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Top Managers' Academic Credentials and Firm Value*

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Abstract

This study investigates whether top management teams' (TMTs) academic credentials from prestigious universities can be a source of competitive advantage. We examine the academic backgrounds of 72,165 top managers in 590 non-financial firms in South Korea from 1990 to 2006. We find that firms with a higher proportion of top managers from top universities have a higher *Tobin's Q*. Furthermore, this relation is stronger in challenging environments when firms face higher volatility, more growth opportunities, or financial distress, or when managers have greater discretionary power or are held accountable for their decisions. These results suggest that the effects of TMTs' human capital on firm value vary in the contexts of organizational and corporate environments. In short, our study suggests that education from elite schools is an important managerial attribute that contributes to performance.

Keywords Management academic credentials; Firm value; Top management team; Challenging corporate environments

JEL Classification: G30, G32, G34

> Ability is of little account without opportunity.
>
> Napoleon Bonaparte [1769–1821]

1. Introduction

As most top managers have graduated from colleges, whether top managers have a college education does not often significantly affect their firms' economic

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outcomes. In contrast, top managers with academic credentials from prestigious universities are relatively few. Do top managers with superior academic credentials add value to their firms? Since academic credentials, like other educational backgrounds, affect management decision making on corporate strategy and policies,[1] they may affect firm performance. If so, as important characteristics of firms' top managers often affect organizational outcomes (Hambrick and Mason, 1984), we can argue that top managers' education from a top university can be an important characteristic of human capital and a source of competitive advantage.[2] However, researchers rarely show the impact of managers' prestigious school education on performance except with regard to fund managers in the financial sector (Chevalier and Ellison, 1999; Gottesman and Morey, 2006) when it helps managers advance their careers (Useem and Karabel, 1986). This study investigates whether TMTs with superior academic credentials improve firm value in non-financial firms.

Moreover, we further examine how economic conditions and specific corporate environments might affect the relation between TMTs' academic credentials and firm value. According to the resource-based view, internal and external corporate environmental resources can increase the impact of managerial characteristics on firm performance.[3] Specifically, the effects of managerial human capital on firm value can be amplified when managers have more discretionary power, when their decisions are more critical to corporate policy making, or when dynamic managerial capabilities become an issue in regimes of rapid change. We argue that top managers with training from prestigious schools can have greater impact on firm value in challenging corporate environments in which they have greater discretionary power and decision-making scope.

Using firm-level management academic credentials (*MAC*) from prestigious universities as a proxy for TMTs' human capital, we examine the effects of firm-level *MAC* on *Tobin's Q*. To isolate the effects of *MAC* from those of other factors affecting human capital, we control for other managerial characteristics such as age, tenure as top managers, years of education, and expertise. We focus on how the effects of *MAC* vary in challenging environments, such as when firms have better

[1]Previous literature shows that the educational background of CEOs or top management teams (TMTs) in finance or law, or differences in knowledge and experience, affect corporate strategy and policies. Differences in specialty and academic degrees affect environment disclosure policy (Lewis *et al.*, 2014). Managers with higher human capital (higher educational level or heterogeneity in specialty) often make better management decisions and develop superior corporate strategies to address corporate challenges (Wiersema and Bantel, 1992).

[2]One might argue that the innate characteristics of top managers and human capital are the important factors of the firm value, not the academic credential per se. However, it is meaningful to examine the association between managerial academic credentials and firm value in that the credentials are observable while the human characteristics are deemed "unobservable".

[3]For more discussions see Haleblian and Finkelstein (1993) and Teece *et al.* (1997).

governance, high ownership concentration, higher volatility, more growth opportunities, or financial distress.

In our analysis, we address the issue of the ex-ante direction of causality between managerial attributes and firm performance. While managers with academic credentials from elite universities can improve firm value, better performing firms can also recruit better managers. We estimate a system of simultaneous equations with *Tobin's Q* and *MAC* as endogenous variables. We also discuss whether the effects of *MAC* represent those of top managers' social capital, because human capital and social capital are often interdependent.[4] Education from top schools enhances social capital, as graduates from top schools constitute a large portion of elites in business, government, and politics. Hence, we examine whether the effects of *MAC* remain after controlling for the magnitude of sociopolitical networks.

We test our hypotheses on 590 listed, non-financial firms in South Korea from 1990 to 2006 for a total of 7,100 firm-year observations. We focus on South Korean firms for three reasons. First, Korea's educational system has a well-established, universally recognized hierarchy of universities. College admissions strictly depend on test scores, as universities are required to select students solely on the basis of academic merit. Second, the experience of high growth in the early 1990s and then the 1997 Asian financial crisis exposed many Korean firms to volatile corporate environments. Many firms faced an increased risk of financial distress during the economic crisis, engaged in subsequent restructuring, or experienced corporate governance reform. Finally, the prevalence of Korean business groups (*chaebols*) provides a framework for examining the role of managers in different business organizations. While managers tend to make corporate decisions in stand-alone firms, group headquarters or controlling families are the decision makers in *chaebol*-affiliated firms.

We focus on the characteristics of TMTs instead of chief executive officers (CEOs) or boards of directors (BOD). First, Korean CEOs have short, often unrenewed terms, and those who are not from controlling families have limited influence. The mean term of a CEO is 3.5 years and only 36% of professional CEOs have their terms renewed (CEO Score, 2015). Second, South Korean firms did not appoint outside directors until 1999 when the South Korean government introduced governance reform measures (Black and Kim, 2012). Third, outside directors have little influence and little involvement in corporate decision-making processes when transferring firm-specific information is costly (Joh and Jung, 2012). Hence, TMTs have greater overall influence on firms than do CEOs or outside directors.

Grounded in the resource-based view of the firm, we show the effects of managerial human capital, specifically academic credentials. Our data show that greater *MAC* at the firm level is linked to greater firm value when measuring *MAC* as the

[4]Becker (1964) defines an individual's expertise, experience, knowledge, reputation, and skills as "human capital" whereas Nahapiet and Ghoshal (1998, p. 243) define an individual's actual and potential resources embedded within, available through, and derived from the network of relationships as "social capital".

percentage of top managers who graduated from prestigious colleges. Managers from academically strong schools generate firm-level benefits and improve the stock market value of their firms. Moreover, this effect is stronger in volatile, challenging business environments or in firms where managers are more accountable for their decision making. Our study results suggest that an elite education from top schools not only helps managers derive personal benefits through higher promotion chances (Useem and Karabel, 1986; Bennett, 2009) but also helps their firms perform better in the stock markets.

To our knowledge, our study is the first to demonstrate that *MAC* is an important managerial characteristic that improves firm value. We investigate how top managers with more prestigious academic backgrounds are related to firm value outside of the financial industry. Furthermore, our study also contributes methodologically to the literature on the effects of managerial characteristics on firm value in two ways. First, our results do not suffer from endogeneity issues, as they are robust even when we estimate a system of simultaneous equations with *Tobin's Q* and *MAC* as endogenous variables. Second, prestigious school education constitutes human capital beyond social capital. The effects of *MAC* on *Tobin's Q* remain significant after controlling for sociopolitical networking.

The rest of the paper is organized as follows. We first review the background information on manager education and describe the data. We then describe the methodology and variables. The empirical results are reported in the following section, followed by the robustness check. The last section summarizes our findings and presents our conclusions.

2. Background Information and Development of Hypotheses

2.1. Higher Education and Prestigious Schools in South Korea

The hierarchy among higher education institutions in South Korea is based on a stable and rigid academic ranking system (Kim, 2004). The ranking of schools is based on admitted students' scores on the Korean government-administered annual College Scholastic Ability Test that all students are required to take if they plan to apply to college. With few exceptions, top-ranking schools have successfully recruited the highest-scoring students in this college admission test. Students in these schools had admission test scores within the top 1.5%, even as the number of universities increased from 160 in 1970 to 340 in 2013. The ranking of schools based on students' academic scores has not changed much over time. The average test scores of students admitted to each university have not differed significantly from past scores over the past 10 years (Kim, 2004).

Additionally, per-capita spending by schools on students at top-ranking colleges is higher, and their faculties produce more research output than those at less selective schools (Lee *et al.*, 2003). Table 1 shows that graduates from prestigious universities comprise a large proportion of the leaders in Korea, including legal professionals, high-level government officials, and high-level managers in the private

Table 1 Characteristics of elite schools in Korea (unit: %, persons, number)

Table reports the characteristics of top colleges with high average admission test scores. The sample consists of data from 124 Korean universities. We divide universities by the deciles of admission percentile scores administered by the Korean government for the year 2000. The values of each variable are adjusted according to the total number of students in each university. *Admission test score* is the average percentile test score of entering students in each group. *Influential graduates* is the number of alumni whose information is included in the databases of four daily newspapers as of August 2001. *Success in national exams* is the number of graduates who passed the National Bar Examination or National Civil Servants Examination in 2000.

	Admission test score	Influential graduates	Success in national exams
Top school	99.5	102,934	419.0
Top 2–5 schools	98.7	39,343	173.6
1st decile (Excluding top 1–5)	97.8	40,914	177.1
2nd decile	92.5	11,551	19.8
3rd decile	87.7	5,733	7.0
4th decile	82.1	2,366	1.4
5th decile	78.2	3,775	1.3
6th decile	74.3	2,899	1.3
7th decile	68.6	755	0.0
8th decile	62.3	486	0.0
9th decile	55.4	861	0.1
10th decile	41.2	115	0.0
Overall mean of all universities	73.9	5,777	16.4

sector (Lee *et al.*, 2003). With a larger network of influential people, top managers from prestigious schools have access to more expansive resources through this network of relationships.

Figure 1 shows the proportions of managers and government ministers from elite schools at the beginning of each year from 1990 to 2006. The proportion of government ministers from elite schools reached its peak (83%) during President Kim Young Sam's administration in the mid-1990s, and fell below 50% after the economic crisis of 1997–1998. This decline suggests that the influence of top school graduates on government policies also fell during this period. On the other hand, the ratio of top managers from the top universities has been stable during this same period: about 50% of the top managers are from the top five prestigious schools. The lack of a direct relationship between the two ratios suggests that firms do not simply appoint managers from top universities for their access to sociopolitical networks.

2.2. Managers' Prestigious Schooling

Firms often use the academic ranks of the alma maters of the managers as a screening device because these ranks can signal managers' ability (Becker, 1964; Arrow, 1973; Spence, 1973). While employers do not fully know the management ability of

Figure 1 Trends in the proportion of cabinet members and managers, segregated by alma mater

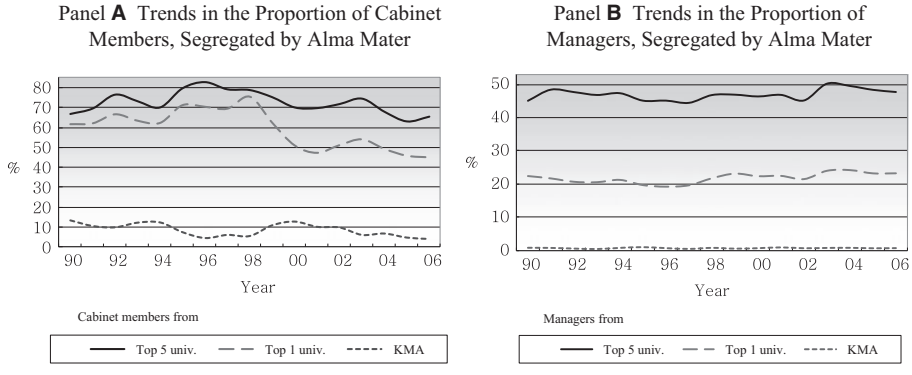

Figure shows the trends in the proportion of cabinet members to the total number of ministers (Panel A), and top managers to the total number of managers (Panel B), and their alma maters. KMA stands for the Korea Military Academy. Data are from 1990 to 2006 and are plotted at the beginning of each year, respectively.

job seekers due to information asymmetry between job seekers and employers, job seekers' academic credentials signal their managerial ability, according to job market signaling theory (Spence, 1973). Academic credentials can also signal managers' unobserved attributes such as motivation and perseverance (Arkes, 1999) or social capital (Helliwell and Putnam, 2007).

Academic credentials are linked to work performance. Graduates from higher ranked educational institutions earn higher income (Juhn *et al.*, 1993). Useem and Karabel (1986) find that managers with a degree from top-ranked universities are more likely to get promoted, and Bennett (2009) finds that senior marketing managers who graduated from elite schools are more likely to be on a BOD. In the financial industry, fund managers with more prestigious academic backgrounds tend to have better stock-picking skills and outperform other fund managers (Chevalier and Ellison, 1999; Gottesman and Morey, 2006). In short, extant studies show that graduates with better academic credentials outperform those without such credentials.

2.3. Management Academic Credentials and Firm Value

As managers' academic credentials are part of a firm's "human capital", they can improve firm performance. According to the resource-based view of a firm, a firm's competitive advantage is determined by several resources, including managerial human capital, organizational capital, and physical capital (Penrose, 1959). Top managers' managerial human capital can improve firm value because important organizational outcomes often reflect characteristics of firms' top managers (Hambrick and Mason, 1984).

In short, superior *MAC* are valuable, rare, inimitable, and nonsubstitutable, and in listed firms, less than half of managers are considered to have superior academic credentials (see Section 3).

Hypothesis 1: Firms with a higher portion of managers from academically prestigious universities show higher firm value; firms with high *MAC* improve *Tobin's Q*.

2.4. Management Academic Credentials in Turbulent Corporate Environments

Unlike stable markets, top managers in volatile environment markets experience less predictable outcomes. For example, financially distressed firms deal with creditors while outcomes become less predictable with vulnerable financial conditions and weak earnings. In addition, firms with high research and development (R&D) industries might face competitors with newer technology.

In highly volatile environments, effective dynamic capabilities rely less on existing knowledge and more on rapidly creating idiosyncratic, firm situation-specific new knowledge and experience within various market conditions (Eisenhardt and Martin, 2000). Top managers' higher education level or heterogeneity in education specialty often helps top managers develop corporate strategies to address corporate challenges (Wiersema and Bantel, 1992).

We hypothesize that TMTs with superior human capital can help their firms economically outperform other firms managed by colleagues without such abilities in turbulent environments. Specifically, the relation between *MAC* and firm value might be stronger when a firm faces (i) great risks or volatility, (ii) higher growth opportunities, or (iii) financial distress.[5]

Hypothesis 2: The positive relation between *MAC* and firm value is larger when the business environment is more challenging.

2.5. Management Human Capital and Managerial Discretion

Top managers often have discretionary power to decide on the adoption of a policy and the timing of its implementation. However, top managers do not always have complete discretion or latitude of action. When managers have limited discretion, managerial predispositions become less important and environmental and organizational factors become more significant in influencing corporate strategy and firm performance (Hambrick and Finkelstein, 1987).

Managers with large inside ownership are less likely to be subject to board monitoring. Managers with large inside ownership can have more discretionary power

[5]One might raise questions about what led to distress and why the superior managerial team allowed this to happen. However, on this point, we believe that even the firms with a superior managerial team may face crises, so what matters for capable top managers is how skillfully they turn the crisis situation around, and academic credentials may corroborate such ability.

and can pursue their own interests and preferences. Top managers in stand-alone firms have a greater decision-making scope than those in business group-affiliated firms whose group headquarters often make decisions for the group-affiliated firms (Morck *et al.*, 2005). Similarly, *chaebol* headquarters (large business groups in Korea), rather than the managers of each affiliated firm, make the important financing and investment decisions for the group (Joh, 2003; Joh and Kim, 2013). Top managers of each subsidiary follow the group headquarters' decisions, and only have limited discretion with regard to their own firm.

In summary, we hypothesize that *MAC* enhancing TMTs' human capital are more likely to affect firm value when a TMT has greater discretionary power and scope due to organizational structure, or due to their large ownership.

Hypothesis 3: The positive effects of *MAC* on firm value (*Tobin's Q*) are larger in a firm where top managers have more discretionary power.

3. Data

We obtained data from two sources. With the help of the Korea Listed Companies Association and Korea Information Service, Inc., we hand-collected information on age, educational backgrounds, titles, ranks within a company, and career paths for top managers. Using FnDataguide, we also collected accounting data on publicly traded, non-financial firms. From the latter, we selected all firms with information on the size and composition of TMTs for more than two years.

Our final data set includes information on 72,165 top managers, as well as financial information for 590 unique firms gathered from 1990 through 2006; a total of 7,100 firm-years are represented in our data set. Top managers are those holding positions as CEOs and senior executives in a firm. Table 2 summarizes the trends of TMT attributes and firm financial characteristics over the sample period in our study. Of all the TMTs in our data, 47% graduated from one of the top five universities, and 22% graduated from the top university (i.e., Seoul National University). These percentages remained nearly constant during the sample period. Table 2 also shows the means of *TMT size*, *TMT age*, *TMT tenure*, *TMT years of education*, and *TMT expertise* across the firms in a given year. *TMT size* is the number of top managers in a firm, so the mean *TMT size* is the mean number of top managers across the firms in a given year. *TMT age* is the mean age of the top managers in the TMT, *TMT tenure* the mean working years for the top managers as a TMT, *TMT Years of education* the mean years of attending college or graduate school for the top manages, and *TMT expertise* a dummy that takes the value 1 when a firm has a financial expert who is a Certified Public Accountant (CPA)/Certified Financial Analyst (CFA) or a lawyer in the TMT.

During the sample period, mean *TMT size* decreased, while mean *TMT age* increased. After corporate restructuring that requires proportional outside directors following the financial crisis, mean *TMT size* fell substantially. Mean *tenure*, mean

Table 2 The trend of TMT characteristics and financial characteristics

Table reports the annual trends of the number of firms, the characteristics of top managers in TMTs, and financial characteristics of the sample firms. We hand-collected information from 590 firms on age, educational background, title, ranking within a company, and career paths for each top manager from 1990 to 2006, a total of 7,100 firm-years. *TMT size* is the mean number of top managers across firms for a given year. *TMT age* is the mean age of top managers in TMT across firms. *TMT tenure* is the years of working as a TMT. *TMT years of education* is the years of attending college or graduate school. *TMT expertise* is a dummy that takes the value 1 when a firm has a financial expert who is CPA/CFA or has a lawyer in the TMT. *TMT from top 5* (*or top*) *schools* measures the ratio of top managers who graduated from one of the top five universities (or the top university) within a firm TMT. See Table 3 for exact definitions of the variables.

Year	Number of firms	*TMT size*	*TMT age*	*TMT tenure*	*TMT years of education*	*TMT expertise*	*TMT from top 5 schools*	*TMT from top school*	*Volatility*	*Sales growth rate*	*Financial distress*
1990	293	12.1	50.9	5.37	3.78	0.14	0.45	0.22	0.35	0.14	0.14
1991	312	11.8	51.1	5.45	3.97	0.14	0.48	0.22	0.33	0.15	0.16
1992	314	12.0	51.4	5.31	3.98	0.15	0.48	0.21	0.54	0.15	0.21
1993	326	12.6	51.6	5.23	3.99	0.15	0.47	0.20	0.43	0.12	0.25
1994	349	12.5	51.9	5.28	3.91	0.15	0.47	0.21	0.48	0.12	0.24
1995	370	12.3	52.1	5.25	3.96	0.16	0.45	0.20	0.43	0.14	0.23
1996	397	11.9	52.3	5.14	3.99	0.17	0.45	0.19	0.50	0.18	0.25
1997	435	12.7	52.2	5.04	4.08	0.17	0.44	0.20	0.82	0.16	0.38
1998	432	11.4	52.9	4.99	4.06	0.17	0.47	0.22	0.93	0.09	0.47
1999	415	12.9	52.8	4.96	4.01	0.17	0.47	0.23	0.75	0.08	0.43
2000	425	9.4	53.4	4.97	4.03	0.17	0.46	0.22	0.79	0.08	0.40
2001	441	9.0	54.1	5.10	4.04	0.18	0.47	0.22	0.58	0.10	0.38
2002	493	8.2	54.6	5.13	4.04	0.18	0.45	0.21	0.60	0.06	0.42
2003	502	8.0	54.8	5.09	4.05	0.17	0.50	0.24	0.48	0.05	0.40
2004	516	8.0	55.3	5.11	4.07	0.19	0.50	0.24	0.45	0.09	0.34
2005	538	8.0	55.1	5.06	4.10	0.18	0.48	0.23	0.51	0.08	0.32
2006	542	8.0	55.5	5.02	4.11	0.18	0.48	0.23	0.43	0.07	0.31
Mean		8.7	52.7	5.28	4.02	0.17	0.47	0.22	0.56	0.10	0.28

Years of education, and mean *Expertise in finance or law* are stable over time. For the period of the Asian financial crisis, *Volatility* and *Financial distress* increased, while *Sales growth rate* decreased.

Among top managers, women account for a mere 1.8% in 2006 and ethnic non-Koreans for 0.65% in 2011 (Korea Listed Companies Association, 2012). Owing to the small share of women or ethnic non-Koreans in the TMT, we do not consider gender or ethnic minority issues.

4. Methodology and Variables

To test Hypothesis 1, we examine whether top managers' *MAC* are reflected in *Tobin's Q* using the following equation[6] :

$$Tobin'sQ = \beta_0 + \beta_1 MAC + \beta_2 TMT\ Variables + control\ variables. \quad (1)$$

In equation (1), the dependent variable is *Tobin's Q*, the ratio of the stock market value of a firm's assets over the firm's replacement cost. Owing to the difficulty associated with calculating replacement costs, we use the book value of assets. Many researchers have used *Tobin's Q* as it is closely related to shareholder payoff (Morck *et al.*, 2005). As profit sharing through stock options and stock grants is not common in non-financial firms in Korea (Cin *et al.*, 2003), our *Tobin's Q* values are based on firm value after deducting management compensation.

As part of our robustness tests, we use an *industry-adjusted Tobin's Q* which is a firm's *Q* minus the industry median *Q* based on a two-digit industry classification in a given year as a dependent variable to control for the market structural effects in *Tobin's Q*. Monopolistic firms have a higher value than those in the competitive market. In addition, we also use two alternative dependent variables: the *industry-adjusted sales growth rate* (a firm's sales growth minus industry median sales growth) and *R&D ratio* (R&D expenditure to total assets).

Management academic credentials (*MAC*) is the ratio of managers who graduated from one of the top five universities divided by the total number of TMTs at a given firm at an annual regular shareholders' meeting. Other TMT characteristics include *TMT size, TMT age, TMT tenure*, *TMT years of education*, and *TMT expertise in finance/law*. These variables are defined in Table 2. In most firms, top managers are appointed early in the year during the annual shareholders' meetings and *Tobin's Q* presents the market value of the common stocks at the end of a year. Thus, this regression investigates the one-year lag effect of *MAC* on firm value.

[6]One might wonder if a different approach could further corroborate the results. Specifically, if academic credentials are indeed value-relevant, the market should react positively to the announcement of the appointment of managers with such credentials. We were able to confirm positive market reactions to the announcement of the appointment of CEOs who graduated from the top schools through case studies on several firms.

Following Yermack (1996), we control for financial factors on *Tobin's Q* by using *Firm size, Leverage, Capital expenditure, ROA, Financial distress,* and *Sensitivity to market risk*. *Firm size* is the natural logarithm of total assets, *CAPEX/Assets* the ratio of capital expenditures to total assets, *Leverage* the ratio of total debt to total assets, *ROA*[7] the ratio of earnings before interest and taxes (EBIT) to total assets, and *Distressed dummy* a dummy that equals 1 when a firm has suffered ordinary income losses in the past three years or equity losses in a given year (Hoshi *et al.*, 1990). Risk is measured through *Sensitivity to market risk,* that is, *beta,* which is an estimate from the market model where the firm's monthly returns over the past year are regressed on the KOSPI's monthly returns.

Non-financial factors, such as ownership and organizational structure, also affect *Tobin's Q*. Ownership concentration can increase firm value by mitigating agency problems (Jensen and Meckling, 1976). To avoid a causality problem where ownership may depend on firm performance (Demsetz and Lehn, 1985), we use the lagged values of *Largest shareholder's ownership* and *Management ownership*. We also control for *chaebol*-affiliated firms, which affect firm value (Joh, 2003). *Chaebol dummy* is 1 for firms belonging to one of the 50 largest business groups based on the Korea Fair Trade Commission classification, and 0 otherwise. We also include firm dummies to control for observed and unobserved time-invariant firm-fixed effects, or the two-digit primary Standard Industrial Classification (SIC) code dummies to control for *Industry*-fixed effects. We also include *Year* dummies to account for economy-wide shocks in the market.

To test how the effects of *MAC* vary across corporate environments, we include interaction terms of *MAC* with corporate environment variables.

$$\begin{aligned} Tobin'sQ = {} & \gamma_0 + \gamma_1 MAC + \gamma_2 TMT\ Variables + \gamma_3 MAC * Corporate\ environments \\ & + \gamma_4 Corporate\ environments + control\ variables \end{aligned} \quad (2)$$

To test Hypothesis 2, we use two volatility measures: *Sensitivity to market risk* and *Return volatility* as a proxy for a turbulent, volatile corporate environment. *Return volatility* is measured by the annualized standard deviation of daily returns during the year. Growth options are measured by the *sales growth rate* and by the expenditures on *R&D* activities over assets, following Billett *et al.* (2007).

To examine the mediating effects of managerial discretion as discussed in Hypothesis 3, we use *chaebol* dummy and TMT ownership structure as a proxy for the condition that TMTs are granted more discretion for their decision making.

Before conducting our analyses, we address the issue of the ex-ante direction of causality between *MAC* and firm performance in three ways. First, we examine how

[7]ROA captures profitability that is likely to affect *Tobin's Q*. Choi *et al.* (2007) and Black and Kim (2012) use *Tobin's Q* not ROA as a dependent variable to study the relationship between firm managers and firm value.

the change of *MAC* between $t-1$ and t (representing differences of old versus new managers within a firm) affects future firm value, after controlling for firm-fixed effects. Second, we examine how the magnitude of changes in *MAC* affect future performance. Based on the changes from $t-1$ to t, we divide the sample firms into three equal-sized groups: those with the largest, medium, and smallest changes in *MAC*. Third, we develop a system of simultaneous equations with *Tobin's Q* and *MAC* as endogenous variables, including variables that affect firms' choice of managers as instruments in the moment conditions, which are *Firm's popularity*, *Top school admission rate*, and *Geographic proximity*. We employ the generalized method of moments (GMM) instead of 2SLS as errors might be heteroskedastic and/or auto-correlated (Kennedy, 2003).

$$MAC = g(Firm's\ popularity, Top\ school\ admission\ rate, Geographic\ proximity, TMT\ Variables, control\ variables) + \varepsilon, \quad (3)$$

$$Tobin'sQ = f(Predicted\ MAC, TMT\ Variables, control\ variables) + \varepsilon. \quad (4)$$

Identifying equations (3) and (4) requires the assumption of heteroskedastic errors. We therefore first implement the White (1980) test for homoskedasticity of the error term. *Firm's popularity* is a dummy variable for the top 30 firms reported as "best workplaces",[8] controlling for the notion that popular firms can recruit more managers from prestigious colleges. *Top school admission rate* is the ratio of the total number of freshmen at the top five universities divided by the total number of high school graduates when each manager was 18 years old. This variable varies each year as illustrated in Appendix, due to the changes in the number of students admitted and the number of birth year cohorts. It reflects that a firm's likelihood of appointing top managers from the top five universities might be associated with the supply of such managers in the market. As a TMT consists of managers of various birth years, we use the mean *Top school admission rate* for each firm. *Geographic proximity* is the mean geographical distance from top managers' hometowns to Seoul, where the top five universities are located. According to Card (2001),[9] distance indicates that managers had to incur an additional cost to attend college away from where they grew up. Some smart managers chose a college close to home rather than a top school in Seoul so that they could continue living with their families due to either economic hardship or the cost of room and board in

[8]Firms are selected by three representative Korean job-listing companies based on their annual surveys of job seekers, workers, and students at the top five colleges. These three representative firms are JobKorea Co., Incruit Co., and Recruit Co.

[9]Card (2001) uses the distance to college as an instrumental variable for education decision, which is correlated with unmeasured factors (e.g., ability) when estimating the effect of education (years of schooling) on wages.

the city during college years.[10] This is an important variable considering Korea's poor economic position during the 1970s and 1980s, the time in which many of the managers in our sample grew up.

Table 3 lists the descriptions and Table 4 summarizes the statistics and correlation matrix of variables. *Tobin's Q* is the ratio of a firm's market value to the replacement cost of that firm's assets. We observe that the mean value of *Tobin's Q* is 1.00.

5. Empirical Results

5.1. Basic Results: Effects of *MAC* on Firm value—Hypothesis 1

Table 5 shows that *MAC* has a significant, positive effect on *Tobin's Q* after controlling for other financial and non-financial factors, supporting Hypothesis 1. We can gauge the economic magnitude of *MAC* from column (2). In column (2) of Table 5, the magnitude of *MAC* is 0.083, which means that a one-percentile increase in *MAC* will increase the number of *Tobin's Q* by 0.084, on average, all else being equal. Because the mean value of *Tobin's Q* is 1, it means an 8.4% increase in the market value of the firm, all else being constant, which shows the large economic magnitude of *MAC*. In column (3), we use all the independent variables including *MAC* as one-year-lagged values for a sensitivity analysis, which shows similar results. Column (4) shows that the result holds even when we control for firm-fixed effects[11] and cluster the error terms at both the firm and year levels. In these regressions, *ROA*, *Leverage*, and *Ownership concentration* are also positively related to *Tobin's Q*. On the other hand, *Firm size*, *Financial distress*, *TMT size*, and *TMT age* are negatively related to *Tobin's Q*. *Chaebol* dummy was not significant.

5.2. Endogeneity Issues

5.2.1. Changes in MAC and Future Firm Value.

Panel A of Table 6 shows the effect of changes in *MAC* on changes in firm value. A positive and significant coefficient of changes in *MAC* suggests that an increase in *MAC* resulting from management turnovers leads to an increase in firm value, after controlling for the possibility of unobservable time-invariant firm-fixed effects on performance.

Panel B shows how the magnitude of changes in *MAC* affect *Tobin's Q* when sample firms are divided into three equal-sized groups. *Tobin's Q* improved in the group with the greatest change, but dropped in the group with the smallest change.

[10]Considering that per capita GNI was about KRW90,000 (about US$80) when a representative top manager was 18 years old, the cost of attending college was a major concern in the 1970s.

[11]Given that we are essentially analyzing cross-section panel data, we might violate the independence assumption of ordinary least squares (OLS) tests. To alleviate this concern, we include "firm fixed effects" (a dummy variable for each firm) in all our main models.

Table 3 Description of variables

Variable	Description
Dependent variables	
Tobin's Q	The ratio of the market value of common stock and the book value of preferred stock and total debts, divided by the book value of total assets
Industry-adjusted Tobin's Q	A firm's *Tobin's Q* minus the industry median *Tobin's Q* based on a two-digit industry classification in a given year
Industry-adjusted sales growth	A firm's sales growth rate minus the industry median sales growth based on a two-digit industry classification in a given year
R&D	R&D expenses over total assets
Test variables	
MAC	Management academic credentials measured through the percentage of top managers within a firm who graduated from one of the top five universities to the total number of top managers
MAC_top1	The percentage of top managers within a firm who graduated from the top university to the total number of top managers
MAC_KMA	The percentage of top managers within a firm who graduated from the KMA to the total number of top managers
Instrument variables	
Firm age	The natural logarithm of firm age
Firm's popularity dummy	=1 if a firm is one of 30 firms preferred by job seekers, 0 otherwise
Top 5 school admission rate	Firm-level average of the total freshman intake of the top five schools divided by the number of high school graduates when each top manager was 18 years old
Geographic proximity	The ratio of top managers who were born in the same city where the top five schools are located
Control variables	
TMT size	The natural logarithm of the total number of top managers in a firm
TMT age	The natural logarithm of the mean age of a top management team
TMT tenure	The years of working as a TMT
TMT education years	The years of attending college or graduate school
TMT expertise dummy	=1 if a firm has a CPA/CFA or a lawyer in the TMT, 0 otherwise
Firm size	The natural logarithm of total assets
ROA	The ratio of EBIT to beginning total assets

Table 3 (*Continued*)

Variable	Description
Leverage	The ratio of total debt to total assets
CAPEX/Assets	The ratio of capital expenditures to total assets
Distressed dummy	=1 if a firm experienced ordinary income losses in the past three years, or an equity loss in the given year, 0 otherwise
Sensitivity to market risk (*beta*)	The estimate from the market model in which the firm's monthly returns over the past year are regressed on the KOSPI monthly returns
Return volatility	The annualized standard deviation of daily returns during the year
Sales growth	The net sales growth rate between year t and year $t - 1$
Chaebol dummy	=1 if a firm belongs to one of the 50 largest *chaebols* according to the Korea Fair Trade Commission, 0 otherwise
Largest ownership	A lagged value of the percentage shareholding of the largest shareholder
TMT ownership	A lagged value of the percentage of common stocks owned by the top managers
Governance	The natural logarithm of combined scores by the Korea Corporate Governance Service based on shareholder rights, board structure, audit committees, and ownership parity for the period between 2002 and 2006
Governance A	The natural logarithm of governance scores excluding board related items
Political network_top5	The proportion of ministers who graduated from the top five universities in the cabinet at the beginning of each year
Political network_top1	The proportion of ministers who graduated from the top university in the cabinet at the beginning of each year
Political network_KMA	The proportion of ministers who graduated from the KMA in the cabinet at the beginning of each year

The mean value and the median value of changes in *Tobin's Q* from t to $t + 1$ in the group with the greatest change are 4.3 and 1.9%, respectively. The differences of group-means (group-medians) of changes in *Tobin's Q* are significant when the Student's t-test (the Wilcoxon–Mann–Whitney test) is used.

In addition, we run simple OLS regressions of *Tobin's Q* on a constant term and lagged value of *MAC* in each group. Its coefficient is significant and positive for the group with the greatest change in *MAC*, while the coefficient for the group

Table 4 Descriptive statistics for sample firms for 1990–2006

The variables are described in Table 3. Pearson correlations appear below the diagonal. Correlations in bold are significant at a 5% level (two-tailed).

	1st *Q*	Mean	3rd *Q*	Std.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Non-financial firms (N = 7,100)																		
(1) Tobin's Q	0.77	1.00	1.11	0.47	1													
(2) Industry adj. Tobin's Q	−0.01	0.23	0.42	0.38	**0.70**	1												
(3) Industry adj. sales growth	−0.08	−0.01	0.06	0.18	**0.07**	**0.06**	1											
(4) R&D (N = 5,909)	0.01	0.01	0.01	0.02	**0.22**	**0.20**	**0.04**	1										
(5) MAC	0.27	0.47	0.67	0.27	**0.04**	**0.03**	**0.04**	**0.08**	1									
(6) MAC_top1	0.00	0.22	0.33	0.22	**0.06**	**−0.16**	**0.05**	**0.06**	**0.67**	1								
(7) MAC_KMA	0.00	0.01	0.00	0.04	−0.01	0.06	−0.03	−0.01	**−0.09**	**−0.04**	1							
(8) Firm age	3.10	3.33	3.67	0.57	**−15**	**−13**	**−10**	**−0.08**	**0.10**	**0.06**	0.01	1						
(9) Firm's popularity	0.00	0.08	0.00	0.27	**0.07**	**0.08**	0.05	**0.05**	**0.16**	**0.14**	−01	**0.03**	1					
(10) Top school admission rate	0.05	0.06	0.06	0.01	**0.09**	**0.11**	0.06	**0.15**	0.01	−0.02	−0.01	**0.07**	0.01	1				
(11) Geographic proximity	0.00	0.18	0.25	0.29	**−0.07**	−0.05	**−0.08**	**0.08**	**0.14**	**0.10**	**−0.03**	**0.11**	**0.05**	**0.08**	1			
(12) TMT size	1.80	2.16	2.40	0.51	0.01	0.01	**0.11**	**−0.08**	**0.18**	**0.15**	−0.02	**0.14**	**0.23**	**−0.24**	**−0.11**	1		
(13) TMT age	3.92	3.97	4.03	0.10	**−0.22**	**−0.20**	**−0.05**	**−0.04**	**0.03**	**0.06**	0.02	**0.21**	−0.02	**−0.53**	**0.14**	**−0.04**	1	
(14) TMT tenure	2.09	5.28	7.01	4.46	−0.02	−0.01	0.01	**0.06**	**0.30**	**0.25**	−0.01	**0.07**	**0.07**	**0.03**	**0.11**	0.02	**0.06**	1
(15) TMT education years	3.64	4.02	4.41	2.11	**−0.03**	**−0.04**	0.01	0.05	**0.27**	0.17	0.01	**0.09**	**0.05**	0.02	**0.10**	0.04	0.05	**0.48**
(16) TMT expertise dummy	0.00	0.17	0.00	0.31	0.02	0.02	0.02	0.03	**0.31**	**0.46**	−0.01	0.02	0.02	**−0.08**	**0.10**	**0.12**	**0.08**	**0.33**
(17) Firm size	4.28	5.24	6.14	1.58	**−0.06**	**−0.05**	**0.07**	−0.01	**0.34**	**0.33**	0.01	**0.31**	**0.38**	−0.01	**0.20**	**0.49**	**0.20**	**0.14**
(18) ROA	0.01	0.02	0.06	0.12	**−0.10**	0.13	**0.15**	**−0.05**	0.02	**0.03**	0.01	**−0.06**	0.02	**−0.09**	**0.08**	**0.03**	**0.12**	0.01
(19) Leverage	0.42	0.63	0.71	0.50	**0.31**	**0.30**	−0.01	**−0.07**	−0.01	−0.01	**0.05**	**0.03**	**0.07**	**−0.11**	**−0.13**	**0.15**	**−0.16**	**−0.06**
(20) CAPEX/Assets	0.01	0.06	0.08	0.26	0.02	0.03	**0.09**	−0.01	0.02	**0.03**	−0.01	**−0.07**	**0.04**	**−0.08**	−0.02	**0.05**	0.02	−0.01
(21) Distressed dummy	0.00	0.28	1.00	0.45	0.02	0.03	**−0.19**	**0.06**	**−0.05**	**−0.04**	**0.06**	**0.11**	**−0.04**	**0.19**	**−0.01**	**0.05**	**−0.11**	−0.01
(22) Sensitivity to market risk	0.49	0.76	1.04	0.44	**0.06**	0.05	**0.05**	**0.09**	**0.07**	**0.06**	0.01	−0.01	**0.11**	**0.03**	0.01	**0.15**	**−0.05**	0.02
(23) Return volatility	0.38	0.56	0.69	0.26	**0.11**	**0.13**	**−0.12**	**0.03**	**−0.09**	**−0.07**	0.02	**−0.03**	**−0.05**	**0.19**	−0.02	**−0.13**	**−0.18**	**−0.05**
(24) Sales growth	0.02	0.10	0.17	0.24	**0.08**	**0.07**	**0.90**	**0.06**	**0.04**	**−0.07**	0.02	**−0.04**	**−0.06**	**0.21**	0.01	**0.09**	**−0.06**	0.02
(25) Chaebol dummy	0.00	0.19	0.00	0.39	0.01.	0.07	**0.04**	0.01	**0.26**	**0.24**	**0.03**	**,12**	**0.30**	**−0.06**	**0.13**	**0.26**	**0.07**	**0.08**
(26) Largest ownership	0.19	0.30	0.42	0.17	**−0.09**	**−0.08**	−0.02	**−0.05**	**−0.06**	**−0.03**	−0.02	**−0.11**	**−0.14**	**0.03**	**0.04**	**−0.18**	**0.12**	−0.02
(27) TMT ownership (N = 3,743)	0.00	0.14	0.24	0.14	**−0.14**	0.02	0.04	**−0.04**	**−0.17**	**−0.15**	0.02	**−0.09**	**−0.18**	**−0.08**	−0.03	**−0.06**	**0.06**	**−0.04**

Table 4 (*Continued*)

	1st *Q*	Mean	3rd *Q*	Std.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(28) Governance (*N* = 2,164)	4.58	4.70	4.80	0.21	**0.12**	**0.13**	**0.10**	**0.09**	**0.29**	**0.31**	−0.03	−0.02	**0.35**	**−0.12**	**0.19**	**0.31**	**0.13**	**0.16**
(29) Governance A (*N* = 2,164)	4.19	4.54	4.65	0.19	**0.11**	**0.09**	**0.07**	**0.08**	**0.28**	**0.27**	−0.05	−0.05	**0.36**	**−0.13**	**0.17**	**0.30**	**0.16**	**0.18**
(30) Political network_top5	0.68	0.73	0.79	0.06	**−0.03**	**−0.03**	**0.08**	**−0.05**	−0.02	−0.04	0.03	**−0.06**	0.02	0.06	0.09	**0.20**	**−0.12**	−0.02
(31) Political network_top1	0.49	0.58	0.67	0.10	**0.08**	**0.07**	**0.14**	**−0.09**	**−0.03**	**−0.04**	0.03	**−0.07**	0.03	0.07	0.06	0.32	**−0.22**	**−0.08**
(32) Political network_KMA	0.06	0.08	0.11	0.03	−0.01	−0.01	**0.03**	**−0.09**	−0.01	−0.02	0.01	**−0.06**	0.04	0.03	0.06	**0.14**	**−0.17**	**−0.03**

	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)
(15) TMT education years	1																	
(16) TMT expertise dummy	**0.28**	1																
(17) Firm size	**0.10**	**0.16**	1															
(18) ROA	0.03	**0.03**	**0.09**	1														
(19) Leverage	−0.03	−0.01	**0.07**	−0.32	1													
(20) CAPEX/Assets	−0.03	**0.03**	**0.05**	**0.04**	−0.02	1												
(21) Distressed dummy	−0.08	**−0.04**	**−0.08**	**−0.31**	0.28	**−0.08**	1											
(22) Sensitivity to market risk	0.03	**0.03**	**0.23**	**−0.19**	**0.10**	−0.02	**0.07**	1										
(23) Return volatility	**−0.04**	**−0.05**	**−0.12**	**−0.07**	**0.24**	**−0.07**	**0.39**	**0.29**	1									
(24) Sales growth	0.03	**0.03**	**0.08**	**0.11**	0.01	**0.07**	**−0.15**	**0.06**	**−0.08**	1								
(25) Chaebol dummy	**0.06**	**0.16**	**0.45**	0.02	**0.08**	**0.05**	**−0.05**	**0.13**	**−0.07**	**0.05**	1							
(26) Largest ownership	−0.03	**−0.03**	**−0.11**	**0.12**	**−0.18**	**0.03**	**−0.05**	**−0.17**	**−0.05**	**−0.03**	**−0.06**	1						
(27) TMT ownership (*N* = 3,743)	−0.02	**−0.08**	**−0.29**	**0.09**	**−0.21**	0.02	**−0.14**	**−0.16**	**−0.16**	0.05	**−0.18**	**0.24**	1					
(28) Governance (*N* = 2,164)	0.10	**0.19**	**0.63**	**0.26**	−0.02	0.03	**−0.25**	**0.21**	**−0.23**	**0.11**	**0.32**	**−0.16**	**−0.13**	1				
(29) Governance A (*N* = 2,164)	**0.14**	**0.17**	**0.61**	**0.28**	−0.02	0.05	**−0.21**	**0.23**	**−0.22**	**0.06**	**0.30**	**−0.17**	**−0.15**	**0.82**	1			
(30) Political network_top5	−0.04	**0.06**	**−0.02**	**−0.04**	**0.19**	**0.03**	**0.03**	**0.18**	**0.23**	**0.06**	−0.01	**−0.10**	0.04	0.07	0.07	1		
(31) Political network_top1	−0.07	**0.06**	**−0.10**	**−0.06**	**0.30**	**0.08**	**−0.03**	**0.16**	**0.19**	**0.10**	−0.01	**−0.14**	0.03	0.08	0.06	**0.80**	1	
(32) Political network_KMA	**−0.05**	**−0.05**	**−0.11**	**0.04**	**0.12**	0.01	**−0.04**	**−0.16**	−0.01	0.02	0.01	**−0.06**	0.05	0.06	0.06	**−0.13**	**0.05**	1

Table 5 Management academic credentials and firm value

This table presents linear OLS regression analyses of firm performance on *Management academic credentials* and other firm characteristics between 1990 and 2006. *MAC* is the proportion of managers within a firm who graduated from the top five universities. Firm performance is measured as *Tobin's Q*, which is the market value of common stock and the book value of preferred stock and total debts, divided by the book value of total assets. Columns (1), (2), and (3) show the results of basic regressions and column (4) controls for firm-fixed effects. In column (3), all the independent variables including *MAC* are lagged one year at $t-1$. See Table 3 for exact definitions of the variables. Standard errors are shown in parentheses under parameter estimates. We correct the standard errors for heteroskedasticity and double-cluster the errors at the firm and time levels. Levels of significance are indicated by ***, **, and * for 1, 5, and 10%, respectively.

	Tobin's Q			
Variable	(1)	(2)	(3)	(4)
MAC	0.085***	0.083***	0.068***	0.058***
	(0.019)	(0.019)	(0.018)	(0.024)
TMT size	−0.024*	−0.026**	−0.022*	−0.067***
	(0.013)	(0.013)	(0.012)	(0.014)
TMT age	−0.521***	−0.592***	−0.586***	−0.319***
	(0.055)	(0.053)	(0.055)	(0.061)
TMT tenure	−0.223*	−0.217	−0.199	−0.202
	(0.129)	(0.134)	(0.131)	(0.130)
TMT education years	−0.187	−0.191	−0.189	−0.194
	(0.118)	(0.121)	(0.119)	(0.120)
TMT expertise dummy	0.054	0.058	0.053	0.069*
	(0.035)	(0.036)	(0.033)	(0.039)
Firm size	−0.020***	−0.021***	−0.020***	−0.106***
	(0.004)	(0.005)	(0.005)	(0.013)
ROA	0.081*	0.069	0.073*	0.199***
	(0.046)	(0.045)	(0.044)	(0.043)
Leverage	0.582***	0.624***	0.546***	0.521***
	(0.021)	(0.021)	(0.024)	(0.061)
CAPEX/Assets	−0.002	−0.006	−0.005	0.026
	(0.019)	(0.019)	(0.017)	(0.020)
Distressed dummy		−0.073***	−0.058***	−0.055***
		(0.012)	(0.018)	(0.012)
Sensitivity to market risk		0.036***	0.023*	0.023*
		(0.014)	(0.013)	(0.013)
Chaebol dummy		0.017	0.018	
		(0.014)	(0.013)	
Largest ownership		0.054*	0.054*	0.056*
		(0.031)	(0.031)	(0.039)
Industry-fixed effects	Yes	Yes	Yes	
Year-fixed effects	Yes	Yes	Yes	Yes
Firm-fixed effects				Yes
Number of firms	7,100	7,100	7,024	7,100
Adjusted R^2	0.299	0.307	0.264	0.401

Table 6 Changes in management academic credentials and *Tobin's Q*

This regression uses 6,396 observations and includes industry dummies and time dummies. Dependent variable is the changes in *Tobin's Q* between t and $t + 1$. All explanatory variables are measured through changes between t and $t - 1$. *MAC* represents management academic credentials, *Age* represents TMT age, *Capex/AT* represents CAPEX/Asset, *Own* means the value of the percentage shareholding of the largest shareholder. See Table 3 for exact definitions of the other variables. We divide the sample firms into three groups: those with the largest, middle, and smallest changes in *MAC* from $t - 1$ to t. The largest group comprises firms with the top one-third changes while the smallest group represents firms with the bottom one-third changes in *MAC*. Means (Median) of change in *Tobin's Q* are the mean (median) value of changes in *Tobin's Q*. Coefficient of *MAC* is derived by regressing *Tobin's Q* on constant term and lagged value of *MAC* in each group. (1) refers to the robust t-values of the mean difference between two groups. (2) refers to Wilcoxon z-score of the median difference between two groups in the Mann–Whitney test. Standard errors are shown in parentheses under parameter estimates. Levels of significance are indicated by ***, **, and * for 1, 5, and 10%, respectively.

Panel A

Change in *MAC*	Change in TMT size	Change in age	Change in firm size	Change in ROA	Change in leverage	Change in Capex/AT	Change in beta	Change in own	Adjusted R^2
0.057**	0.033**	0.035	−0.136***	0.001	0.068***	0.01	−0.038***	−0.004	0.14
(0.025)	(0.016)	(0.062)	(0.024)	(0.001)	(0.026)	(0.015)	(0.011)	(0.047)	

Panel B

	Group of firms with largest changes in *MAC* (*A*)	Group of firms with smallest changes in *MAC* (*B*)	Difference (*A* − *B*)
Mean of changes in *Tobin's Q*	0.043 (0.456)	−0.008 (0.382)	(1) 1.977**
Median of changes in *Tobin's Q*	0.019 (0.437)	−0.008 (0.369)	(2) 1.658*
Coefficient of *MAC* in the simple regression (Dependent variable: *Tobin's Q*)	0.157*** (0.045)	0.028 (0.048)	
Number of observations	2,179	2,179	

with the least change is not significantly positive. These results suggest that an increase in the share of top managers with high academic credentials leads to a higher future firm value.

5.2.2. GMM Methods.

Table 7 shows the results when we estimate a system of simultaneous equations with *Tobin's Q* and *MAC* endogenous variables while employing GMM. Although not listed in this paper due to the space constraint, we obtained similar results when we used 2SLS in our analysis.

The second column in Table 7 shows that *MAC* is higher when: (i) a firm enjoys popularity as a work place; (ii) the top school admission rate is higher; (iii) more managers were born and raised in Seoul; (iv) a firm has a relatively large number of managers; or (v) a firm is affiliated with a *chaebol*. When the *MAC* equation was run simultaneously with the *Tobin's Q* equation, *MAC* appeared to exert a strong and positive effect on firm value. Table 7 shows that the White test statistics decisively reject the null hypothesis of homoskedasticity. A test of over-identifying restrictions (Sargan test) supports the validity of the chosen instrumental variables.[12] We do not report the R^2s for our estimated equations because R^2s reported in the system estimation techniques are not guaranteed to be between zero and one. In short, Table 7 shows that the significant positive correlation between *MAC* and firm value is not only robust, but also consistent with causation running from *MAC* to firm value.

5.3. Effects of *MAC* in Turbulent Environments—Results of Hypothesis 2

Table 8 summarizes the interaction effects of *MAC* with a volatile and uncertain environment. We control for the endogeneity issues in the analyses, and we report the results of the *Tobin's Q* equation. The coefficients of the interaction terms between *MAC* and *Sensitivity to market risk, Return volatility, Sales Growth, R&D over assets*,[13] or *Distressed dummy* are positive. These results indicate that *MAC* has a positive effect on *Tobin's Q* when firms face more risk, enjoy high growth options, or are financially distressed. On the other hand, the coefficients of *MAC* are positive but not always significant, suggesting that *MAC* does not necessarily improve firm value in stable and predictable situations.

5.4. Effects of *MAC* when TMT faces Accountability—Results of Hypothesis 3

Table 9 summarizes the interaction effects of *MAC* with organizational structure and inside management's ownership concentration. (As before, we control for the endogeneity issues in analyses and we report the results of the *Tobin's Q* equation.)

[12]We examine the likelihood that exclusion restrictions are met. We choose to exclude *firm age* and *firm size* from the *MAC* equation model because they do not change any qualitative simulation outcomes.

[13]The results are essentially the same when we use R&D expenditure divided by sales as the R&D variable.

Table 7 Two-equation system by nonlinear GMM

Table estimates the systems of equations by nonlinear GMM, based on 7,100 firm-year observations over the period 1990 to 2006. The dependent variable in column (1) is *Tobin's Q*, the market value of total assets divided by the book value. The dependent variable in column (2) is *MAC*, the ratio of top managers from the top five universities to the total number of top managers. *Firm's popularity* is a dummy variable that takes the value 1 if a firm is one of 30 firms preferred by job seekers or 0 otherwise. *Top school admission rate* is a firm-level average of the total number of freshmen at the top five universities divided by the total number of high school graduates when each manager was 18 years old. *Geographic proximity* is the ratio of top managers who were born in the same geographic area as the top five schools. See Table 3 for exact definitions of the variables. *Industry* and *year-fixed effects* are employed to control for industry and economy-wide shocks. Standard errors are shown in parentheses under parameter estimates. We correct the standard errors for heteroskedasticity and double-cluster the errors at the firm and time levels. Levels of significance are indicated by ***, **, and * for 1, 5, and 10%, respectively.

	Two-equation system	
Variable	Firm value	*MAC*
Tobin's Q		0.058 (0.077)
Firm's popularity		0.051 (0.012)***
Top school admission rate		0.434 (0.263)*
Geographic proximity		0.125 (0.027)***
MAC	2.165 (0.530)***	
TMT size	0.004 (0.037)	0.081 (0.007)***
TMT age	0.027 (0.069)	0.025 (0.039)
TMT tenure	−0.215 (0.144)	0.046 (0.029)
TMT education years	−0.144 (0.108)	0.038 (0.022)*
TMT expertise dummy	0.066 (0.037)*	0.014 (0.008)*
Firm age	0.036 (0.021)	
Firm size	−0.152 (0.034)***	
ROA (%)	0.390 (0.199)**	
Leverage	1.013 (0.217)***	−0.027 (0.052)
CAPEX/Assets	0.018 (0.019)	
Distressed dummy	−0.084 (0.042)**	0.003 (0.016)
Sensitivity to market risk (beta)	0.048 (0.027)*	
Chaebol dummy	−0.198 (0.063)***	0.086 (0.021)***
Largest ownership	0.156 (0.057)***	
Industry-fixed effects	Yes	Yes
Year-fixed effects	Yes	Yes
Number of firms	7,100	7,100
White test	186.41***	192.29***
Sargan test (*p*-value)	0.392	0.749

The coefficients of *MAC* with *Chaebol* are negative and significant. This means, conversely, that the effects of *MAC* in standalone firms are positive, suggesting that managers' *MAC* may improve firm value, when they have more discretion. The coefficient of *MAC* and *TMT ownership* is positive and significant, suggesting that *MAC* becomes important in firms where TMTs have more discretionary power.

Table 8 Impact of volatility, growth options, and distress on effects of management academic credentials

Table reports the cross-sectional differences in the effect of *MAC* on firm value between 1990 and 2006. The dependent variable is *Tobin's Q*, which is the market value of common stock and the book value of preferred stock and total debts, divided by the book value of total assets. *MAC* is the proportion of top managers who graduated from the top five universities. Regressions include interaction terms between *MAC* and *Sensitivity to market risk, Volatility, Growth rate, R&D expenses, and Distressed dummy*. *Sensitivity to market risk* is the estimate from the market model in which the firm's monthly returns over the past year are regressed on the KOSPI monthly returns. *Return volatility* is measured as the annualized standard deviation of daily returns during the year. *Sales growth* is the net sales growth rate between year t and year $t-1$. *R&D* represents the R&D expenses over total assets. *Distressed dummy* is a dummy that takes the value 1 when a firm experienced ordinary income losses in the past three years or an equity loss in the given year, and 0 otherwise. Regressions include the following controlling variables: *TMT size*, *TMT age*, *TMT tenure*, *TMT education years*, *TMT expertise dummy*, *Firm size*, *ROA*, *Leverage*, *CAPEX/Assets*, *Chaebol*, and *Largest ownership*, which are as defined in Table 3. *Year* and *firm-fixed effects* are employed to control for economy-wide shocks and firm-fixed effects. Standard errors are shown in parentheses under parameter estimates. We correct the standard errors for heteroskedasticity and double-cluster the errors at the firm and time levels. We estimate the systems of equations by nonlinear GMM, based on the equations in Table 7 and we report the results of the *Tobin's Q* equation. Levels of significance are indicated by ***, **, and * for 1, 5, and 10%, respectively.

Variable	(1)	(2)	(3)	(4)	(5)
MAC	0.037	0.038	0.068***	0.021	0.081***
	(0.036)	(0.043)	(0.021)	(0.028)	(0.025)
TMT size	−0.022*	−0.024*	−0.020*	−0.29**	−0.017
	(0.012)	(0.013)	(0.012)	(0.012)	(0.013)
TMT age	−0.509***	−0.515***	−0.507***	−0.478***	−0.354***
	(0.052)	(0.055)	(0.056)	(0.053)	(0.054)
TMT tenure	−0.203	−0.212	−0.191	0.112	0.131
	(0.131)	(0.132)	(0.129)	(0.111)	(0.123)
TMT education years	−0.179	−0.182	−0.189	−0.189	−0.194
	(0.121)	(0.120)	(0.118)	(0.124)	(0.111)
TMT expertise dummy	0.057*	0.053	0.042	0.048	0.060
	(0.033)	(0.035)	(0.036)	(0.032)	(0.038)
Sensitivity to market risk (beta)	−0.014		0.023	−0.002	0.018
	(0.026)		(0.014)	(0.018)	(0.014)

Table 8 (*Continued*)

Variable	(1)	(2)	(3)	(4)	(5)
Return volatility		0.363***			
		(0.041)			
Sales growth			−0.017		
			(0.032)		
R&D				1.192	
				(0.810)	
Distressed dummy	−0.067***	−0.114***	−0.070***	−0.071***	−0.073***
	(0.012)	(0.011)	(0.012)	(0.016)	(0.022)
*MAC * Sensitivity to market risk*	0.072*				
	(0.044)				
*MAC * Return volatility*		0.110*			
		(0.067)			
*MAC * Sales growth*			0.159***		
			(0.057)		
*MAC * R&D*				6.734***	
				(1.331)	
*MAC * Distressed dummy*					0.061*
					(0.038)
Other control variables	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes	Yes	Yes
Number of firms	7,100	7,100	7,100	5,909	7,100
Adjusted R^2	0.407	0.421	0.411	0.414	0.413

Table 9 Interaction effects of management academic credentials with business organizations, and TMT ownership on firm value

Table presents the regression results of firm value and management academic credentials using an interaction term between *MAC (Management academic credentials)* and *Chaebol dummy*, or TMT *Ownership* variables between 1990 and 2006. All regressions use *Tobin's Q* as the dependent variable. *MAC* is the proportion of top managers who graduated from the top five universities. Regression (1) examines whether the effect of management academic credentials on firm value changes with a firm's *Chaebol* affiliation. *Chaebol dummy* takes 1 for a firm belonging to one of the 50 largest chaebols according to the Korea Fair Trade Commission, 0 otherwise. *TMT ownership* is a lagged value of the percentage of common stocks that TMT owned. Regressions include *Firm size*, *ROA*, *Leverage*, *CAPEX/Assets*, *Distressed dummy*, and *Sensitivity to market risk*, which are as defined in Table 3. Standard errors are shown in parentheses under parameter estimates. We correct the standard errors for heteroskedasticity and double-cluster the errors at the firm and time level. We estimate the systems of equations by nonlinear GMM, based on the equations in Table 7 and we report the results of the *Tobin's Q* equation. Levels of significance are indicated by ***, **, and * for 1, 5, and 10%, respectively.

Variable	(1)	(2)
MAC	0.088***	−0.026
	(0.032)	(0.042)
TMT size	−0.023*	−0.019**
	(0.012)	(0.011)
TMT age	−0.506***	−0.329***
	(0.051)	(0.055)
TMT tenure	−0.187	−0.198
	(0.130)	(0.132)
TMT education years	−0.186	−0.190
	(0.117)	(0.118)
TMT expertise dummy	0.061*	0.064*
	(0.035)	(0.038)
Chaebol dummy	0.105**	0.037
	(0.053)	(0.023)
Largest ownership	−0.022	0.028
	(0.045)	(0.046)
TMT ownership		−0.504***
		(0.108)
*MAC*Chaebol dummy*	−0.124*	
	(0.076)	
*MAC*TMT ownership*		0.571***
		(0.205)
Other control variables	Yes	Yes
Year-fixed effects	Yes	Yes
Firm-fixed effects		
Number of firms	7,100	3,743
Adjusted R^2	0.276	0.259

6. Robustness Test

6.1. Human Capital and Management Accountability

When there is more transparency in management, top managers are more accountable and have more incentives to exert their effort in making decisions. *MAC* also has a higher impact on firm value when firms are governed with greater transparency and accountability. When the largest shareholder has large ownership, agency problems are smaller (Jensen and Meckling, 1976) and monitoring managers becomes more effective (Shleifer and Vishny, 1986).

We use governance index and the largest shareholders' ownership concentration to represent a condition where TMTs face more accountability for their decision making. *Governance* is the log value of combined governance scores[14] evaluated by the KCGS based on shareholder rights, board structure, transparency and information disclosure, audit committee's activities, and ownership and payout policy for 2,164 firm-years, from 2002 to 2006. *Governance A* is the governance scores less the board structure scores.

Table 10 summarizes the interaction effects of *MAC* with the corporate governance system, and largest shareholders' ownership concentrations. (As before, we control for the endogeneity issues in analyses and we report the results of the *Tobin's Q* equation.) The correlation coefficients of *MAC* with governance scores and with largest shareholders' ownership concentration are positive and significant. On the other hand, the coefficients of *MAC* are not necessarily positive. Taken together, these results suggest that *MAC* becomes important in well-governed firms or in firms with high ownership concentration of largest shareholders.

6.2. Management Human Capital versus Sociopolitical Network

Managers from prestigious schools can benefit from networking with influential business leaders and high-ranking government officials from the same schools. As the government agencies have a strong influence on the economy in South Korea, managers' connections with government officials are valuable to firm performance (Siegel, 2007).[15] Yoo and Lee (2009) argue that the coordinating mechanism to promote public–private cooperation, which contributes to South Korea's high growth, was maintained through elite schools' alumni networks between business leaders and high-ranking government officials.

We deal with the issue that academic credentials may reflect managers' social capital as well as human capital. To detect whether the impacts of *MAC* are

[14]Korea Corporate Governance Service (KCGS) evaluates the corporate governance system of all the listed firms based on disclosed information in the five categories of shareholder rights, board structure, transparency and information disclosure, audit committee's activities, and ownership structure and payout activities. KCGS assigns a score of 1 (not strong) to 7 (very strong) to each of the multiple subcategories in each category.

[15]Siegel (2007) uses affiliations with elite high schools in the five regions of the country as a proxy of an elite sociopolitical network.

Table 10 Interaction effects of management academic credentials and governance and accountability on firm value

Table presents the regression results of firm value and management academic credentials using an interaction term between *MAC* and *Governance* score, *Chaebol dummy*, or *Ownership* variables between 1990 and 2006. All regressions use *Tobin's Q* as the dependent variable. *MAC* is the proportion of top managers who graduated from the top five universities. In regression (1), *Governance* is the natural logarithm of corporate governance scores based on shareholder rights, board structure, disclosure, audit committees, and ownership parity. Regression (2) uses *Governance A* that equals the governance scores in (1) less board structure scores. *Governance* scores are available for 2,164 firm-years between 2002 and 2006. *Largest ownership* is a lagged value of the percentage shareholding of the largest shareholder. Regressions include *Firm size*, *ROA*, *Leverage*, *CAPEX/Assets*, *Distressed dummy*, *Chaebol dummy* and *Sensitivity to market risk*, which are as defined in Table 3. Standard errors are shown in parentheses under parameter estimates. We correct the standard errors for heteroskedasticity and double-cluster the errors at the firm and time levels. We estimate the systems of equations by nonlinear GMM, based on the equations in Table 7 and we report the results of the *Tobin's Q* equation. Levels of significance are indicated by ***, **, and * for 1, 5, and 10%, respectively.

Variable	(1)	(2)	(3)
MAC	−1.596*	−1.531	−0.025
	(0.931)	(0.923)	(0.041)
TMT size	−0.026**	−0.028**	−0.033**
	(0.013)	(0.012)	(0.013)
TMT age	−0.516***	−0.574***	−0.489***
	(0.053)	(0.054)	(0.057)
TMT tenure	−0.213	−0.209	−0.184
	(0.131)	(0.132)	(0.135)
TMT education years	−0.189	−0.192	−0.191
	(0.119)	(0.122)	(0.120)
TMT expertise dummy	0.059*	0.057*	0.065*
	(0.034)	(0.032)	(0.037)
Governance	0.065		
	(0.118)		
Governance A		−0.055	
		(0.121)	
Largest ownership			−0.117*
			(0.063)
*MAC * Governance*	0.345*		
	(0.196)		
*MAC * Governance A*		0.387**	
		(0.196)	
*MAC * Largest ownership*			0.353***
			(0.114)
Other control variables	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	
Number of firms	2,164	2,164	7,100
Adjusted R^2	0.392	0.381	0.305

sociopolitical networking effects associated with prestigious schooling, we examine whether the effects of *MAC* increase with the scope of managers' sociopolitical network.

TMT political network is the scope of a TMT's political network. It is measured through the ratio of all government officials connected with any member of a TMT over the total number of government officials in a given year. A government official is connected to a top manager if they graduated from the same alma mater and are of similar ages. The three largest groups of connected government officials are from the top five universities, top university, and the KMA. All Korean presidents from the early 1960s to the early 1990s were military generals. Hence, many cabinet members are from the KMA and have served as high-ranking military officers. Top managers from the KMA are likely to have substantial political connections.

We include an interaction term between *MAC* and the scope of *TMT political network*. If the effects of *MAC* on firm value are due partially to the managers' TMT political network, we expect the coefficient of the interaction term to be positive and significant.

$$\begin{aligned} Tobin'sQ = & \gamma_0 + \gamma_1 MAC + \gamma_2 TMT\ Variables + \gamma_3 TMT\ Political\ Network \\ & + \gamma_4 MAC * TMT\ Political\ Network + control\ variables \end{aligned} . \quad (5)$$

As Figure 1 illustrates, more than two-thirds of South Korean cabinet members are from the top five universities in Korea. The figure also shows that the composition of cabinet members' alma maters changes over time, implying that the social benefit from networking with government officials varies as well. If *MAC* reflects the benefits from social network, its effects will be larger when the scope of the sociopolitical network is greater. In contrast, if *MAC* reflects the benefits from human capital, its effects will not depend on the scope of the social network.

In Table 11, the coefficients of the share of top managers from the top universities are positive and significant. The coefficients of their interaction term with the scope of political connection are negative, although not always significant. The results indicate that the positive effect of the top school graduates on firm value decreases when their political network is strong. Conversely, managers from top schools improve firm value when they have limited access to political elites. This is consistent with earlier results showing that *MAC* improves firm value when the firm faces potential challenges. In contrast, the coefficient of the share of KMA graduates in the TMT is negative, but not significant. The coefficient of its interaction term with the size of political connection is positive, but not significant. For KMA graduates, their access to political decision makers appears to increase firm value. In summary, the results suggest that the sociopolitical connections of managers from the top schools have not been a major source of raising firm value.

6.3. Alternative Measures of Firm Value or Performance

We have included analyses using *industry-adjusted Tobin's Q*, *industry-adjusted sales growth rate*, or *R&D* activities as our dependent variable. Using *industry-adjusted*

Table 11 Management academic credentials, political network effects, and firm value

Table shows the results of our analysis of whether the effect of *MAC* on firm value differs with regard to sociopolitical network effects. We estimate the systems of equations by nonlinear GMM, based on the equations in Table 7 and we report the results of the *Tobin's Q* equation. The dependent variable is *Tobin's Q*, which is the market value of common stock and the book value of preferred stock and total debts, divided by the book value of total assets. We classify *MAC* as the proportion of top managers within a firm who graduated from the top five universities in regressions (1) and (2), top university in regression (3), and the Korea Military Academy (*KMA*) in regression (4). *TMT political network* is the ratio of all government officials connected with any member of a TMT with academic credentials from the top 5, top, and KMA over the total number of government officials in a given year. *MAC * TMT political network* is an interaction term between management academic credentials and political network. See Table 3 for exact definitions of the other variables. All data are from 1990 to 2006, and standard errors are shown in parentheses under parameter estimates. We correct the standard errors for heteroskedasticity and double-cluster the errors at the firm and time levels. Levels of significance are indicated by ***, **, and * for 1, 5, and 10%, respectively.

Variable	(1) Top 5	(2) Top 5	(3) Top 1	(4) KMA
MAC	0.102***	0.430*	0.688***	−0.386
	(0.021)	(0.231)	(0.132)	(0.342)
*MAC * TMT political network*		−0.459	−0.844***	3.224
		(0.317)	(0.241)	(3.710)
TMT political network	−0.616***	−0.694***	−0.728***	−1.629***
	(0.229)	(0.227)	(0.193)	(0.348)
TMT size	−0.025**	−0.024**	−0.020	−0.025**
	(0.013)	(0.012)	(0.013)	(0.013)
TMT age	−0.595***	−0.597***	−0.604***	−0.602***
	(0.052)	(0.053)	(0.052)	(0.053)
TMT tenure	−0.209	−0.204	−0.203	−0.207
	(0.132)	(0.131)	(0.130)	(0.129)
TMT education years	−0.190	−0.191	−0.188	−0.192
	(0.125)	(0.129)	(0.128)	(0.127)
TMT expertise dummy	0.065*	0.068*	0.070*	0.067*
	(0.036)	(0.037)	(0.038)	(0.036)
Firm size	−0.021***	−0.022***	−0.023***	−0.017***
	(0.005)	(0.005)	(0.005)	(0.005)
ROA	0.068	0.068	0.066	0.066
	(0.045)	(0.045)	(0.045)	(0.045)
Leverage	0.622***	0.620***	0.622***	0.624***
	(0.021)	(0.023)	(0.021)	(0.021)
CAPEX/Assets	−0.006	−0.006	−0.008	−0.006
	(0.018)	(0.019)	(0.019)	(0.019)
Distressed dummy	−0.072***	−0.070***	−0.074***	−0.072***
	(0.012)	(0.012)	(0.012)	(0.012)
Sensitivity to market risk	0.035***	0.035***	0.037***	0.036***
	(0.013)	(0.014)	(0.014)	(0.014)

Table 11 (*Continued*)

Variable	(1) Top 5	(2) Top 5	(3) Top 1	(4) KMA
Chaebol dummy	0.017	0.017	0.014	0.025*
	(0.014)	(0.014)	(0.014)	(0.014)
Largest ownership	0.054*	0.053*	0.048*	0.052*
	(0.031)	(0.030)	(0.030)	(0.031)
Year-fixed effects	Yes	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes	Yes
Number of firms	7,100	7,100	7,100	7,100
Adjusted R^2	0.478	0.503	0.506	0.501

Tobin's Q controls for possible industry common shocks. *Industry-adjusted sales growth rates* or *R&D* represent the economic outcome of corporate choices and strategies. We rerun regressions based on equations 2 and 3. Table 12 shows that our results do not change and that the effects of *MAC* on firm performance are robust regardless of the choices of dependent variables.

6.4. A Quadratic Specification to Examine the Association between *MAC* and Firm Value

We have included a quadratic specification to examine the association between managerial quality and firm value because the effect is possibly non-linear. Table 13 shows the quadratic relationship between *MAC* and firm value. The quadratic relationship between *MAC* and firm value is negative, but not significant, inferring that the association between managerial quality and firm value is linear. However, the demand and supply for the top managers with high academic credentials in the labor market could prevent each firm from hiring top managers with such credentials.

7. Summary and Conclusion

Firms often use academic credentials as a screening criterion when they recruit managers. However, past studies have not shown that academic credentials of top managers affect the value of non-financial firms. Our study of top managers in publicly listed South Korean firms in non-financial industries from 1990 to 2006 shows that firms with a higher proportion of managers from top universities show better performance than do other firms, after controlling for endogeneity issues and other explanatory variables. Moreover, this relation is stronger in challenging environments.

In a stable, routine, and predictable business environment, managers can follow previously tried-and-tested management procedures and decisions made by their

Table 12 Alternative measures of firm value

Table reports the cross-sectional differences in the effect of *MAC* on *Industry-adjusted Tobin's Q*, *Industry-adjusted sales growth*, or *R&D* expenses over total assets' *MAC* is the proportion of top managers who graduated from the top five universities. Regressions include *TMT size, TMT age, TMT tenure, TMT education years, TMT expertise dummy, Firm size, ROA, Leverage, CAPEX/Assets, Distressed dummy, Sensitivity to market risk, Volatility, Governance, Chaebol dummy, Largest ownership, TMT ownership, and Political network*. These variables are as defined in Table 3. We estimate the systems of equations by nonlinear GMM, based on the equations in Table 7 and we report the results of the *Tobin's Q* equation. Standard errors are shown in parentheses under parameter estimates. We correct the standard errors for heteroskedasticity and double-cluster the errors at the firm and time levels. Levels of significance are indicated by ***, **, and * for 1, 5, and 10%, respectively.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Industry-adjusted *Tobin's Q*									
MAC	0.077***	0.025	0.026	0.074***	−1.487*	0.092***	−0.022	−0.020	0.675***
	(0.019)	(0.036)	(0.041)	(0.027)	(0.901)	(0.035)	(0.040)	(0.043)	(0.133)
*MAC * Sensitivity to market risk*		0.064*							
		(0.038)							
*MAC * Return volatility*			0.108*						
			(0.064)						
MAC Distressed dummy				0.060*					
				(0.036)					
*MAC * Governance*					0.356*				
					(0.194)				
*MAC * Chaebol dummy*						−0.128*			
						(0.075)			
*MAC * Largest ownership*							0.349***		
							(0.115)		
*MAC * TMT ownership*								0.568***	
								(0.212)	
*MAC * Political network*									−0.798***
									(0.240)

Table 12 (*Continued*)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Number of firms	7,100	7,100	7,100	7,100	2,164	3,872	7,100	3,743	7,100
Adjusted R^2	0.389	0.398	0.411	0.396	0.391	0.390	0.392	0.398	0.397
Panel B: Industry-adjusted sales growth									
MAC	0.029***	0.157	0.147	0.202***	0.197*	0.213*	0.101	0.119	0.588**
	(0.008)	(0.038)	(0.043)	(0.028)	(0.120)	(0.128)	(0.125)	(0.098)	(0.242)
*MAC * Sensitivity to market risk*		0.188**							
		(0.052)							
*MAC * Return volatility*			0.146*						
			(0.083)						
*MAC * Distressed dummy*				0.171**					
				(0.085)					
*MAC * Governance*					0.414**				
					(0.202)				
*MAC * Chaebol dummy*						−0.209*			
						(0.121)			
*MAC * Largest ownership*							0.401*		
							(0.213)		
*MAC * TMT ownership*								0.623***	
								(0.209)	
*MAC * Political network*									−0.821**
									(0.391)
Number of firms	7,100	7,100	7,100	7,100	2,164	3,872	7,100	3,743	7,100
Adjusted R^2	0.108	0.254	0.169	0.154	0.158	0.116	0.120	0.119	0.129

Table 12 (*Continued*)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel C: R&D									
MAC	0.005***	0.003*	0.003	0.008**	−0.016	0.038**	−0.002	−0.002	0.102**
	(0.001)	(0.001)	(0.002)	(0.004)	(0.003)	(0.017)	(0.004)	(0.004)	(0.039)
*MAC * Sensitivity to market risk*		0.028*							
		(0.016)							
*MAC * Return volatility*			0.007*						
			(0.004)						
*MAC * Distressed dummy*				0.037*					
				(0.020)					
*MAC * Governance*					0.106*				
					(0.64)				
*MAC * Chaebol dummy*						−0.108			
						(0.067)			
*MAC * Largest ownership*							0.117**		
							(0.059)		
*MAC * TMT ownership*								0.327	
								(0.199)	
*MAC * Political network*									−0.349*
									(0.201)
Number of firms	5,909	5,909	5,909	5,909	2,001	3,669	7,100	3,527	7,100
Adjusted R^2	0.201	0.213	0.208	0.204	0.206	0.206	0.209	0.211	0.208
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes

Table 13 A quadratic specification of management academic credentials and firm value

Table shows the results of our analysis of whether the effect of *MAC* on firm value differs with regard to a quadratic specification. We estimate the systems of equations by nonlinear GMM, based on the equations in Table 7 and we report the results of the *Tobin's Q* equation. The dependent variable is *Tobin's Q*, which is the market value of common stock and the book value of preferred stock and total debts, divided by the book value of total assets. We classify *MAC* as the proportion of top managers within a firm who graduated from the top five universities. See Table 3 for exact definitions of the other variables. All data are from 1990 to 2006, and standard errors are shown in parentheses under parameter estimates. We correct the standard errors for heteroskedasticity and double-cluster the errors at the firm and time levels. Levels of significance are indicated by ***, **, and * for 1, 5, and 10%, respectively.

Variable	(1)
MAC	0.146***
	(0.058)
$(MAC)^2$	−0.066
	(0.057)
TMT size	−0.023*
	(0.013)
TMT age	−0.571***
	(0.053)
TMT tenure	−0.207
	(0.132)
TMT education years	−0.191
	(0.125)
TMT expertise dummy	0.066*
	(0.036)
Firm size	−0.019***
	(0.005)
ROA	0.093**
	(0.044)
Leverage	0.590***
	(0.020)
CAPEX/Assets	−0.001
	(0.019)
Distressed dummy	−0.071***
	(0.012)
Sensitivity to market risk	0.030**
	(0.014)
Chaebol dummy	0.019
	(0.014)
Largest ownership	0.060*
	(0.031)
Year-fixed effects	Yes
Firm-fixed effects	Yes
Number of firms	7,100
Adjusted R^2	0.309

predecessors, so managers with greater intellectual ability may not substantially influence their firms' performance. In challenging business environments that require novel solutions, however, managers with superior academic credentials outperform other managers. Firms with *MAC* show greater firm value when they face higher growth opportunities, greater risks, or financial distress, when managerial decisions have greater scope and impact (i.e., stand-alone firms), or when firms have better governance structures.

Our study suggests that the need for BODs to consider prestigious schooling as a criterion in selecting top managers depends on the external and internal contexts of organizations. We also suggest that BODs need to consider academic credentials when designing incentive compensation to derive top managers' effort, given the expected potential contributions of managers. Furthermore, in future studies, researchers need to control for academic credentials in their analysis of top management characteristics.

Academic credentials are not always linked to academic aptitude. In some countries, university admission policies are based on criteria other than academic ability. Furthermore, many countries do not have a hierarchy of universities as strict as that in Korea. In these countries, a manager's alma mater does not necessarily reflect his academic ability. Therefore, possible biases may occur from categorizing managers from other top institutions (e.g., European or US). In this study, however, since a mere 4% of top managers went to schools overseas, the effects are quite limited. Adding a dummy for those who went to school overseas did not lead to our hypothesis being rejected.

Our study was based on the concept that differences in environment affect the relationship between human capital and firm value, so an examination from the perspective of either corporate investment or industrial characteristics may further expand our study implications. For instance, it would be meaningful to examine how different aspects of corporate investment, labor costs, and annual compensation for top managers affect the influence of superior academic credentials on firm value, and to identify some of the differences between industry groups where academic aptitude counts and industry groups where it does not.

Furthermore, if academic credentials are indeed value-relevant, the market should react positively to the announcement of the appointment of managers with such credentials. Thus, our future research plan is targeted at obtaining the announcement dates of the appointment of new managers in order to shed light on the relationship between top managers' academic credentials and firm value through an event-study framework.

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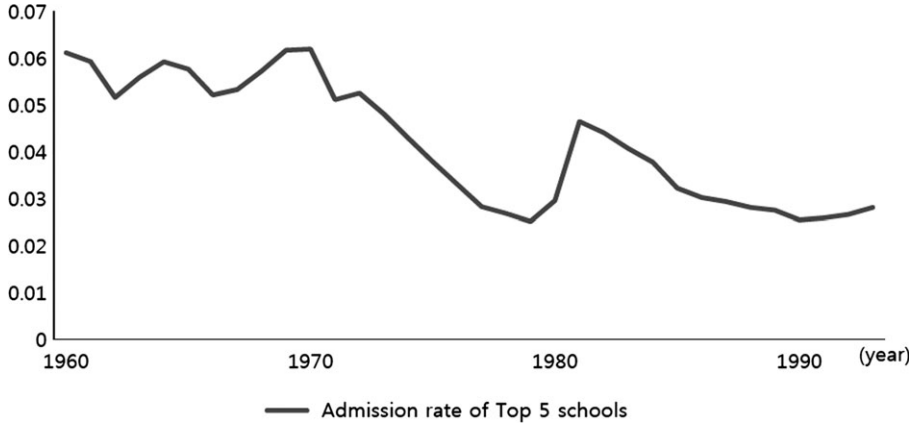
Appendix
Aggregate admission rate of top five prestigious universities for 40 years



Using the information in the *Statistical Yearbook* of the Ministry of Education, Korean Educational Development Institute, and homepages of the top five universities, we calculated the admission rate of the top five schools, which is the total freshman intake of the top five universities divided by the number of high school graduates. We argue that this admission rate affects the supply of managers from prestigious schools.