Directors Employment

	<u>Log Outside Director Ratio</u>	<u>Log Outside Director Ratio</u>	<u>Log Number Outside Directors</u>
Log Number Female Directors	0.044 *** (0.0145)		0.0510 *** (0.0151)
One or More Female Directors		0.0337 ** (0.0143)	
Log Revenue	0.021 *** (0.005)	0.022 *** (0.005)	0.0211 *** (0.006)
Debt-to-Market Value %	-0.003 * (0.002)	-0.003 * (0.002)	-0.004 * (0.002)
Stock Price Volatility	0.078 * (0.040)	0.094 * (0.051)	0.097 ** (0.051)
Directors > Mean	-0.012 (0.013)	-0.013 (0.015)	
Log Number Directors			0.9839 *** (0.0225)
Industry Effects (55)	Yes	Yes	Yes
Year	Yes	Yes	Yes
Number of obs	1092	1092	1092
R-squared	0.187	0.178	0.811
Adj R-squared	0.137	0.132	0.801

*Notes: Pooled OLS regression with robust standard errors. ExecuComp and Board data in 1998 and 2000
Year variable controls for 1998; Industry controls at the 2-digit SIC level*

Coefficients show with standard errors in parentheses

****=significant at .01 level, **=significant at .05 level; *=significant at .10 level*

Table 4: Descriptive Statistics for All Directors

	<u>All Directors</u>	<u>All Female Directors</u>	<u>All Male Directors</u>	<u>T-stat</u>
Gender (male=1)	0.90 (0.003)	0.00 (0.000)	1.00 (0.000)	
Insider (yes=1)	0.22 (0.005)	0.05 (0.008)	0.24 (0.005)	-14.26
CEO (yes=1)	0.32 (0.005)	0.16 (0.013)	0.34 (0.006)	-9.36
Chair	0.36 (0.005)	0.11 (0.011)	0.39 (0.006)	-16.10
Top Manager	0.24 (0.005)	0.32 (0.017)	0.23 (0.005)	4.22
Non-TMT Business	0.03 (0.002)	0.06 (0.009)	0.03 (0.002)	3.03
Government	0.01 (0.001)	0.02 (0.004)	0.00 (0.001)	2.08
Military	0.00 (0.001)	0.00 (0.000)	0.00 (0.001)	-4.91
Education	0.04 (0.002)	0.10 (0.011)	0.03 (0.002)	5.34
Social Services/Non-profit	0.00 (0.000)	0.01 (0.003)	0.00 (0.000)	1.61
Professional Services	0.06 (0.003)	0.07 (0.009)	0.06 (0.003)	1.09
Private Investor	0.01 (0.001)	0.01 (0.004)	0.01 (0.001)	0.30
Number of Directors	12.58 (0.048)	12.62 (0.142)	12.58 (0.051)	0.22
Number of Male Directors	11.36 (0.045)	10.80 (0.135)	11.42 (0.047)	-3.38
Number of Female Directors	1.23 (0.010)	1.82 (0.029)	1.16 (0.011)	16.62
Number of Outside Directors	9.91 (0.042)	10.02 (0.124)	9.90 (0.045)	0.69
Number of Inside Directors	2.67 (0.017)	2.61 (0.057)	2.68 (0.018)	-0.96
Female Director Ratio	0.10 (0.001)	0.15 (0.002)	0.09 (0.001)	18.10
Outside Director Ratio	0.78 (0.001)	0.79 (0.004)	0.78 (0.001)	1.87
Number of directorships held	1.65 (0.012)	1.85 (0.044)	1.63 (0.012)	4.06
n	8049	782	7267	

Notes: Means shown with standard errors in parentheses

Table 5: Descriptive Statistics for Outside Directors

	<u>All Outsiders</u>	<u>Female Outsiders</u>	<u>Male Outsiders</u>	<u>T-stat</u>
Gender (male=1)	0.88 (0.004)	0.00 (0.000)	1.00 (0.000)	
CEO (yes=1)	0.30 (0.006)	0.17 (0.014)	0.32 (0.006)	-7.28
Chair	0.34 (0.006)	0.11 (0.012)	0.37 (0.007)	-13.96
Top Manager	0.20 (0.005)	0.32 (0.017)	0.19 (0.005)	5.73
Non-TMT Business	0.02 (0.002)	0.05 (0.008)	0.02 (0.002)	3.07
Government	0.01 (0.001)	0.02 (0.005)	0.01 (0.001)	1.80
Military	0.00 (0.001)	0.00 (0.000)	0.00 (0.001)	-4.91
Education	0.05 (0.003)	0.11 (0.011)	0.04 (0.003)	4.54
Social Services/Non-profit	0.00 (0.000)	0.00 (0.002)	0.00 (0.000)	1.23
Professional Services	0.08 (0.003)	0.08 (0.010)	0.08 (0.004)	-0.17
Private Investor	0.01 (0.001)	0.01 (0.004)	0.01 (0.001)	-0.15
Number of Directors	12.64 (0.055)	12.61 (0.146)	12.65 (0.059)	-0.18
Number of Male Directors	11.39 (0.051)	10.80 (0.139)	11.47 (0.055)	-3.48
Number of Female Directors	1.25 (0.011)	1.81 (0.030)	1.17 (0.012)	15.18
Number of Outside Directors	10.15 (0.048)	10.09 (0.128)	10.15 (0.052)	-0.36
Number of Inside Directors	2.49 (0.019)	2.52 (0.058)	2.49 (0.020)	0.35
Female Director Ratio	0.10 (0.001)	0.15 (0.002)	0.09 (0.001)	16.81
Outside Director Ratio	0.80 (0.001)	0.80 (0.004)	0.80 (0.001)	-0.01
Number of directorships held	1.73 (0.014)	1.89 (0.046)	1.71 (0.015)	3.01
n	6240	739	5501	

Notes: Mean shown with standard error in parentheses

Table 6: Descriptive Statistics for Multiple Directorship Holders

	All Multiple Directorship Holders	Female Multiple Directorship Holders	Male Multiple Directorship Holders	T-stat
	Mean	Mean	Mean	
Gender (male=1)	0.88 (0.006)	0.00 (0.000)	1.00 (0.000)	
Insider (yes=1)	0.15 (0.007)	0.02 (0.008)	0.17 (0.007)	-9.52
CEO (yes=1)	0.45 (0.009)	0.20 (0.021)	0.48 (0.010)	-8.96
Chair	0.53 (0.009)	0.15 (0.019)	0.58 (0.010)	-14.64
Top Manager	0.21 (0.007)	0.33 (0.025)	0.19 (0.008)	4.36
Non-TMT Business	0.02 (0.002)	0.05 (0.011)	0.01 (0.002)	2.53
Government	0.00 (0.001)	0.01 (0.006)	0.00 (0.001)	1.16
Military	0.00 (0.001)	0.00 (0.000)	0.00 (0.001)	-2.00
Education	0.05 (0.004)	0.15 (0.019)	0.04 (0.004)	4.78
Social Services/Non-profit	0.00 (0.000)	0.00 (0.000)	0.00 (0.000)	
Professional Services	0.05 (0.004)	0.08 (0.014)	0.05 (0.004)	1.81
Private Investor	0.00 (0.001)	0.00 (0.000)	0.00 (0.001)	-3.32
Number of Directors	12.53 (0.069)	12.38 (0.175)	12.56 (0.075)	-0.72
Number of Male Directors	11.14 (0.064)	10.53 (0.168)	11.23 (0.069)	-2.93
Number of Female Directors	1.39 (0.017)	1.84 (0.043)	1.33 (0.018)	8.42
Number of Outside Directors	10.07 (0.061)	9.85 (0.155)	10.10 (0.066)	-1.12
Number of Inside Directors	2.47 (0.027)	2.53 (0.080)	2.46 (0.028)	0.64
Female Director Ratio	0.11 (0.001)	0.15 (0.004)	0.10 (0.001)	9.66
Outside Director Ratio	0.80 (0.002)	0.80 (0.005)	0.80 (0.002)	-0.90
Average number of directorships	2.77 (0.019)	2.89 (0.061)	2.76 (0.020)	1.65
n	2947	353	2594	

Notes: Means shown with standard errors in parentheses

Table 7: Pooled Regressions for 1998 and 2000

	Log Number of Female Directors					Percentage of Female Directors				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log board size	2.6390 *** (.200)	2.3911 *** (.211)	2.4541 *** (.221)	2.4153 *** (.221)	2.3729 *** (.211)	0.0299 *** (.006)	0.0231 *** (.008)	0.0209 ** (.009)	0.0191 ** (.009)	0.0224 ** (.008)
Log firm size	0.3720 *** (.055)	0.4247 *** (.061)	0.3572 *** (.063)	0.4022 *** (.062)	0.4199 *** (.061)	0.0134 *** (.002)	0.0163 *** (.002)	0.0144 *** (.002)	0.0162 *** (.002)	0.0161 *** (.002)
Asset intensity	-0.0591 *** (.017)	-0.0549 * (.029)	-0.0574 * (.030)	-0.0498 * (.030)	-0.0523 * (.029)	-0.0020 ** (.000)	-0.001 (.001)	-0.000 (.001)		-0.001 (.001)
5yr TSR			-0.0063 * (.003)					-0.0003 ** (.000)		
3yr TSR				-0.0044 * (.002)					-0.000 (.000)	
1yr TSR					-0.0016 (.001)					-0.0001 (.000)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
n	998	998	998	998	998	998	998	998	998	998
R-squared	0.255	0.329	0.324	0.324	0.329	0.086	0.177	0.178	0.174	0.177
Adj R-squared	0.252	0.290	0.282	0.283	0.289	0.082	0.129	0.126	0.124	0.128

Notes: Pooled OLS regression with robust standard errors. ExecuComp and Board data in 1998 and 2000

Year variable controls for 1998; Industry controls for 51 industries at the 2-digit SIC level

Coefficients show with standard errors in parentheses; ***=significant at .01 level, **=significant at .05 level, *=significant at .10 level

Table 8: Fixed and Random Effects Regressions

Method DV	Fixed Effects		Random Effects	
	Log Number Female Directors	Percentage of Female Directors	Log Number Female Directors	Percentage of Female Directors
	(1)	(2)	(3)	(4)
Log Board Size	1.686 *** (0.2137)	0.008 (0.0084)	2.117 *** (0.1737)	0.016 ** (0.007)
Log Revenue	0.186 (0.1490)	0.013 ** (0.0059)	0.386 *** (0.0639)	0.015 *** (0.0027)
Asset Intensity	-0.035 (0.0414)	-0.001 (0.0016)	-0.045 ** (0.0193)	-0.002 ** (0.0008)
n	998	998	998	998
g	499	499	499	499
R-squared within	0.121	0.014	0.120	0.014
R-squared between	0.276	0.082	0.272	0.086
R-squared overall	0.252	0.077	0.252	0.081
corr(u _i , X _b)	0.241	0.058	= 0 (assumed)	= 0 (assumed)
sigma _u	1.773	0.074	1.561	0.068
sigma _e	0.998	0.039	0.998	0.039
rho	0.759	0.777	0.710	0.748
F(u _i =0)	5.880	6.840		

Notes: Fixed and random effects, ExecuComp and Board data in 1998 and 2000

Coefficients show with standard errors in parentheses

****=significant at .01 level, **=significant at .05 level, *=significant at .10 level*

Table 9: Effects on Moderating Variables of Female Director Ratio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log board size	0.027 * (.014)	-0.158 ** (.070)	0.018 (.012)	0.042 ** (.016)	0.027 ** (.011)	-0.095 (.111)	0.026 ** (.011)	0.059 *** (.017)
Log firm size	0.017 *** (.003)	-0.004 (.020)	0.015 *** (.003)	0.010 * (.005)	0.013 *** (.003)	0.029 (.023)	0.013 *** (.003)	0.014 ** (.006)
Asset intensity	-0.001 (.001)	0.011 (.010)	-0.001 (.001)	-0.001 (.002)	-0.001 (.001)	-0.010 (.008)	-0.001 (.001)	-0.001 (.001)
Industry Discretion		-0.097 ** (.040)						
Discretion*Board Size		0.040 *** (.014)						
Discretion*Firm Size		0.004 (.004)						
Discretion*Asset Intensity		-0.002 (.001)						
CEO Tenure				0.004 (.004)				
Tenure*Board Size				-0.004 ** (.002)				
Tenure*Firm Size				0.001 (.000)				
Tenure*Asset Intensity				-0.000 (.000)				
Salary-to-Pay Ratio						-0.192 (.127)		
Variable Pay*Board Size						0.149 (.136)		
Variable Pay*Firm Size						-0.018 (.029)		
Variable Pay*Asset Intensity						0.013 (.012)		
Board Human Capital								0.016 (.007)
Board HC*Board Size								-0.007 (.002)
Board HC*Firm Size								0.000 (.000)
Board HC*Asset Intensity								0.000 (.000)
n	253	253	447	447	483	483	486	486
Adj R-squared	0.255	0.310	0.137	0.141	0.111	0.112	0.110	0.117
F-statistic (all new variables)		2.58		1.24		1.06		2.89
p-value (F-statistic)		0.0378		0.2933		0.3741		0.0221

Notes: Data from 1998 only; coefficients shown with standard errors in parentheses

Table 10: Effects on Moderating Variables of Log Number Females

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log board size	2.764 *** (.408)	-1.342 (2.06)	2.379 *** (.315)	2.941 *** (.428)	2.533 *** (.301)	-0.146 (2.85)	2.522 *** (.300)	2.823 *** (.461)
Log firm size	0.450 *** (.110)	-0.157 (.606)	0.412 *** (.091)	0.253 * (.132)	0.383 *** (.089)	0.671 (.603)	0.398 *** (.088)	0.464 *** (.171)
Asset intensity	-0.036 (.051)	0.076 (.300)	-0.039 (.040)	-0.021 (.055)	-0.045 (.039)	-0.293 (.222)	-0.039 (.039)	-0.028 (.050)
Industry Discretion		-2.686 ** (1.17)						
Discretion*Board Size		0.887 ** (.433)						
Discretion*Firm Size		0.121 (.120)						
Discretion*Asset Intensity		-0.020 (.058)						
CEO Tenure			0.026 (.123)					
Tenure*Board Size			-0.107 ** (.053)					
Tenure*Firm Size			0.028 * (.015)					
Tenure*Asset Intensity			-0.000 (.004)					
Salary-to-Pay Ratio						-3.130 (3.27)		
Variable Pay*Board Size						3.263 (3.48)		
Variable Pay*Firm Size						-0.564 (.743)		
Variable Pay*Asset Intensity						0.364 (.310)		
Board Human Capital							0.418 ** (.194)	
Board HC*Board Size							-0.104 (.070)	
Board HC*Firm Size							-0.012 (.017)	
Board HC*Asset Intensity							-0.002 (.004)	
Number of obs	253	253	447	447	483	483	486	486
Adj R-squared	0.371	0.388	0.300	0.304	0.279	0.279	0.280	0.284
F-statistic (all new variables)		2.13		1.21		1.52		3.32
p-value (F-statistic)		0.0776		0.304		0.1938		0.0107

Notes: Data from 1998 only; coefficients shown with standard errors in parentheses

Table 11: Director Pay

	Pooled Cross-Section	Fixed Effects
Log board size	0.006 (0.053)	-0.005 (0.045)
Log revenue	.152 *** (0.014)	.158 *** (0.030)
Log number female directors	-0.012 (0.007)	0.010 (0.0087)
Asset intensity	0.007 (0.006)	.020 *** (0.007)
Year	Yes	No
Industry	Yes	No
n	998	998
Number of firms		499
R-squared	0.263	
Adj R-squared	0.217	
R-squared within		0.072
R-squared between		0.117
R-squared overall		0.115
corr(u i, Xb)		-0.061

*Notes: Pooled OLS regression, Fixed and random effects
ExecuComp and Board data from 1998 and 2000
Coefficients shown with standard errors in parentheses*

Figure 1: Plot of Female Director Percentage in 1998 and 2000

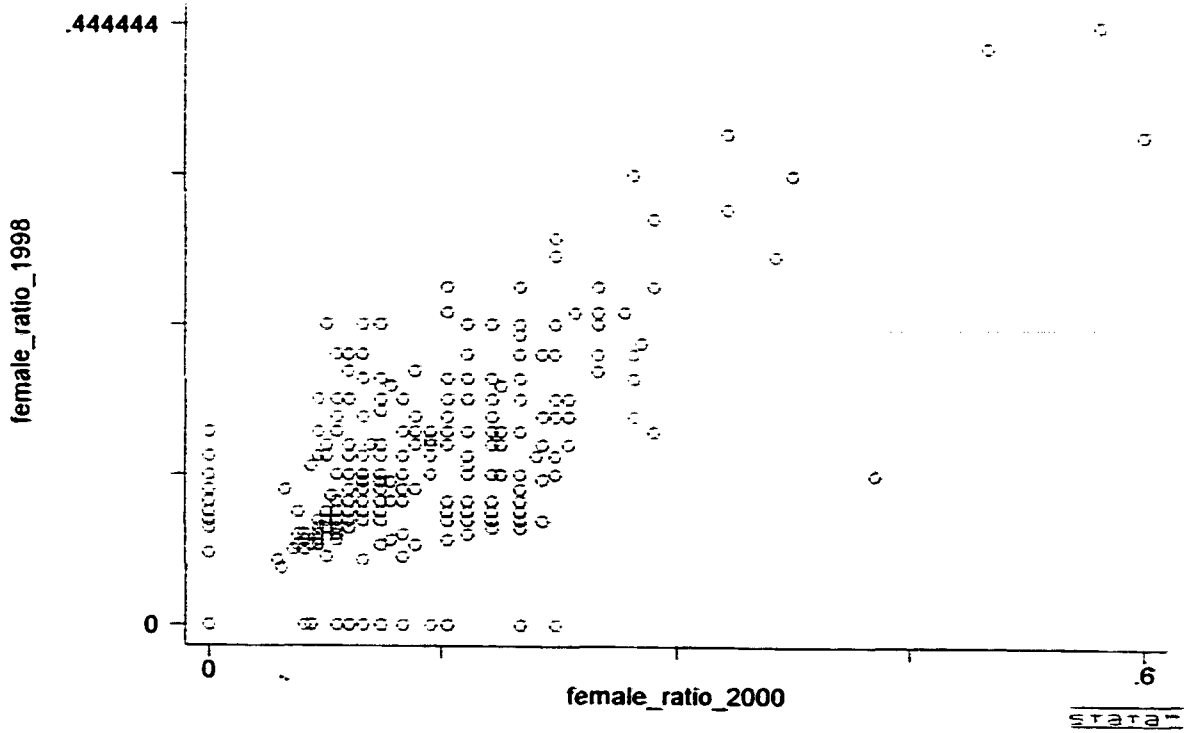
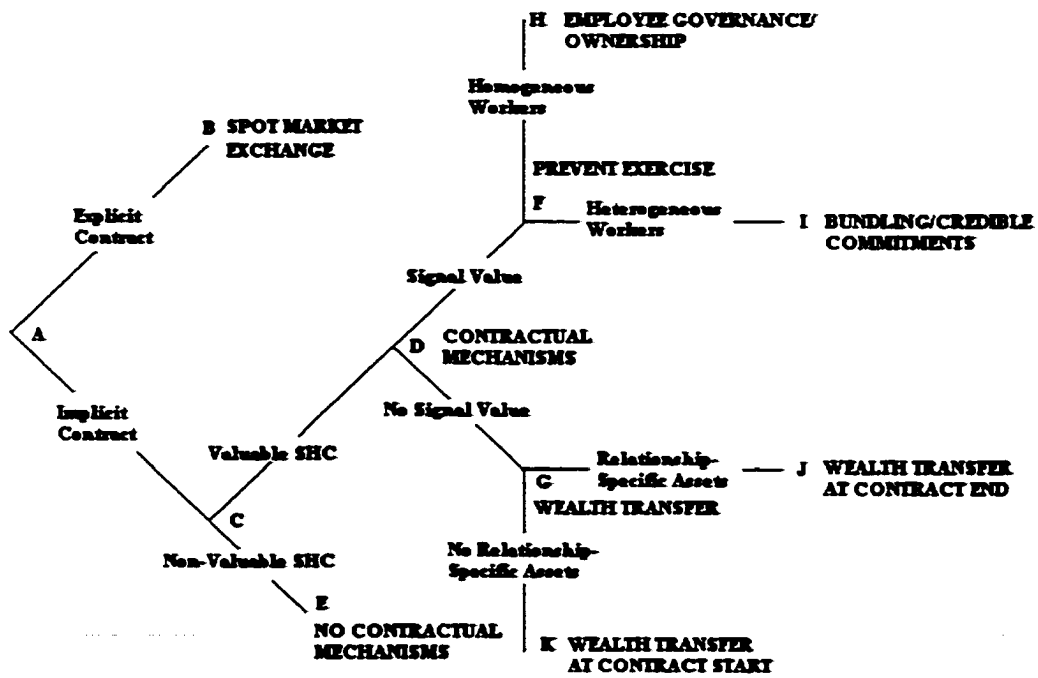


Figure 3: Mechanisms to solve underinvestment

Other Relationship- Specific Assets	Low	<p>WEALTH TRANSFER UPON EXERCISE (Low signal value, low relationship-specific assets)</p> <p>Company agrees to pay workers severance, early retirement, separation bonus, golden parachute, golden handshake, or some other form of reimbursement</p> <p>Workers agree to give up pension, seniority, invested equity and stock options, and other benefits or agree to non-complete agreements that compensate the firm</p>	<p>BUNDLING (High signal value, low homogeneity)</p> <p>Company designs a human resource management or production system around the worker's specific human capital, such as in high performance work systems or commitment-based systems.</p> <p>Workers make multiple specific investments, including human capital, signaling, information, and related sunk costs</p>	Low	Worker Homogeneity
	High	<p>WEALTH TRANSFER ON INVESTMENT (Low signal value, high relationship-specific assets)</p> <p>Company finances the specific human capital investment or offers a signing bonus</p> <p>Workers accept lower wages during the training period</p>	<p>EMPLOYEE GOVERNANCE (High signal value, high homogeneity)</p> <p>Company allows employees a voice in high-level corporate decisions that directly or indirectly affect future payments for specific human capital investments through seats on the board, a workers council or employee ownership</p> <p>Workers cannot have this option; company already has complete residual decision rights</p>	High	
		Low	High		
Signal Value of Specific Human Capital Investment					

FIGURE 4: Decision path for parties investing in specific human capital



VITA

Todd William Fister was born in Cincinnati, Ohio on July 12, 1974. He graduated from Miami University in Oxford, Ohio in 1996 with a bachelors degree in economics and history and from the University of Illinois at Urbana-Champaign in 2001 with a masters degree in human resources and industrial relations. He worked at Procter & Gamble before pursuing graduate studies in labor and industrial relations. He will join Skidmore College as an assistant professor of management and business in fall 2003.