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WHY INFORMATION TECHNOLOGY WORKERS OWN THEIR FIRMS: HOW THE RELATIVE IMPORTANCE OF HUMAN CAPITAL AFFECTS FIRM OWNERSHIP

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Abstract

Knowledge workers are critical for the production of goods and services in the information economy, and thus investment in human capital plays an increasingly important role in economic growth. Since firms cannot directly own human capital and cannot easily monitor or verify human capital investments made by their employees, they need to devise appropriate incentives to attract skilled employees and to encourage them to develop their human capital. One such scheme is employee ownership of the firm, and in this paper we use the theory of incomplete contracts to show that when investments in human capital are relatively more important, firms should be characterized by higher levels of employee ownership.

Specifically, we employ a model of the firm where production requires both human capital and nonhuman (e.g., physical) capital. Because of the difficulty of ex ante contracting with employees and managers to invest in human capital specific to the firm, employees and users need to be given partial ownership of firm in order to increase their incentives to invest in human capital. As the importance of human capital relative to the physical capital employed by the firm increases, the model predicts an increase in the appropriate level of employee and serial ownership. We test this prediction through the empirical analysis of firm-level data in three high tech sectors, software, hardware, and biotechnology. Our results confirm the predicted relationship, and demonstrate that the high degree of managerial ownership in the IT industry in comparison to the biotechnology industry (e.g., managerial ownership in software companies is an order of magnitude higher than biotechnology companies) can be explained by the relative importance of human capital compared to physical capital in these industries.

Keywords: Ownership, corporate governance, human capital, high-tech, information technology, biotechnology

¹On leave from New York University.

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Introduction

Over the past half century, the economists' view of employees has evolved from seeing them as a generic factor of production that complements physical assets to seeing them as an essential contributor to productivity, economic growth, and profitability (Becker 1993; Jorgenson and Fraumeni 1995). This is particularly important in firms where knowledge workers are an essential part of the production process, such as firms in information technology (IT) industries,³ where human capital is a central asset to individual companies. Not surprisingly, data show that 60 percent of the people working in the computer software industry hold a bachelor's degree or above, as opposed to only 12 percent of the workforce in other industries.⁴ This study uses economic modeling and firm-level data to explore whether the increasing importance of human capital that characterizes the IT industry affects corporate governance, and in particular the degree of employee and managerial ownership.

Since firms cannot directly own human capital and cannot easily monitor or verify human capital investments made by their employees, they need to devise appropriate incentives to attract skilled employees and to encourage them to develop their human capital. One such scheme is employee ownership of the firm, commonly used to attract skilled employees and encourage their investment in firm-specific human capital. As a result, one would expect the level of employee ownership to be higher in high-technology firms, where knowledge workers and their associated human capital investments are essential. For example, Liebeskind (2000) found that the level of managerial ownership in young biotech firms is much larger than the average for public corporations in general. However, few studies have investigated employee ownership in the IT industry.

This paper offers an empirical investigation of the level of managerial and employee ownership in the IT industry, and whether the IT industry is significantly different in this respect from other non-technology-intensive industries. Furthermore, we study how the ownership structure of IT firms compares to other technology-intensive industries. Specifically we compare the IT and biotechnology (BT) industries, two industries at the forefront of technology-sector growth and with many common characteristics. Both of these industries depend heavily on high-skilled personnel, as over half of the workforce in the software and biotechnology industries holds a college degree, more than twice the rate found in other industries. These industries are leaders in technological innovation; both are driven by enormous research and development resources, and both are highly staffed with science, engineering, and technical personnel. Both industries are entrepreneurship-driven, with start-up companies typically financed through venture capital investments.

However, there are some critical differences between the IT and BT industries, such as the relative role of human and physical capital in their corresponding knowledge production processes. For example, knowledge production in the biotechnology industry usually requires substantial investment in physical capital, such as expensive laboratory facilities and instrumentation. In contrast, software firms require relatively little investment in physical capital. The requisite degree of investment in physical capital for hardware firms is likely to fall between these two extremes. These differences in the relative role of physical capital compared to human capital for software, hardware, and biotechnology firms is likely to result in different corporate governance, and specifically different patterns of employee ownership. We study this relationship through the development of appropriate economic models and through the empirical analysis of firm-level data.

First, we draw on the theory of incomplete contracts (Grossman and Hart 1986; Hart 1995; Hart and Moore 1990) to develop an economic model for the relationship among physical capital, human capital, and employee ownership, as shown in Table 1. The incomplete contracts view of the firm provides a theory for why higher levels of firm ownership induce higher levels of employee investment in human capital. Because in the real world contracts cannot specify all possible eventualities, ownership of the firm results in residual rights of control over the firm's physical capital, and higher ability to appropriate income streams generated from the firm. As a result, employees with higher levels of ownership would invest in human capital more than nonowners, as they know that they will be able to appropriate a larger fraction of the value generated from this investment. Our model shows how the relative importance of human capital, compared to nonhuman capital,⁵ affects the appropriate level of such ownership.

³We define the information technology industries as industries related to computers such as software and hardware production and computer consulting service industries.

⁴Data are from Current Population Survey (U.S. Department of Labor) for 2001.

⁵Nonhuman capital, here, includes physical capital and other nonhuman capital such as brand names. However, in our study, we consider only physical capital and use the two terms, nonhuman capital and physical capital, without distinction, because our study investigates industry-averaged characteristics. Although other nonhuman capital of individual companies can vary from each other significantly, industry-averaged values of the other nonhuman capital are not likely to differ significantly from one industry to the other, particularly among high-technology

Specifically, if human capital factors more significantly into production, corporate governance is likely to be more efficient when the ownership or the residual power over the firm’s physical capital is at least partially controlled by the firm’s employees. In the empirical component of our study we measure the intensity of human capital relative to physical capital at the firm level, and we find that it is higher in software firms, lower in hardware firms, and still lower in biotechnology firms. We use this measure to study the relationship between the relative importance of human capital compared to physical capital and the level of employee ownership for firms in these high-technology sectors (software, hardware, and biotechnology). Our results show a significant relationship both within each sector and across sectors in our sample.

Table 1. Differences in Managerial Ownership

(Model to explain differences in managerial ownership among software, computer hardware, and biotech industries on the basis of the importance of human capital relative to physical capital.)

<i>Dependent Variable</i>	<i>Independent Variable</i>	<i>Control</i>
Level of Managerial Ownership	Ratio of Physical Capital to Human Capital	<ul style="list-style-type: none"> • Firm Characteristic • Industry Characteristic • Labor Characteristic

Background

The importance of ownership over physical assets in corporate governance has been addressed by Oliver Hart in his work with Sandy Grossman and John Moore (Grossman and Hart 1986; Hart and Moore 1990). If all possible state-contingent contracts could be written at no cost, and if contracts could be enforced, ownership would not matter for human capital investment. However, in the real world, all possible contingencies cannot be reasonably anticipated and covered in contracts. In other words, contracts are *incomplete*. In eventualities that are not covered through contracts, ownership maintains the *power* to reassign control rights back to the owner(s). Power plays a significant role in the efficiency of an organization’s management structure and policies. Power affects an agent’s incentive to make firm-specific investments in human capital, and can also be leveraged to allocate tasks so that specialized investments by employees are aligned with the organization’s own goals and directives.

In organizations in which the importance of human capital relative to physical capital is high, control over valuable human capital would be a greater source of power than would control over physical capital. Recent changes in the nature of organizations, the extent and requirements of markets, and the availability of financing have made specialized human capital much more important and mobile. However, human capital is inalienable; power over it must be obtained through mechanisms other than ownership. Even agents sell their labor; they cannot pledge the residual control rights over their human capital to someone else for any significant length of time through a contract. Rajan and Zingales (1998a, 1998b) state that in human-capital-intensive organizations, control over valuable human capital is derived from control over access to critical resources of the organizations. Critical resources include not only unique or specialized machines, but also human networks, friendly coworkers, complimentary and specialized employees, a good environment, etc. Employees, given privileged access to these critical resources, have incentives to develop their human capital specific to the firm. An employee would gain more by having the access to critical resources and specializing in the firm than by working alone without critical resources. If general human capital, which is not specific to the particular firm and marketable to other firms, can only be developed by having access to the critical resources, access can be an effective control over human capital. On the other hand, if employees can afford to own the critical resources for the development of their general capital, the access cannot be as effective. Taking BT and IT industries as examples, the importance of physical capital such as laboratory facilities in developing both general and firm-specific human capital in BT can make the access to the physical capital more effective than it does in IT industries. In other words, the access to physical capital cannot replace giving the ownership to managers in inducing their human capital in IT industries as much as it does in BT industries.

Because power over human capital is obtained through different mechanisms, an organizational structure varies depending on the relative importance of human capital. In organizations in which highly specialized nonhuman capital is more important than human capital (i.e., where the ownership of nonhuman capital is the primary source of power), ownership rights are delegated to the top management by dispersed shareholders, and both power and the rent generated from production are concentrated in the

industries.

top managers. These organizations are vertically integrated and have a hierarchical structure. In contrast, human capital-intensive organizations are horizontally integrated, and the surplus in these organizations is shared much more evenly throughout the organization.

The present study develops a model based on both the Grossman/Hart/Moore and the Rajan/Zingales models. The developed model shows the correlation of the ownership structure with the importance of human capital relative to physical capital in the biotech, computer hardware, and software industries. We argue that the software industry is likely to demonstrate an organizational structure with more dispersed power and ownership than the biotech industry because the relative importance of human capital in the software industry is greater.

The Model

Based on two-person Grossman/Hart/Moore models of ownership together with multi-person Rajan/Zingales models of access, the model developed in this study investigates how human and nonhuman capital intensities affect the ownership, structure and behavior of organizations. This model can also be applied to determine the effect of those human and nonhuman capital intensities on employee incentive plans in specific firms. Grossman/Hart/Moore models attempt to resolve a more efficient ownership structure, while Rajan/Zingales models identify control mechanisms by regulating employees' access to the firm's critical resources. To more completely understand the behaviors of organizations and employees, a model is needed that directly considers the relative sizes of human and nonhuman assets. This has been lacking in the literature. Since our model concerns organizations where research and development in science and technology is a key function, i.e., in firms in BT and IT industries, we consider scientists as representative employees in this model.

For a brief demonstration of our model setup, let us first consider the model setup similar to that of Hart's and especially to that of Rajan and Zingales's. The setup is essentially a two-person version of Rajan/Zingales model setup, both simplified and enhanced to specifically consider the capital intensities of specific investments. In this simplified model as shown in Figure 1, an entrepreneur, E, owns a unique asset, which can be either a unique machine, i.e., nonhuman capital (A), and/or specialized human capital (H_E). The entrepreneur needs help from a scientist (M) who owns no physical asset but possesses general human capital that can be serviced elsewhere, H_I . E and M comprise the only members of the firm in this model.

The social utility function can be written as

$$R(P, H_G, H_S; A, H_E, H_I) - C(H_G, H_S, P; A, H_E, H_I) + P + H_G \tag{1}$$

where R is revenue and C is cost. The first two terms indicate the net revenue generated from sales of a product created by the collaboration of the entrepreneur with the scientist. The third term, P, indicates the value of alienable assets developed during this particular product development, such as the net revenue of a technology license fee. The P belongs to the firm. However, the fourth term in the above equation, the general human capital that the scientist develops during this particular product development, stays with the scientist even after leaving the firm.

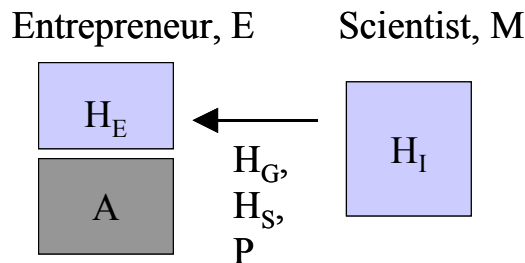


Figure 1. Two-Person Model

A is a unique machine or physical assets that E, an entrepreneur, owns. E has her own human capital, H_E . A scientist with an initial human capital, H_I , develops and provides her human capital to the entrepreneur. The human capital that the scientist develops for the entrepreneur over time can be categorized into two; one is general, applicable to other firms (H_G), and the other is specific to the firm or the entrepreneur (H_S). The scientist also provides an alienable knowledge product such as patent, denoted as P, to the entrepreneur.

It is assumed that $R(\bullet)$ is a standard concave production function, i.e., $R_i(\bullet) > 0$ and $R_{ii}(\bullet) < 0$, where the subscripts i and ii stand for the first and the second derivative, respectively. It is assumed that $M, H_E, H_I, H_G, H_S,$ and P are all strictly complementary, i.e., $R_{ij} > 0$ for all i and j . Both E and M understand $R(\bullet)$ completely, but E observes only R and P . M decides and therefore observes $H_G, H_S,$ and P . E has a binary choice between investment ($A \neq 0$ and $H_E \neq 0$) or no investment ($A = 0$ and $H_E = 0$). On the other hand, M allocates her resources to generate $H_G, H_S,$ and P such that she uses all available resources to yield these three assets.

Maximizing the social utility yields the following conditions:

$$\begin{aligned} R_P - C_P + 1 &= 0 \\ H_G - C_{H_G} + 1 &= 0 \\ R_{H_S} - C_{H_S} &= 0 \\ P + H_G + H_S &= T \end{aligned} \tag{2}$$

where T is the total resources available to S . The functions can be drawn with respect to $P, H_G,$ or H_S as shown in Figure 2.

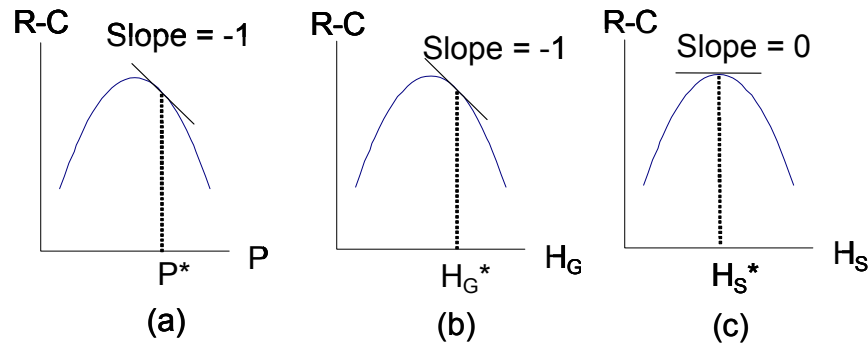


Figure 2. The Social Utility Function is Concave

(a) The optimal P, P^* , is obtained when the first derivative of the function with respect to P is -1 . (b) The optimal H_G, H_G^* , is obtained when the first derivative of the function with respect to H_G is -1 . (c) The optimal H_S, H_S^* , is obtained when the first derivative of the function with respect to H_S is 0 .

Consider a bargaining process between E and M over time from 0 to 2 . At time 0 , M must make an investment, a part of which is specific to the E 's asset. M 's investment comprises the labor and the service of M 's human capital (H_I), and yields three components: nonhuman assets specific to E 's assets (P), human assets specific to E 's assets (H_S), and human assets not specific to E 's assets (H_G). When M permanently leaves the firm, the specific nonhuman asset, P , stays in the firm but the specific human capital, H_S , is lost. The general human capital, H_G , however, becomes hers so that her human capital increases by H_G . If E and S bargain successfully at time 1 , they produce and share the payoff at time 2 .

As for the bargaining game at time 1 , the solution concept is simply the Nash bargaining solution, which is identical to the Shapley value solution concept for the two-person case. The Shapley value gives an agent, j (M or E in our two-person model), her expected contribution to a coalition, where the expectation is taken over all coalitions to which M or E might belong. The benefit to an agent j, B_j , can be written as

$$B_j = \sum_{S|j \in S} \frac{(s-1)!(n+1-s)!}{(n+1)!} \{R(S) - R(S \setminus [j])\} \tag{3}$$

where $s=|S|$, the number of agents in coalition S , $n+1$ is the total number of agents bargaining, $R(S)$ is the revenue produced by coalition S , and $R(S \setminus [j])$ is the revenue produced by coalition S without agent j .

For simplicity, let us consider the case where $R(\bullet) = R(A, H_S)$. From a cursory look at the model setup, we can immediately notice the following implications. First, as the level of E 's nonhuman asset (A) becomes more important, the bargaining position of E becomes stronger. On the other hand, as the size of M 's firm-specific human capital investment (H_S) becomes more important,

the bargaining position of M strengthens. The reason is as follows. Assuming the cost with the human capital investment is the same as that without the human capital investment, the benefit to the scientist, B_M , becomes, by equation (3), that

$$\frac{1}{2}[R(A, H_s) - R(A, 0)] \quad (4)$$

The higher the $R(A, 0)$ is relative to $R(A, H_s)$, the smaller the value of the share for M. Similarly, the higher $R(A, H_s)$ is relative to $R(A, 0)$, the larger the value of the share for M. However, in all these cases, M will invest less than social optimum due to the concavity of the revenue function.

An interesting case arises when $R(\bullet) = R(A, H_G)$, i.e., when the revenue depends on nonspecific human capital investment not firm-specific human capital investment. Since the payoff to M becomes now $\frac{1}{2}[R(A, H_G) - R(A, 0)] + H_G$, we can expect over-investment since M will invest in H_G up to the level where $R_H(\bullet) = 3/2$, which is larger than the optimal level for the firm where $R_H(\bullet) = 1$. Similarly, we can consider various cases of this model, changing the relative importance of $(A, H_E, H_I, H_G, H_S, P)$, and investigate the implications. Additionally, we also may be able to consider the optimal incentive scheme, including stock ownership and corporate control.

To put together all this discussion, in short, drawn from the original insight of Grossman/Hart/Moore's model, our analysis shows the optimal decision right and residual claim should rest with the parties with essential human capital when physical capital is less important. On the other hand, if the relative importance of the physical capital grows, the decision right and thereby the residual claim should reside in investors who are usually outside of the firm. Thus we have the following propositions:

- Proposition 1: If the firm requires essential human capital—inalienable assets—and its complementary physical capital—alienable assets—is obtainable easily through efficient capital market, then the ownership and residual claim should rest with the inside managers and workers of the firm.
- Proposition 2: If the firm's requirement of the human capital is less essential and the requirement of the physical assets are essential, then the decision maker of the investment in the physical capital should assume the ownership and residual claims of the firm.

From these two propositions we have the following testable hypothesis:

- Hypothesis: The insider ownership of a company grows as the relative importance of human capital to physical capital increases. In other words, the more firms depend on the physical assets, the more likely the ownership would be assumed by outside owners.

Methods and Data

Data and Regression Analysis

Investment in human capital, as in physical capital, yields returns over the future. Education is the most important investment in human capital. High school and college education in the United States and other countries greatly raise a person's income, even after adjusting for direct and indirect costs of schooling, and after adjusting for the different family backgrounds and abilities of more educated people. In the study of human and nonhuman capital in the United States by Jorgenson and Fraumeni (1995), human capital was estimated in terms of lifetime labor incomes for all individuals in the U.S. population. In their study, the lifetime labor incomes correspond to the asset values for investment goods used in accounting for physical capital. In our study, the education level and wage are used as proxies for human capital and the education level is used in our regression analyses. The data on education level in different industries are drawn mostly from the Current Population Survey (CPS) over the period from 1992 to 2001. Other labor characteristics in different industries such as the gender ratio are also drawn from the CPS.

As a proxy for nonhuman capital, we use the data on the physical assets. The data on physical assets are mostly drawn from the Compustat database on Industrial Data. Compustat is a commercially available set of financial and other data for publicly held firms. Ownership data are also derived from the Compustat database on Executives over the period of 1992 to 2001. Other firm characteristics are drawn from the Compustat database.

We constructed firm-level data on physical assets, sales, number of employees, and managerial ownership from the Compustat Industrial database. Then, the firms were grouped by industries, based on SIC codes, and the weighted industrial averages on managerial ownership, physical assets, number of employees, and sales were estimated. In order to characterize the workforce of each industry, the CPS data containing labor characteristics were grouped by industries and the statistical data on labor in each industry such as education years and percentage of high-skilled workers were obtained. The labor characteristics averaged in each industry were matched to the industrial averages on other industry characteristics drawn from Compustat. Only observations with no missing variables were selected. A summary of the data construction procedures and the data sources is provided in Table 2.

We conducted the regression analysis with the following equation:

$$\ln(m) = \varepsilon + \beta_{1h} \ln(H/K) + \beta_{2h} \ln(E) + \beta_{3h} \ln(S) \tag{5}$$

where m, H/K, E and S are as in Table 2.

Table 2. Variables, Data Source and Data Construction Procedures

Variables	Data Source	Construction Procedure
Percent of shares owned by executives (m)	Compustat Industrial and Executives	Shares owned by executives in each firm, available from Compustat Executives, were added over each industry. It was then divided by the sum of common outstanding shares of firm in the industry, available from Compustat Industrial.
Physical Capital (K)	Compustat Industrial	Net value of property, plant, and equipment was used.
Employee Number (E)	Compustat Industrial	Employee numbers of firms averaged over each industry.
Sales (S)	Compustat Industrial	Sales of firms averaged over each industry.
Years of education	CPS	Data on education degrees were converted to generate the years of education. Average of years of education in each industry was estimated.
Human Capital Intensity Relative to Physical Capital (H/K)	CPS and Compustat Industrial	Average years of education and the number of total employees in the industry divided by sum of net value of property, plant, and equipment over each industry.

Result and Discussion

Descriptive Statistics

The percentages of highly educated workers in the IT and BT industries are much higher than those in the other industries, as shown in Figure 3. In particular, the difference between the percentage of workers with a bachelor’s degree or above in the three industries and that in the other industries was the highest. However, the difference among high-technology industries was small. There was no difference in the percentage of workers holding a bachelor’s degree between the BT and software industries. In comparison with the IT industry, the BT industry had a higher percentage of workers with advanced degrees.

The software industry has, on average, the lowest value of physical assets, whereas the BT industry has the highest, as shown in Figure 4 and Table 3. The BT industry is likely to have laboratory facilities with expensive instruments for testing and development of biochemical products and manufacturing machinery for production, whereas the software industry does not require such physical capital. The Hardware industry, which manufactures physical products, is also likely to require more physical capital than the software industry.

Among the three industries, the workforce of the software industry, on average, is the youngest, has the least number of women, the longest years of education, and earns the highest wage, as summarized in Table 3. While the average firm size is similar among IT and BT industries, there are significant differences in the value of physical assets and managerial ownerships among the industries. The degree of managerial ownership in the software industry is one order of magnitude higher than that in BT industry. There is an inverse relationship between the value of physical assets and the managerial ownership, which supports our argument that the lowest requirement for physical capital results in the highest level of managerial ownership.

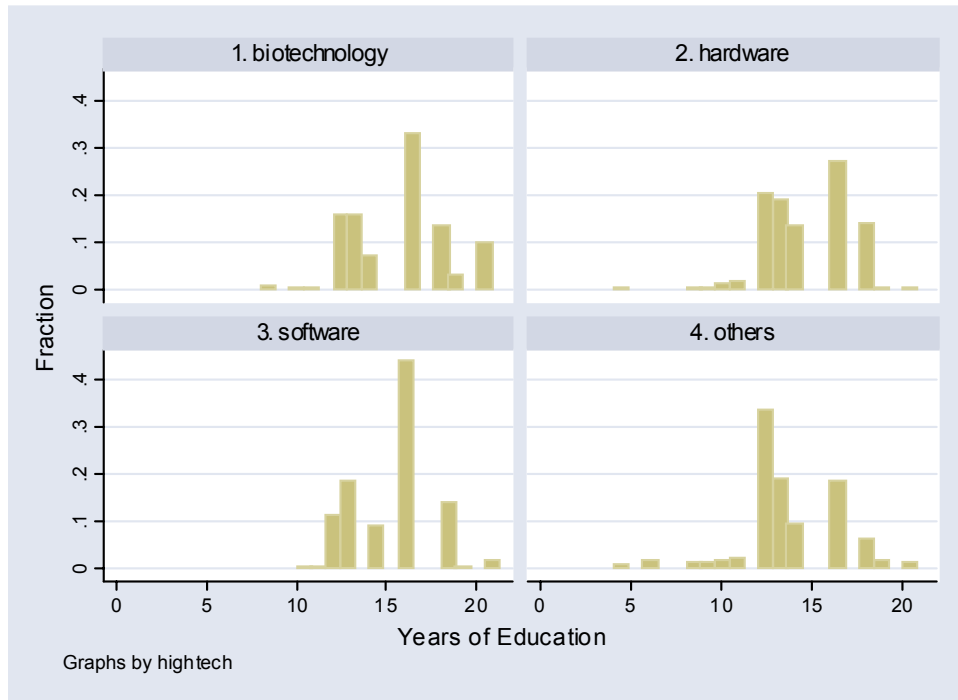


Figure 3. Education Level of Workers in Each Industry for Year 2001

In the selected high-tech industries, college graduates are the majority of their workforce, while, in other industries, high school graduates are. (Numbers of observations are 415 for biotechnology, 183 for hardware, 884 for software, and 44601 for others.)

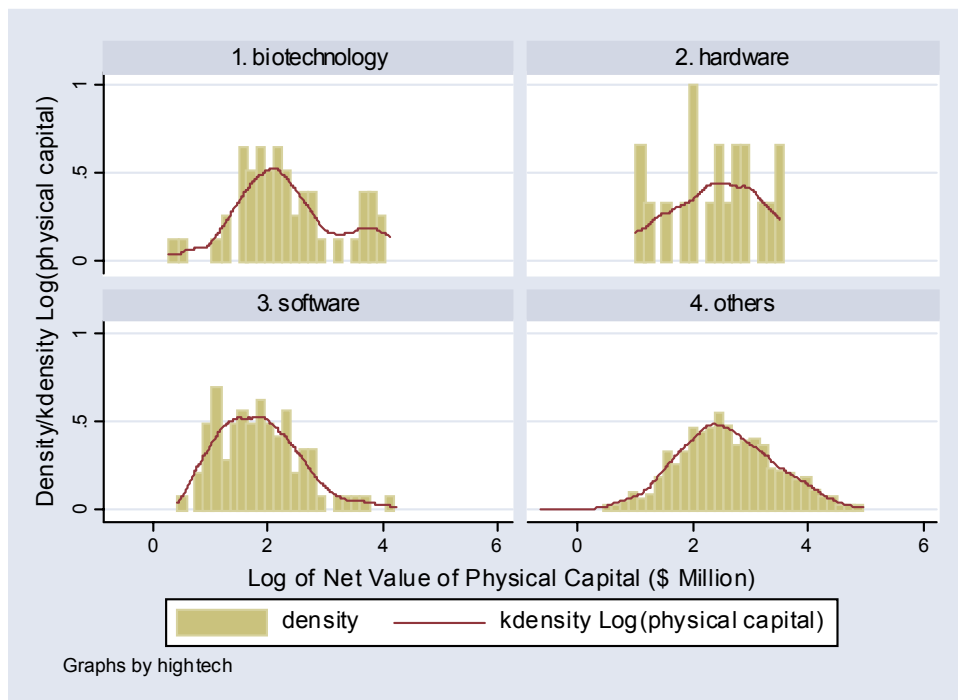


Figure 4. Distribution of Firms' Physical Capital in Each Industry for Year 2001

The distribution is based on companies available from Compustat Industrial database: 96 firms for software, 51 firms for biotechnology, 20 firms for hardware, and 1088 firms for other industries.

Table 3. Descriptive Statistics of High-Technology Industries for the Year 2001

	Computer Hardware Industry	Software Industry	Biotech Industry
SIC code (CPS Industry Code)	3570, 3571, 3572, 3575, 3577 (322 – 330)	7371, 7372, 7373, 7374, 7375, 7376, 7378 (732 – 740)	2833, 2834, 2835, 2836, 8731 (181 and 891)
Labor Characteristics (full-time workers)			
Observations (workers)	183	884	415
Worker Age (yr)	41	37	41
Female Ratio (%)	39	30	42
Wage (\$)	64500	66200	39200
Years of Education (yr)	14.4	15.1	13.5
Percentage of B.S. or B.A or above (%)	43	60	59
Industry Characteristics			
Observations (firms)	28	96	51
Average number of employees per a firm	13,000	11,000	13,000
Average Net Value of Physical Assets (\$Million)	605	413	1,380
Percentage of Shares owned by executives (%)	2.7	5.7	0.5

Regression for High-Technology Industries

A strong correlation of managerial ownership with the human capital intensity relative to physical capital was demonstrated, supporting our hypothesis, as shown in Table 4 and in Figures 5 and 6. Examining the data points of the highest ratio of human capital to physical capital in Figure 5 reveals that computer programming services (SIC = 7371) in all years of the studied period top all other high-tech industries investigated in this study.

It can be explained that the high-skilled workers are so important in the business activities of high-technology industries that, even after counting the human capital of all workers, their proportion makes a difference to ownership structures of these industries. We also conducted regression analyses including the percentage of workers holding more advanced degrees as another independent variables but they did not show the correlation as strongly.

Table 4. Regression for High-Tech Industries (N=115, R² = 0.56)

As predicted by our model, the human capital intensity relative to physical capital explains the differences in the level of managerial ownership among high-technology industries.

Parameter	Coefficients (standard error)	P > t
β_{1h} (Human capital intensity relative to physical capital)	1.01 (0.09)	0.000
β_{2h} (Numbers of Employees)	-0.69 (0.11)	0.000
β_{3h} (Sales)	0.31 (0.06)	0.000

Regression for All Industries

For all industries, the level of managerial ownership is still correlated to the physical capital intensity relative to human capital as shown in Figure 7 and Table 5. The correlation is lower in degree for all industries other than high technology. There are significant differences in industry characteristics other than physical and human capital across all industries. Nonetheless, a trend for a higher level of managerial ownership with higher human capital intensity relative to physical capital is clearly shown.

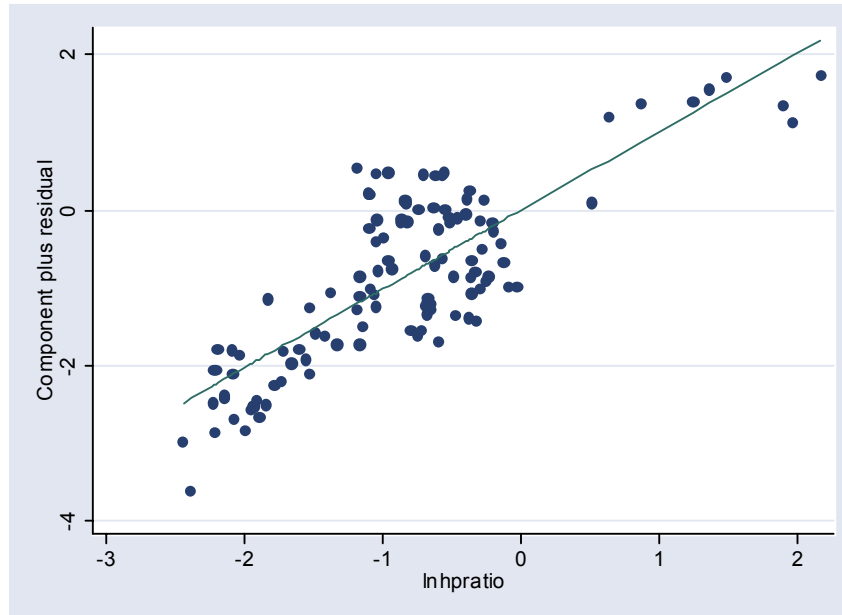


Figure 5. Partial Residual Plots

The component $\ln(H_p)$ for high-tech industries demonstrate a strong correlation of managerial ownership with the human capital intensity relative to physical capital.

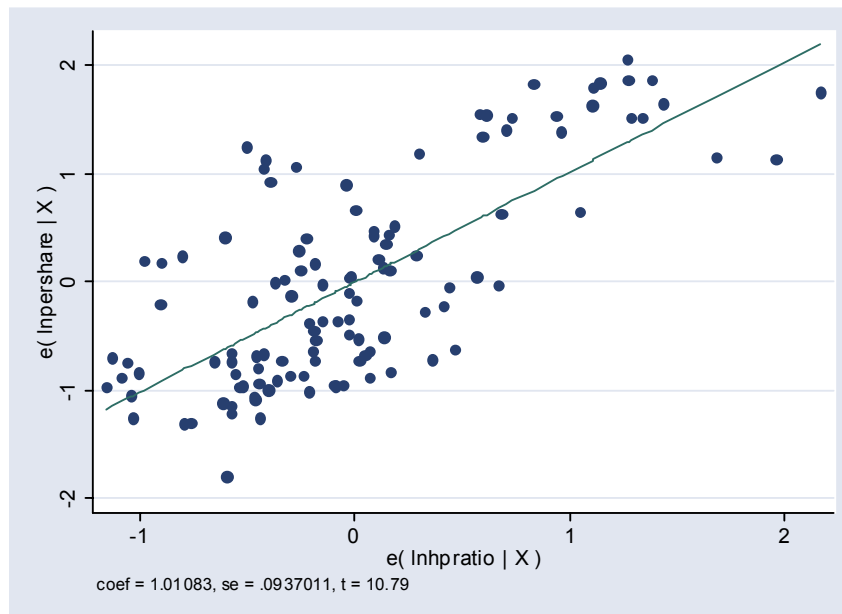


Figure 6. Adjusted Partial Residual Plot for High-tech Industries

The graph shows that the strong correlation also holds when the estimation is done probabilistically.

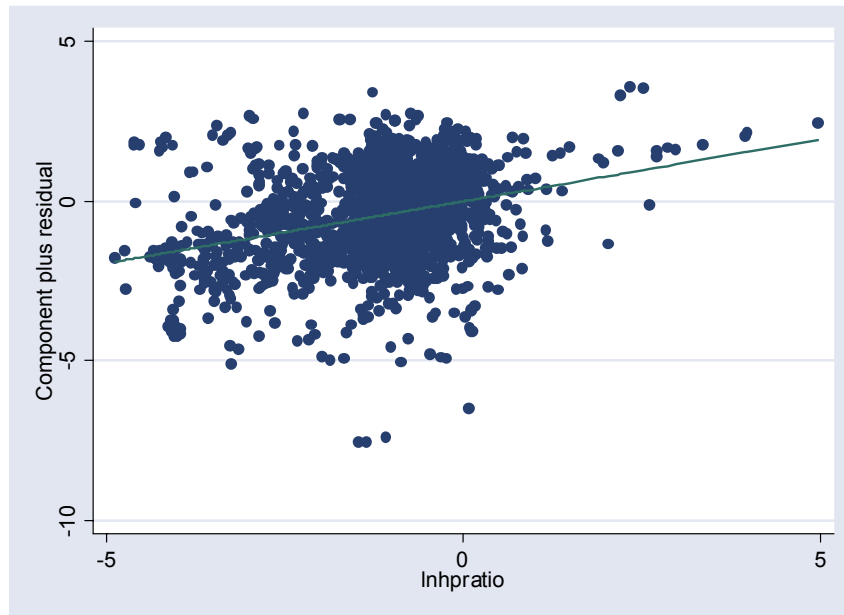


Figure 7. Partial Residual Plot for All Industries with H_p as the Component

Table 5. Regression for All Industries (N = 1876, $R^2 = 0.13$)

Parameter	Coefficients (standard error)	P > t
β_{1a} (Human capital intensity relative to physical capital)	0.39 (0.030)	0.000
β_{2a} (Numbers of Employees)	-0.37 (0.036)	0.000
β_{3a} (Sales)	0.086 (0.026)	0.001

Conclusion

In this paper, we studied how the relative role of human capital compared to physical capital affects corporate governance, and specifically employee ownership, in high-technology firms. We studied this relationship both through the development of appropriate economic models and through the empirical analysis of firm-level data.

Our economic model, based on the theory of incomplete contracts, predicts that employee ownership should be higher in firms where human capital is more important relative to physical capital. Using firm-level data from high technology firms in software, hardware, and biotechnology, we measured the relative intensity of human capital compared to physical capital. Our empirical analysis confirmed the predicted relationship, and demonstrated that the relative importance of human capital is a significant determinant of the ownership structure employed by high-technology firms. One can easily draw from our results managerial implications for motivating employees and designing organizations in high-technology industries. However, as we are moving toward a knowledge-intensive economy, our analysis and our results may become increasingly significant for a broader range of firms.

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