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OWNERSHIP STRUCTURES AND R&D INVESTMENTS OF U.S. AND JAPANESE FIRMS: AGENCY AND STEWARDSHIP PERSPECTIVES

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This study analyzes the impact of ownership structure on R&D investments in the United States and Japan. It begins with the premise that U.S. and Japanese firms have distinct patterns of ownership that may result in disparities in R&D investments. Agency theory and stewardship theory are used to hypothesize about the relationship between ownership and R&D investments. Empirical evidence shows that the level of ownership concentration, and its impact, differ across countries. We argue that these differences result from a mixture of motives and incentives.

> With communism laid to rest . . . it has become fashionable to talk of numerous capitalist "models"—the American model . . . in which firms feed on a huge and liquid stock market; the Japanese one, in which groups of firms and banks are bound together through complex webs of crossholdings.
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> *The Economist,* October 8, 1994: 82

Agency theorists have long argued that differences in ownership structure are crucial to understanding the resolution and the outcomes of principal-agent problems in modern corporations (e.g., Jensen & Meckling, 1976). Recent research has demonstrated that agency assumptions, which address possible disparity between the interests of the owners and managers of corporations, only fit particular contexts and may be contingent on competitive factors (Boyd, 1994, 1995). For example, Lane, Cannella, and Lubatkin (1998) suggested that the predictions of agency theory are unsupported in instances when managerial interests do not clearly conflict with those of stakeholders. Similarly, we argue that the differences between the ownership structures of relationship-oriented Japanese firms and market-based U.S. firms (Kaplan, 1997; Porter, 1992; Prowse, 1994) may also limit the generalizability of agency theory. In the United States, the separation of ownership from control and the presence of atomistic shareholders have induced conflicts of interests between managers and shareholders (Berle & Means, 1932). In contrast, the ownership structure of a Japanese firm is often a manifestation of existing cooperative links with suppliers, members of the *keiretsu* (business group) with which the firm is affiliated, or debt holders; consequently, the conflict of interests between managers and shareholders tends to diminish with the ties that bind managers and shareholders (Aoki, Patrick, & Sheard, 1994; Kester, 1991).

Stewardship theory offers an alternative perspective (Davis, Schoorman, & Donaldson, 1997; Fox & Hamilton, 1994); its key argument is that the interests of managers may be aligned with those of owners. If this is true, then governance devices adopted on the basis of agency-theoretic prescriptions may be redundant (at best) and inefficient (Barney & Hansen, 1994). In other words, what works well to control or motivate an opportunistic manager may not work well to control or motivate a steward. In some instances, agency-based prescriptions applied to stewards may have no material impact on performance outcomes. In other instances, though, misapplied agency-theory-derived prescriptions, such as increased levels of managerial ownership, might lead to a misallocation of resources in a firm. That is, increased levels of management ownership may decrease the levels of R&D (Jensen, 1989a) and, in turn, decrease the long-run value of a firm (David, Hitt, & Gimeno, 2001). Furthermore, it is possible that classic agency assumptions are specific to Anglo-American contexts (Phan & Yoshikawa, 2000).

This study examined the relationship between the ownership structures and R&D investments of U.S. and Japanese firms. In doing so, we extended and tested the applicability of both agency and stewardship theory in this particular context. From

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an agency theory perspective, the extent of a firm's investment in R&D is a decision that is subject to potential manager-shareholder conflicts (Baysinger, Kosnik, & Turk, 1991). Indeed, empirical studies of U.S. firms have found that stock concentration and institutional ownership are linked to R&D investments (Graves, 1988; Hansen & Hill, 1991). Furthermore, R&D investments have become increasingly important in a knowledge-based economy (Badaracco, 1991). Nonetheless, empirical evidence on the effects of ownership structure in cross-national settings is sparse. The following sections review the importance of and the characteristics of R&D investments and develop hypotheses based on agency-theoretic and stewardship-theoretic arguments.

THEORETICAL REVIEW

Ownership "represents a source of power that can be used to either support or oppose management depending on how it is concentrated and used" (Salancik & Pfeffer, 1980: 655). Consequently, it has important strategic implications for takeover resistance, R&D investments, and the long- or short-term orientation of managers (Hill & Snell, 1989; Williamson, 1964). The influence of ownership structure is often studied in the context of agency theory.

Agency theory has its foundations in the seminal work of Berle and Means (1932). Berle and Means (1932) introduced the concept of the separation of owners and managers as a central aspect of the American corporate governance system. This separation has been touted as efficient by financial economists and business historians who view managers as the principal drivers of American industry (Chandler, 1962). In particular, this separation allows shareholders to efficiently diversify their portfolios, thereby specializing in risk bearing, and allows managers, who may lack resources for ownership, to specialize in managing.

Although the separation of ownership from control has many benefits, it also has a number of costs associated with it. Prominent among these costs are agency problems, which are frequently manifested in opportunistic behavior by managers and excessive consumption of perks (Jensen, 1989a, 1989b). Agency problems exist because principals (shareholders) and agents (managers) have differing risk preferences, are boundedly rational, and have conflicting interests (Eisenhardt, 1989; Holstrom, 1979). Furthermore, as ownership disperses, the incentive to exercise ownership rights disperses, a pattern resulting in "strong managers and weak owners" (Roe, 1994; Walsh & Seward, 1990). Thus, U.S. managers are typically monitored through mechanisms such as the market for corporate control, active investors, and boards of directors; small atomistic shareholders play a minimal role in monitoring managers.

In Japan, ownership is concentrated, relationship-based, and relatively illiquid (Aoki et al., 1995; Kaplan, 1997). Japanese managers are monitored by banks, large shareholders, and intercorporate relationships. For example, Japanese "main banks" play a central role in initiating top management turnover and appointments (Kang & Shivdasani, 1995; Kaplan, 1994; Kaplan & Minton, 1994) and influence the investment process, even for companies that are not in distress (Hoshi, Kashyap, & Scharfstein, 1991). These banks tend to be well-informed about firms' prospects (Aoki et al., 1995; Kester, 1991). Perhaps the sharpest distinction between U.S. and Japanese ownership structures is that shareholders of Japanese firms tend to be well-informed and active in important firm decisions. This particular difference is likely to influence managerial behavior, particularly investment decisions.

Stewardship Theory: The United States versus Japan

The ownership differences described above may diminish the explanatory power of agency theory in a Japanese context. Davis, Schoorman, and Donaldson's (1997) stewardship theory offers an alternative perspective. In their words, "stewardship theory defines situations in which managers are not motivated by individual goals, but rather are stewards whose motives are aligned with the objectives of their principals" (1997: 21). Unlike agency theory, stewardship theory rests on the assumption that the goals of managers and shareholders are aligned. To date, the theory has been subject to a limited number of direct and indirect tests (Fox & Hamilton, 1994). Lane, Cannella, and Lubatkin commented that "stewardship theory may prove to be an insightful perspective for corporate governance research" (1998: 574).

As Weick (1979) noted, no theory is accurate in all contexts. A corollary principle might be that any good theory can be accurate in some contexts. Thus, an important question is, What governance contexts and relationships are better explained by stewardship theory than by agency theory? In deriving their theory, Davis and his coauthors (1997) provided psychological and situational clues about "steward-rich" empirical contexts. In describing the psychological underpinnings of stewardship theory, they asserted that a steward will engage in pro-organizational, collectivist behaviors, gaining

more satisfaction from serving the group than from serving him- or herself. Further, these behaviors will be preferred to alternative, self-interested behaviors. This form of group-directed behavior can occur under two conditions.

The first condition occurs when an actor's motivational scheme is based on intrinsic and intangible rewards. This may occur, for example, among individuals who are self-actualizing (Maslow, 1970) or who are self-leaders (Manz, 1990). The second condition occurs when individuals have high levels of organizational identification (Mael & Ashforth, 1992). The effects of organizational commitment or value commitment (Mayer & Schoorman, 1992) are similar: managers who identify with an organization and accept its values will not experience goal conflict with that organization.

In describing the situational underpinnings of stewardship theory, Davis and his coauthors (1997) noted that national culture is an important determinant of steward behavior. They focused on two measures of national culture, drawn from Hofstede's (1980, 1991) work: individualism/collectivism and power distance. In collectivist cultures, in which group interests are valued above those of individuals, managers act on the basis of long-term relationships and have high levels of trust. In high-power-distance cultures, in which individuals cede power to the incumbents of superior positions, managers accept the roles implied by hierarchy and are less likely to act in ways that induce conflict with principals. Japan, in contrast to the United States, is a high-power-distance, collectivist culture (Hofstede, 1980, 1991). As Davis and his colleagues noted, "We might expect that members of a collectivist culture would . . . establish an organizational structure that is conducive to the development of stewardship relationships" (1997: 36).

Studies have revealed differences between the U.S. and Japanese cultures (Davis et al., 1997; Hofstede, 1980, 1991). Specifically, Japan has proportionately more instances of lifetime employment, lower levels of individualism, and higher levels of power distance than the United States (Davis et al., 1997; Hofstede, 1980, 1991). These factors point to a higher incidence of steward forms of relationship in Japan.

The net impact on behavior is a function of the incidence of goal conflict and the power of the market for corporate control as well as the influence of owners, particularly blockholders (owners of 5 percent or more of a firm's equity). Researchers in both finance and strategy have pointed to the importance of blockholders in influencing important firm-level decisions such as mergers and restructuring (Demsetz, 1983; Lane et al., 1998; Shleifer & Vishny, 1986; Walsh & Seward, 1990). In our study, we add to this stream of research by comparing the influence of blockholders in two unique situational environments that might be respectively characterized as an agency environment (the United States) and a stewardship environment (Japan).

The Link between Ownership Structure and R&D Investments

R&D expenditures are specific types of *investments,* in that their outcomes are neither immediate nor certain. Indeed, R&D expenditures may not result in any payoff (they may be entirely unproductive) or may translate into profits only after many years. As Lippman and Rumelt stated, knowledge creation involves "irreducible ex ante uncertainty" (1982: 418). This uncertainty may make it difficult for investors to know the value of R&D expenditures. Nonetheless, investment in R&D is crucial for both the survival and growth of firms, particularly in sectors such as pharmaceuticals and technology. Therefore, decisions regarding the magnitude and allocation of R&D expenditures are extremely important for corporations. Such decisions are at the discretion of management.

Several researchers have argued that the expectations of investors, their concern with stock prices, and their holding periods can affect R&D investments. Shorter horizons for stockholders can lead to shorter horizons for managers, perhaps causing managers to forgo R&D investments (Froot, Perold, & Stein, 1992). More formally, Stein (1988, 1989) developed a model that links investor behavior to R&D investments. He identified two primary determinants of reduced R&D investments: takeover pressures and the behavior or beliefs of investors. The short-term behavior of shareholders can pressure managers to overemphasize current bottom-line earnings. For example, profit-conscious investors may become distressed by low earnings reports (inversely related to the level of R&D investments) and try to sell their stocks. If many investors sell their stocks at the announcement of low quarterly earnings, the value of a firm declines. In this way, the behavior of investors is directly related to the short-term pressures that managers face and may influence their long-term investment decisions.

An underlying assumption of Stein's model is that information asymmetry exists between investors and managers. Information asymmetry arises from the inability of managers to convey information about their firm and from the reluctance of investors to gather information about firm activities. The more information a shareholder has (that

is, information asymmetry is reduced), the easier it is for that investor to value R&D investments. Thus, the larger the presence of "information-intensive" shareholders, the lower the likelihood that managers will be subject to short-term pressures.

The nature of information on R&D investments exacerbates the information gap (Myers, 1984). Announcing R&D projects may provide an important signal to competitors (Bhattacharya & Ritter, 1983); conveying details of R&D programs may put firms at a competitive disadvantage. Thus, managers may release few or no details about R&D initiatives and may even forbear to announce them. This "lack of communication prevents investors from understanding management's long-term goals and objectives. Because most U.S. investors are detached from the business they fund, they rely on outward manifestations of what is really going within a company, namely quarterly earnings" (Jacobs, 1991: 10).

Communication between investors and managers can reduce managerial pressures to produce short-term profits. For example, if investors were aware that a drop in quarterly earnings was the consequence of productive investments in R&D, then these investors might not be so quick to sell their shares. Consistent with that idea is Bebchuk and Stole's (1993) finding that when investors lacked information about long-run projects, underinvestment was induced; on the other hand, when investors were aware of an investment, but not its productivity (in the case of R&D investment), overinvestment occurred. Thus, it is important to distinguish investors with access to information from those who lack such access.

Large shareholders have incentives to obtain more detailed information and reduce information asymmetry. Large shareholders (or blockholders) have more at stake and, hence, a greater incentive to gather information about firm investments. Furthermore, concentrated ownership creates liquidity problems for shareholders: large shareholders cannot sell large holdings in a company without significantly lowering the price of its stock. This creates a mutual dependence. Investors depend on managers to create value and profits, while managers depend on investors' evaluations of a firm. This mutual dependence creates a long-term relationship between investors and managers and increases investors' incentives to reduce information asymmetry. Not surprisingly, studies have shown a positive relationship between the level of stock concentration and R&D investments for U.S. firms (e.g., Hansen & Hill, 1991; Hill & Snell, 1988). In contrast, in an environment where managers' and owners' interests are already aligned (that is, where owners are stewards), the influence of blockholders should be inconsequential for R&D investment. Thus,

Hypothesis 1a. Stock concentration is positively related to investments in R&D in the United States.

Hypothesis 1b. Stock concentration is unrelated to investments in R&D in Japan.

The type of relationship that exists between investors and managers can also affect information asymmetry. In the United States, managers may want to divorce ownership from control of firm activities completely, so that access to capital comes with few or no obligations to shareholders. Shareholders tend to hold diverse portfolios, so keeping up with specific business activities is often difficult (Jacobs, 1991). Therefore, the atomistic ownership structure of U.S. firms exacerbates the information asymmetry between investors and managers. Given little information, investors may interpret reduced current earnings resulting from an increase in R&D expenditures negatively because they cannot distinguish between profitable and nonprofitable R&D investments. Hence, the ownership structure of U.S. firms appears to exacerbate the information asymmetry between investors and managers and contributes to the short-term pressures that managers face.

In contrast, Japanese firms have relied on a main bank system for equity and debt. The main bank system refers to "a system of corporate financing and governance involving an informal set of practices, institutional arrangements, and behaviors among industrial and commercial firms, banks of various types, other financial institutions, and the regulatory authorities" (Aoki et al., 1995: 3). In this system, the main bank plays an important role in monitoring firms and intervening in their management, as necessary (Sheard, 1994).

Another striking feature of Japanese firms is the prevalence of interlocking shareholdings. A typical listed firm in Japan has extensive shareholdings with transaction partners, including banks, insurance companies, suppliers, and affiliated firms (Sheard, 1994). These owners supply capital, monitor management, and have more information available to them than do the shareholders of U.S. firms. They enhance an already large base of patient capital (that is, investment by investors with a long-term perspective), thereby allowing managers to take a long-term view of investments by insulating them from hostile takeovers and short-term stock price volatility (Abegglen & Stalk, 1985).

Hypothesis 2a. On the average, Japanese firms have a more concentrated ownership structure than their U.S. counterparts.

Three important features arise from concentrated ownership by banks, affiliated firms, and cross-shareholding. First, the relationship between banks and their clients consists of an ownership of both debt and equity, resulting in economies of information gathering and sharing. Second, this relationship is ongoing (James, 1987). Third, concentrated ownership reduces information gaps. In general, these features combine to create a more concentrated ownership structure and to reduce information asymmetry. As a result, there is less pressure on managers to reduce R&D.

Hypothesis 2b. On the average, Japanese firms invest more in R&D than their U.S. counterparts.

Hypotheses 1a and 1b represent incentive alignment arguments, suggesting that the relationship between owner concentration and R&D investments is driven by the influence of concentration on goal alignment. Thus, these hypotheses state that concentration will increase R&D investments in the U.S. environment, an agency context, and will not increase R&D intensity in Japan, a stewardship context. Hypotheses 2a and 2b, building on an information alignment perspective, suggest that R&D investments will be higher in Japan. In fact, concentration can have a positive impact on both incentive and information alignment. Our hypotheses build on the assumptions that both issues are important in the United States but that only information would be relevant in Japan.

In addition to the primary considerations discussed above, a number of other factors may influence R&D investments. Firm size may be positively related to R&D investments because of economies of scale and scope. Debt can be negatively related to R&D investments if it prevents firms from raising necessary funds (Long & Ravenscraft, 1993; Myers, 1977) or curtails overinvestment owing to agency problems between managers and shareholders (Jensen, 1989a). Larger investment opportunities are likely to induce managers to invest more in R&D. Finally, how well firms are able to internalize the benefits of R&D efforts and produce new products (Doukas & Switzer, 1992) can influence R&D investment. This ability is referred to as appropriability. Levin (1988) and Levin, Klevorick, Nelson, and Winter (1987) found that appropriability conditions vary primarily by industry. In addition, industry demands and competition may influence the level of R&D investments (Ito & Pucik, 1993). For example, one might expect that firms in highly competitive industries, such as the semiconductor industry, will need to invest in R&D in order to stay abreast of technological change. All of the above factors served as controls in our empirical methods.

DATA AND METHODOLOGY

Sample

The sample consisted of all U.S. and Japanese firms publicly traded in 1995 in seven different industries: automotive, chemicals, communication, computers, electronics, pharmaceuticals, and power. Examining multiple industries enhances the validity and generalizability of results. For the U.S. sample, we identified industries using two-digit primary SIC codes. Industries for the Japanese firms were categorized according to the *Japan Company Handbook (JCH).* The U.S. sample included 1,044 firms representing all seven industries; the Japanese sample consisted of 270 firms in six of the industries, because firms that compete in the Japanese computer industry are usually placed in the electronics industry.

Differences in Accounting Systems

Since many of the variables used in the empirical tests reported below rely on financial statement data, it is important to describe national differences in accounting systems. Choi and Mueller (1984) identified two broad classifications of accounting systems: those that developed from the Anglo-British tradition (like the U.S. system), and those that developed from the Franco-European tradition (like the Japanese system). The former emphasizes a firm's need to report the numbers to its owners, and the latter is based on the reporting of uniform and comparable numbers within a country.

One primary difference between U.S. and Japanese accounting standards is the way R&D investments are reported. In the United States, firms are required to expense investments in R&D in each period. Japanese firms, in contrast, are allowed to capitalize R&D expenditures; once they have been capitalized, the Japanese government and its sanctioned financial agencies require costs to be amortized over a period not exceeding five years, with at least one-fifth in each accounting period (KPMG, 1989: 5). In other words, Japanese firms *may* report only a fifth of their total expenditures, which would allow them to show higher profits in their financial statements. Dellmann (1983: 948), however, reported that Japanese companies prefer to write off such expenditures as incurred. Moreover, the Japanese firms in this sample are subject to

standards set by the Ministry of Finance, by securities and exchange law, and by the Business Accounting Deliberating Council, thereby ensuring the consistent reporting necessary for within-country comparisons.

In an attempt to produce empirical comparisons, accounting researchers (e.g., Bhagat & Welch, 1995) have recognized differences and limitations of cross-country comparisons and provided guidelines for comparability. There were several reasons to assume that the difference in Japanese and U.S. accounting standards would not bias results. The first is Bhagat and Welch's argument that "one can tolerate differences in accounting procedures . . . basic accounting principles and intents are similar in all OECD countries. Consequently, differences produced by accounting variations among the basic set of variations and countries considered are unlikely to be first order effects" (1995: 450). Second, the *Japan Company Handbook* presents the most reliable R&D numbers (see Hall & Weinstein, 1996) and reports the actual figures that have been expensed in each previous term (Toyo Keizai, 1996: 62). Third, we used accounting data from the Global Vantage databases for robustness checks. The Global Vantage database is collected according to *standardized* definitions researched and written jointly by Standard & Poor's COMPUSTAT Services and Extel Financial Ltd. To ensure consistency across different industries and different countries, we only report data when the same reporting convention was applied across firms. In other words, if a Japanese firm's R&D expenditures were not comparable to U.S. firms', we do not report them. The R&D numbers from the two databases are comparable, with a correlation of .98. Fourth, to the extent that Japanese firms underreport R&D investments, this reporting bias works against the results documented in this study. Finally, we conducted separate regression analyses for each country to test the hypotheses; we estimated a pooled sample to test the potential difference between the two samples by examining the country dummy variable, not to interpret other pooled coefficients.

Measures and Data Sources

Variables. We used the ratio of R&D investment—to sales in 1995 to measure *R&D investments.* For the U.S. sample, these data come from COMPUSTAT. For the Japanese sample, these data come from the *JCH.*

Stock concentration was measured as the total percentage of stock held by shareholders (e.g., Hill & Snell, 1988, 1989) that owned at least 3 percent of a firm's stock for both U.S. and Japanese firms. We used 3 percent to capture the influence of large owners, including pension funds, which customarily hold less than 5 percent of a single firm's stock. U.S. ownership data came from Compact Disclosure. Japanese ownership data come from the *JCH,* which provides information on the identity and ownership position of each "major" shareholder. Major shareholders are defined by the handbook as those "who wield a strong influence in company decisions" (Toyo Keizai, 1996: 58). A dummy variable for country was coded 1 for Japanese firms and 0 for U.S. firms.

Control variables. We also used a number of control variables to account for alternative determinants of R&D. These included firm size, industry dummies, leverage, and investment opportunity. For the United States, accounting data came from COMPUSTAT. For Japan, data came from the *JCH.*

Firm size was measured as the book value of assets. Since total assets are highly skewed when a cross-section is taken, we used a logarithmic transformation. *Leverage* was measured as the book value of debt divided by total assets. Following Cho (1998), we measured *investment opportunities* using the market-to-book ratio, calculating it as the market value of equity at the end of a year plus the book value of debt divided by the book value of total assets. We used two-digit SIC codes to code the *industries* of U.S. firms and the *JCH* to classify the Japanese firms into industries.

To test Hypotheses 1 and 2, we regressed the R&D-to-sales ratio on firm size, leverage, the market-to-book ratio, the industry dummies, and stock concentration for each country subsample and for a pooled sample. Although we suggest a positive causal relationship between stock concentration and R&D investments, an equally persuasive argument can be made for reverse causality. For example, one may argue that particular types of investors may be attracted to firms with high R&D investments (rather than encouraging R&D investments). This endogeneity between ownership concentration and the R&D-to-sales ratio may result in inconsistent ordinary least squares (OLS) estimates (Cho, 1998). We used a two-stage least squares (2SLS) estimation procedure to resolve this causality issue. Specifically, the procedure requires estimation of first-stage and second-stage regressions. In the first-stage regression, values predicted (via OLS) for the endogenous regressor using all exogenous variables are estimated. In the second-stage regression, these predicted values are used instead of the endogenous regressor (Greene, 1997). Here, firm size (the logarithm of total assets), the lagged value of leverage, the industry dummies, and the market-to-

book ratio were used as exogenous variables. We used the lagged value of leverage to control for the possibility that leverage may also be endogenously determined (Cho, 1998). Having a country dummy in the pooled regression allowed for a test of differences between the U.S. and Japanese samples.

Finally, the pooled regression results might be driven by the larger U.S. sample. For a robustness check, we also estimated a weighted least squares model in which the weight of the U.S. sample was the inverse of the number of U.S. firms in the industry multiplied by the number of firms for the same industry in the Japanese sample. This weighting scheme placed U.S. and Japanese firms on an equal footing in terms of their weight in the regression equations. One must be cautious in interpreting the pooled results, however, because the purpose of pooling the results was to test potential differences between the two samples by examining the country dummy variable, not to interpret other pooled coefficients. In the interest of brevity, we do not report results from the weighted least squares regression; the results are similar to those for the 2SLS regressions reported in Table 3.

RESULTS

Descriptive Statistics

Table 1 shows the means and medians of firm R&D expenditures, the R&D sales ratio, and size (as measured by assets) by industry for the U.S. and Japanese samples.

Table 1 suggests that there are a sufficient number of firms in each industry subsample to allow us to pick up industry effects; this is important for the regression estimates since industry effects are significant determinants of R&D investments. It is worth noting that the firms in the U.S. and Japanese samples represented all of the publicly traded firms in these industries; sampling variation due to data constraints was small.

R&D investments are reported in millions of U.S. dollars, and yen are converted at end-of-1995 ex-

TABLE 1
Characteristics of U.S. and Japanese Firms by Industry

	United States		Japan	
Industry	**Mean**	**Median *(n)***	**Mean**	**Median *(n)***
R&D investments				
Automotive	150.66	1.56 (150)	175.95	44.49 (36)
Chemical	55.29	3.28 (156)	53.59	21.55 (87)
Communication	31.36	0.00 (200)	270.92	59.29 (12)
Computer	88.59	4.51 (166)		
Electronic	41.14	2.58 (494)	210.09	28.09 (115)
Pharmaceutical	154.59	4.56 (129)	109.38	59.86 (32)
Power	15.88	0.00 (289)	612.01	89.67 (12)
Total	61.27	0.73 (1,584)	167.53	34.12 (294)
R&D/sales				
Automotive	0.02	0.01 (150)	0.04	0.04 (36)
Chemical	0.04	0.03 (156)	0.05	0.05 (87)
Communication	0.01	0.00 (200)	0.10	0.04 (12)
Computer	0.11	0.08 (166)		
Electronic	0.09	0.05 (494)	0.06	0.05 (115)
Pharmaceutical	0.25	0.10 (129)	0.11	0.11 (32)
Power	0.00	0.00 (289)	0.04	0.01 (12)
Total	0.06	0.01 (1,584)	0.06	0.05 (294)
Assets				
Automotive	4,517.03	209.81 (150)	4,980.65	1,336.67 (36)
Chemical	2,193.56	292.88 (156)	2,049.60	765.17 (87)
Communication	3,456.23	386.68 (200)	10,770.57	1,604.61 (12)
Computer	1,133.58	46.59 (166)		
Electronic	971.70	55.83 (494)	4,333.45	840.62 (115)
Pharmaceutical	1,787.34	46.54 (129)	1,853.86	1,092.61 (32)
Power	2,589.28	110.94 (289)	27,995.03	16,636.03 (12)
Total	2,119.99	91.66 (1,584)	4,695.50	1,006.33 (294)

change rates. The table shows that there is substantial variation across both industry and country. Means and medians differ discernibly, implying that R&D investments are skewed. This result is not surprising, because these numbers do not control for firm size. Hence, this table also presents univariate statistics on the R&D-to-sales ratio for the sample of firms. As expected, the R&D-to-sales ratios are much less skewed; the mean figures do not differ substantially from the median. Second, it appears that the R&D-to-sales ratio is the same (0.06) for both samples. Thus, at an aggregate level, it does not appear that firms in one country spend more on R&D than firms in the other country.

Table 1 also reports total assets for the sample firms by industry. On average, the Japanese firms were larger than U.S. firms. These size differences may be attributable to data collection issues. Specifically, data on large Japanese firms are easier to obtain. It is unlikely, however, that these size differences significantly affected the results for two reasons. First, large firms are also represented in the U.S. sample. Second, we explicitly controlled for firm size in the regressions.

Table 2 presents the correlation coefficients of independent and dependent variables. For the U.S. sample, stock concentration is negatively (−0.31) correlated with firm size (the logarithm of assets). Multicollinearity, though, should not be a problem because while some of the correlations are statistically significant, their magnitudes are not large.

Regression Results

Stock concentration and R&D investments. Hypothesis 1a states that stock concentration will be positively related to investments in R&D in the United States; Hypothesis 1b asserts that there will be no relationship in Japan. Hypotheses 2a and 2b state that ownership will be more concentrated and R&D investments will be higher in Japan. To test these hypotheses, we estimated regression equations with the R&D-to-sales ratio as a dependent variable for each country sample and the pooled sample. The independent variables in these regressions were assets (the measure of firm size), leverage, the market-to-book ratio, industry dummies, and stock concentration. The first four variables were control variables; stock concentration was the primary variable of interest. The automotive industry was the referent category in each of the regressions. Table 3 presents the first- and second-stage results of the 2SLS regressions for the U.S., Japanese, and pooled samples. The sample sizes are slightly smaller than those on which the results presented in Table 2 were based because data on control variables were not available for some firms. Table 3 also shows estimates obtained via "benchmark OLS" regression; these analyses were identical to the second-stage regression but have the stock concentration variable omitted. This omission allows statistics (adjusted R^2s) to be compared for the benchmark OLS regression and the second-stage regression to determine the marginal contribution of stock concentration.

U.S. sample. Consistent with Hypothesis 1, the 2SLS regression shows a significant, positive relationship between stock concentration and the R&D-to-sales ratio. The 0.13 ($p < .001$) coefficient suggests that a 10 percent increase in ownership is related to a 0.01 increase in the R&D-to-sales ratio; with an average R&D-to-sales ratio of 0.06 for many firms, this corresponds to a 22.17 percent change in the R&D-to-sales ratio. The addition of the variable for stock concentration results in a significant increase in variance explained (adjusted R^2 = .19, benchmark, and .22, second-stage). Firms in the computer, electronics, and pharmaceutical industries invested significantly more in R&D than firms in the automotive industry.

Japanese sample. For the Japanese sample, the leverage ratio was not included as an independent

TABLE 2
Pearson Correlation Coefficients for U.S. and Japanese Firms[a]

Variable	1	2	3	4	5
1. Firm size		*.17****	*−.17****	*.26****	*−.31****
2. Market-to-book ratio	−.37***		*.19****	*−.01*	*−.08**
3. R&D-to-sales ratio	.05	.07		*−.20****	*−.02*
4. Leverage	.08	.05	−.18**		*.01*
5. Stock concentration	.06	.01	.04	−.08	

[a] The correlation matrix for the U.S. sample is shown on the upper right (in italic), and the matrix for the Japanese sample is on the bottom left.

* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 3
Results of Regression Analyses of R&D/Sales on Industry and Stock Concentration[a, b]

Variable	United States			Japan			Pooled		
	1st Stage	2nd Stage	Benchmark OLS	1st Stage	2nd Stage	Benchmark OLS	1st Stage	2nd Stage	Benchmark OLS
Intercept	0.67***	−0.08***	−0.01	0.36***	−0.16	0.04***	0.61***	−0.05	0.02***
Firm size	−0.04***			0.01			−0.02***		
Leverage	0.05								
Market-to-book ratio	−0.00	0.02***	0.01***	0.04*	−0.02		−0.02***	0.02***	
Industry									
Chemical	−0.02	0.01	0.01	−0.11***	0.06	0.01	−0.04	−0.01	−0.01
Communication	0.04	−0.01	−0.01	−0.03	0.07***	0.06***	0.02	−0.03	−0.03**
Computer	−0.05	0.07***	0.06***				−0.06		0.03***
Electronics	−0.07	0.07***	0.06***	−0.10	0.06	0.02	−0.06**	0.03***	
Pharmaceutical	−0.08	0.15***	0.15***	−0.13	0.13**	0.07	−0.07**	0.10***	0.10***
Power	−0.04	−0.01	−0.02	−0.28	0.11	0.00	−0.07**	−0.04***	−0.05***
Stock concentration[c]		0.13***			0.42			0.13*	
Japan								0.02*	0.01
Adjusted R^2	0.09	0.22	0.19	0.15	0.13	0.12	0.06	0.17	0.15
F	9.62***	38.02***	26.46***	6.79***	7.18***	5.51***	9.26***	38.07***	26.80***

[a] United States, n = 1,012; Japan, n = 270; pooled sample, n = 1,282. Automotive industry is the referent category.

[b] First stage: *stock concentration* = f(*assets, leverage, market-to-book, industry*). Second stage: *R&D/sales* = f(*market-to-book, industry, stock concentration*).

[c] For stock concentration, the n, mean, and median are as follows: United States, 1,429, 0.39, 0.37; Japan, 293, 0.49, 0.47; t = 8.84***; Wilcoxon rank test = 6.66***. Difference in stock concentration coefficient, t = 3.20.

* $p < .05$
** $p < .01$
*** $p < .001$

variable because large investors were often also debt holders (e.g., Prowse, 1990). As in the U.S. sample, industry effects were significant. Stock concentration is not related to the R&D-to-sales ratio in Japan (the coefficient is statistically insignificant), supporting Hypothesis 1b. The difference (change in the adjusted R^2) from the benchmark OLS regression to the second-stage regression is also very small (adjusted R^2 = .12, benchmark, and .13, second-stage).

Pooled sample. Hypothesis 2a states that on the average, Japanese firms will have a more concentrated ownership structure than their U.S. counterparts, and Hypothesis 2b states that on the average, Japanese firms will invest more in R&D than their U.S. counterparts. Table 3 shows the means (United States = 39.4%, Japan = 48.9%) and medians (United States = 37.2%, Japan = 47.1%) of stock concentration for Japanese and U.S. firms. The t-statistic shows that the mean differences are significant at the .001 level. The results of a Wilcoxon sign rank test of differences in medians are also significant at the .001 level. Consistent with Hypothesis 2a, results show that, on the average, Japanese firms have a significantly more concentrated ownership structures than U.S. firms (additional tests were conducted; see the Appendix).

To test Hypothesis 2b, we also estimated a 2SLS regression for the pooled sample of U.S. and Japanese firms. The coefficient of the Japan country dummy (0.02) is positive and significant. Consistent with Hypothesis 2b, this result suggests that, ceteris paribus, Japanese firms invest significantly more in R&D than their U.S. counterparts. The results show that stock concentration is not related to the R&D-to-sales ratio in Japan. We tentatively conclude that the steward role of managers leads to incentive congruence, which in turn accounts for the higher level of R&D investments in Japan when Japanese firms are compared with firms of similar size and industry conditions in the United States.

DISCUSSION AND CONCLUSION

This study provided an analysis of the differing relationships between ownership structure, R&D investments, and goal alignment in the United States and Japan. In doing so, it began with the premise that U.S. and Japanese firms have different owner-management relationships and that these differences may result in disparities in R&D investments. One explanation for these differences is the dissimilarities in culture between the two nations. Specifically, the Japanese culture creates condi-

tions that favor stewardlike relations (between managers and owners). As a result, the influence of ownership concentration on the R&D-to-sales ratio varies in the two countries. Empirical results show several principal findings.

First, the evidence indicates that stock concentration is related to the level of R&D investments in the United States. Specifically, stock concentration is positively related to the R&D-to-sales ratio in U.S. firms. Although some scholars have expressed concern that the concentration of investable funds in the hands of money managers who have short-term orientations may result in "managerial myopia" (Blinder, 1992; Dobrzynski, 1986; Jacobs, 1991; Monks, 1988; Porter, 1992; Thurow, 1993), these results suggest the opposite.

This pattern of results concerning stock concentration is not inconsistent with the assertion that agency theory reflects U.S. firms adequately, while stewardship theory represents Japanese firms adequately. In the United States, increasing concentration balances the power of owners vis-à-vis self-interested managers in leading to increased R&D investments, but in Japan, increasing concentration does not affect the level of R&D investments. In each country, then, management conditions and the impact of governance are nested in cultural and institutional processes that create important reciprocal relationships and path dependencies.

The results have important implications for agency theory and its applicability in different national settings. The relationships between the managers and shareholders of Japanese firms are different from those found in the United States. The investors of Japanese firms often play multiple roles, including monitoring managers, providing capital (both debt and equity), providing and obtaining information, and acting as suppliers. These interdependencies suggest that Japanese firms may have different types of agency problems or may resolve agency problems differently (e.g., Lee, 1997).

Within the context of this study, we could not determine whether the differences in the influence of concentrated holdings across these two countries is a consequence of the absence of a market for corporate control, the presence of steward relationships, or both. We suspect that the two concepts are intertwined with one another and with other independent institutional and cultural factors. Other institutional practices may help join manager and owner incentives in Japan. Historically, for example, Japanese managers have faced less employment risk than their American counterparts. Employment risk is a frequently mentioned source of owner and manager conflict in American businesses (Amihud & Lev, 1981).

Policy Implications

Recognition of the increasing importance of R&D has fueled a debate as to whether U.S. firms underinvest relative to their Japanese competitors (Jacobs, 1991; Miller, 1994; Porter, 1992; Prahalad, 1994). Critics have argued that profit consciousness among shareholders has led to an overemphasis on short-term profits. Consequently, managers may sacrifice long-term investments, like R&D, in order to boost short-term profits (Porter, 1992). This concern has grown with the increase in institutional ownership and, concomitantly, the more than six-fold increase in the rate of turnover on the New York Stock Exchange since 1987 (Froot et al., 1992). "Greater trading volume is, by definition, equivalent to a reduction in the holding period of the average stockholder" (Froot et al., 1992: 42), and shorter time horizons for investors translate into shorter time horizons for managers, especially with regard to evaluating investment opportunities.

Contrary to opinions expressed in the popular press, it is not clear that the U.S. market for corporate control invariably causes managers to be "myopic" (Cannella & Monroe, 1997; Porter, 1992). In fact, the evidence suggests that the presence of large investors may counter tendencies toward reduced R&D. These results are consistent with Kochhar and David's (1996) study, which suggested that the presence of institutional investors was positively related to innovations.

Future Research

This study suggests at least three opportunities for future research. One avenue of research would be to focus on alternative measures and triggers of innovation, perhaps by looking at stock price responses to product announcements. The ownership structure of firms is only one factor that may influence R&D investments. For example, a company's level of technological diversification (Stewart & Chacar, 1998) and the presence of star scientists (Zucker, Darby, & Brewer, 1998) also contribute to R&D. Another approach might be to further examine the relationship between cross-national differences in ownership structure, managerial stockholdings, and other corporate actions that are influenced by the presence or absence of agency conflict, such as corporate diversification and managerial entrenchment.

The outcomes for our study hint at the complexity of governance issues and suggest a third, inte-

grative stream of research. Contexts vary, and governance variables vary in their impact. Here, the different contexts were defined by two nation states. Within both of the countries studied here, though, owner-manager relationships can vary greatly. Agency conflicts exist in Japan, and stewards exist in the United States. Excessive reliance on one form of control is likely to be a mistake in either country. Similarly, single governance variables can have both positive and negative impacts. This observation is consistent with Finkelstein and D'Aveni's (1994) finding that separating the role of board chair and CEO can increase board vigilance while decreasing CEO effectiveness. Our findings support calls for research comparing the use of multiple measures of corporate governance (e.g., Boyd, 1994).

Finally, our results imply that agency assumptions about managerial opportunism may be a function of context, rather than a reflection of the natural tendencies of management. Managers—fearing a market for corporate control in which owners have little information and low incentive to obtain it—will invest in R&D at low levels. When owners have knowledge (as reflected by high ownership concentration in the United States) or managers have a sense of security (in Japan), managers will invest in R&D at higher levels. The observed investment patterns are in keeping with the image of a rational manager responding to complex incentives and signals in the financial marketplace. Managers, then, are neither naturally opportunists nor stewards. In effect, managerial behavior is nested in a system of intertwined forces, some reinforcing and some countervailing each other.

These issues are particularly pertinent now, when corporate governance structures are under review and changing. U.S. firms have witnessed the increased involvement of institutional investors in their governance (Graves, 1988; Wahal, 1996). In fact, one author, writing in the *Economist,* predicted this: "Today, we see different national models of corporate governance. . . . Tomorrow, we can expect fewer national differences" Kay, 1993: 69). These transitions are especially interesting to study because they allow for a comparison of the differing corporate ownership structures. Further, since the convergence of national models of governance does not come with a guarantee of convergence in employment practices and other related triggers of management behavior, such studies will shed light on issues of material consequence.

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APPENDIX

We used additional tests to understand whether the stock concentration coefficient in the U.S. sample was statistically different from the stock concentration coefficient in the Japanese sample. Following a procedure described in Hardy (1993), we calculated a pooled estimate of the population variance, combining the two samples, and we weighted each subgroup estimate by the appropriate degrees of freedom. With equality of group variance assumed, the formula for the pooled estimate of the population variance is:

$$s^2_{pooled} = \frac{(n_1 - k_1 - 1)s^2{}_1 + (n_2 - k_2 - 1)s^2{}_2}{N - (k_1 + k_2 + 2)},$$

where n_1 and n_2 are the numbers of cases in the samples, N is the number of cases in the pooled sample, k_1 and k_2 are the numbers of independent variables included in the sample regressions, and $s^2{}_1$ and $s^2{}_2$ are the mean residual sums of squares from their respective sample regressions. The t-test for the difference in coefficients from the separate subsample regressions is:

$$t = \frac{B_1 - B_2}{s_{pooled}\left(\frac{s^2_{B1}}{s^2{}_1} + \frac{s^2_{B2}}{s^2{}_2}\right)^{1/2}},$$

where s^2_{B1} and s^2_{B2} are the variances of the estimates of B_1 and B_2. The above t-test reproduces the t-test for the stock concentration coefficient in the pooled sample regression model. For the 2SLS regression, the t-statistic is 3.20; thus, the stock concentration coefficient in the U.S. sample is statistically different from the stock concentration coefficient in the Japanese sample.

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