Human Capital, Management Quality, and Firm Performance

Thomas J. Chemmanur* Lei Kong** Karthik Krishnan***

May 2014

Abstract

We make use of a panel data set from the BoardEx database on the quality of the management teams of 4635 firms during 1999 to 2010 to analyze the relationship between the management quality of firms and their long-run operating performance, current market valuations, and future long-run stock returns. We create a management team quality index using common factor analysis from various individual proxies for the quality of a firm's management team, such as management team size, fraction of managers with MBAs, the average employment- and education-based connections of each manager in the management team, fraction of members with prior working experience in the top management team, and the average number of board positions that each manager serves on. We find that this index is positively related to firms' long-run operating performance, current market valuations, and future long-run stock returns. We overcome hurdles related to endogeneity by using Vietnam War draft deferment rules for graduate education. Individuals graduating from college during this period enrolled into graduate degree programs for reasons unrelated to their intrinsic quality, i.e., to avoid getting drafted. Using this as an instrument, we find a causal relationship between our management quality index and firms' long-run future operating performance, current market valuations, and long-run future stock returns. We also find that firms with higher management quality are characterized by larger levels of investment and investment growth. The relationship of management quality with firm valuation and performance is stronger for firms in R&D intensive, more competitive, financially constrained industries, and during periods of recession.

JEL Classification: G32; L25

Keywords: Human Capital; Management Quality; Operating Performance; Market Valuation; Stock Return

*Professor, Finance Department, Fulton Hall 440, Carroll School of Management, Boston College, Chestnut Hill, MA 02467, Tel: (617) 552-3980, Fax: (617) 552-0431, Email: chemmanu@bc.edu

**PhD Candidate, Finance Department, Fulton Hall 341, Carroll School of Management, Boston College, Chestnut Hill, MA 02467, Tel: (617) 552-2062, Email: kongle@bc.edu

***Assistant Professor and Thomas Moore Faculty Fellow, 414C Hayden Hall, College of Business, Northeastern University, Boston, MA 02115, Tel: (617) 373-4707, Email: k.krishnan@neu.edu.

This paper is scheduled to be presented at the 2014 WFA meeting. We would like to thank seminar participants at Boston College and the NBER Productivity Lunch seminar series. Any errors or omissions remain the responsibility of the authors.

1 Introduction

What drives the economic performance of a firm? The bulk of the academic research in economics and finance has focused on the product market and other characteristics of a firm (e.g., stage of development) to explain the potential of its projects to generate cash flows and therefore its market value and operating and stock return performance. More recently, it has been documented that the operating and stock return performance of a firm may also be affected by its corporate governance arrangements (see, e.g., Gompers, Ishii and Metrick (2003) and Core, Guay and Rusticus (2006)). However, an important feature that has been missing from the academic discussion on the determinant of a firm's stock market value and future performance (with some notable exceptions that we will discuss later) has been the role of the quality or human capital of a firm's management team, which is regarded by practitioners as an important determinant of its future performance. The objective of this paper is to remedy this gap in the literature by analyzing the relationship between the management quality of a firm and its current market valuation and future operating and stock return performance.

The quality of a firm's management team may affect its future performance in the following manner. Higher quality managers may be able to select better projects (characterized by a larger NPV for any given scale) and implement them more ably. This means that firms with higher quality management teams can be expected to have better future operating performance. Further, since, in a symmetric information setting, the market value of a firm will be the present value of future cash flows to stock holders, firms with higher ability management teams will also be characterized by higher market values. Finally, if we assume that the stock market does not fully incorporate the effect of higher operating cash flows instantaneously but only gradually over time (as these cash flows are realized), then firms with higher ability management teams will also be characterized by greater future stock return. We will discuss the underlying theory and develop testable hypotheses in section 2.

The paucity of academic research in finance and economics on the effect of management quality on firm performance may be due to two reasons. First, measuring management quality and human capital involves subjective notions of what constitutes a higher quality management team. Second, potential endogeneity can confound empirical findings on the relation between management quality and firm performance. For instance, higher quality managers can choose to work for better quality firms. Another possibility is that there may be potentially unobservable factors related to both firm performance and management quality which can bias our OLS results. We overcome the first hurdle by creating a management team quality index from various measures used previously in the literature, such as management team size, fraction of managers with MBAs, the average employment- and education-based connections of each manager in the management team, fraction of members with prior working experience in the top management team, and the average number of board positions that each manager serves on. These measures are adjusted for firm size. We create an index of management quality based on common factor analysis of the above-mentioned measures of management quality.

We overcome the second hurdle related to endogeneity by using Vietnam war draft deferment rules for graduate education. In particular, during the Vietnam War and until 1968, draft rules allowed draft deferment for a person who gets admitted to a graduate degree. This led to many individuals getting a higher education for reasons unrelated to their intrinsic quality and provides an exogenous variation in the human capital of managers. Following this reasoning, we use as an instrument for management quality, a dummy variable for whether or not a significant number of its male managers (who were US citizens) graduated from college during the Vietnam war era.

We analyze the relationship between management quality and firm performance using a panel data set of 4635 firms covering the period 1999 to 2010. We obtain the biographical data on the top managers of firms from the BoardEx database, information on firm characteristics from the Compustat database, and stock return and price data from the CRSP database.

The results of our empirical analysis can be summarized as follows. First, we find that our management quality factor is positively related to firm's future operating performance. We use two measures of operating performance: the change in ROA (defined as operating income before depreciation over total assets) from the current year to one, two, and three years after the current year, and the level of ROA in one, two, and three years after the current year. We find that our management quality factor is positively and significantly related to the operating performance of firms in all specifications. In particular, a one inter-quartile range increase in our management quality factor is associated with a 1.3 percentage point increase in the change in the ROA from the current year to the average over the next three years (representing an 12.9 percent increase in ROA for the median firm) We also analyze the relationship between our individual proxies for management quality and the future operating performance of a firm and find that these are positively and significantly related. For instance, a one inter-quartile range increase in the number of managers with MBA degrees is related to a 0.7 percentage point increase in the change in ROA over the next three years.

We then conduct instrumental variables (IV) analyses and find that our management quality factor is positively and causally related to changes in a firm's future operating performance. Our instrument, namely the risk of being drafted during the Vietnam era (i.e., Draft risk), is positively and statistically significantly related to our management quality factor. Further, we conduct a placebo analysis by recreating the instrument for non-U.S. citizens and women managers (for whom the U.S. Vietnam-era draft rules did not apply) and do not find a statistical relation between this placebo instrument and firm management quality. Thus, we rule out the possibility that our instrument reflects cohort or size effects. Broadly, this analysis suggests that management quality has a positive and causal impact on firm performance.

Second, we find our management quality factor is positively related to the firm's current stock market valuation, as measured by its market to book ratio. Specifically, a one inter-quartile range increase in the management quality factor increases the firm's market to book ratio by 3.4 percent. We also find that our individual proxies for management quality are positively and significantly related to firm valuation. Finally, we find from our instrumental variable analysis that our management quality factor is positively and causally related to a firm's current market valuation.

Third, we find that our management quality factor is positively related to a firm's future abnormal stock returns (adjusted by a market index benchmark) over one year as well as three year horizon. Economically, a one inter-quartile range increase in the management quality factor increases the three year market adjusted abnormal returns by 7.2 percentage points. We also find a positive and significant relationship between our individual proxies for management quality and abnormal stock returns. Further, our results are similar when we use return adjustment benchmark based on the analysis of Daniel, Grinblatt, Titman, and Wermers (1997). Finally, from our instrumental variable analysis, we find that our management quality factor is positively and causally related to the long-run abnormal stock returns of the firm.

Fourth, we find that our management quality factor is positively related to a firm's future investment (both levels and changes). The results are robust to various definitions of investment, such as capital expenditure, R&D expenditure, and capital plus R&D expenditure. The economic significance is also large. A one inter-quartile range increase in the management quality factor is associated with 0.5 percentage point increase in the change in the capital expenditure to total asset in the next year (which is 14.3 percent of the median capital expenditure ratio in the sample). Moreover, from our instrumental variable regressions, we find a causal relationship between management quality and firm investment.

Fifth, if management quality is an important driver of firm performance due to the ability of the top management team, we would expect the relationship to be stronger for firms in R&D intensive industries, where knowledge and human capital of top managers is more important; and for firms in more competitive industries, where management quality can be more important in giving the firm an edge over competitors. Consistent with this notion, we find that the relationship between our management quality factor and changes in future operating performance, current market valuations, and future stock returns are stronger for firms in R&D intensive and more competitive industries. Finally, our results indicate that the positive relationship between management quality and firm performance is more important during recessions, when managerial ability in selecting better projects and implementing them ably is important; and for firms in financially constrained industries, where managerial ability in selecting and implementing projects more efficiently is important.

Our paper is related to several strands in the literature. An important paper that studies the effect of top managers on a firm's financial and investment policies is Bertrand and Schoar (2003), who make use of a manager-firm matched panel dataset to track top managers across different firms over time. They find that manager fixed effects explain some of the heterogeneity in the investment, financial, and organizational practices of firms. They also identify specific patterns in managerial decision-making that indicate differences in "style" across managers. Unlike the above paper, our focus is on how various proxies for the quality of a firm's top management team (and a management quality factor derived from the above individual proxies through common factor analysis) are related to a firm's current stock market valuation and subsequent operating as well as stock return performance.[1] Further, unlike their paper, we establish a positive causal relationship between management team quality and the above measures of firm valuation and performance[2].

Our paper is also related to some papers in the entrepreneurial finance literature. Two papers that are close in terms of methodology are Chemmanur and Paeglis (2005) and Chemmanur, Paeglis, and Simonyan (2009). The above papers also make use of a management quality factor based on common factor analysis on some individual proxies of management quality to study the relationship between management quality and IPO characteristics (in the case of the former paper) and SEO characteristics and firm financial policies around the SEO (in the case of the latter paper). In contrast to Chemmanur and Paeglis (2005), who study firms going public, our focus in the current paper is on larger, more established firms and how management quality relates to the stock market valuation and the operating and stock return performance of these firms. Further, while the above two papers make use of cross-sectional data hand-collected from IPO and SEO prospectuses respectively, our paper makes use of a large panel data set that allows us to capture the time series variation in management quality as well.[3]

Our paper is also indirectly related to the literature on the determinants of CEO's quality and how it effects firm performance (see, e.g., Adams, Almeida, and Ferreira (2005) and Malmendier and Tate (2005))[4]. Two important papers in the economics literature that have implications for our paper are Sah and Stiglitz (1986,1991). Their theoretical analysis implies that larger management

[1] In the last part of their paper, Bertrand and Schoar (2003) also study the relationship between two managerial characteristics, namely MBA degree and birth cohort, and firm operating performance variables like ROA. However, they only analyze a sample of CEOs in this part of the analysis.

[2] In more distantly related research, Bloom and Van Reenen (2007) use an innovative survey tool to collect management practices data from various countries and show that measures of managerial practice are strongly associated with firm-level productivity, profitability, Tobin's Q, and survival rates. See also Bloom, Eifert, Mahajan, McKenzie, and Roberts (2013), who ran a management field experiment on large textile firms in India, and show that adopting better management practices raised productivity by 17% on average in the first year after the adoption of these practices. Unlike these papers, which study the effects of management practices, our focus here is on the effect of the human capital of firm management on firm performance.

[3] Hellmann and Puri (2002) study 170 young high-technology Silicon Valley firms and show that VC-backing fosters the professionalization of start-up firms (measured by human resource policies, the adoption of stock option plans, and the hiring of a marketing VP).

[4] See also Kaplan, Klebanov, and Sorensen (2012), who study the individual characteristics of CEO candidates for companies involved in buyout and venture capital transactions and related them to the subsequent performance of their companies.

teams are more likely to reject bad projects, since a project will be accepted only if several group members agree that it is good. One of the implications of their theory is that performance should be less variable when a greater number of executives have influence over corporate decisions.[5] Our paper is also related to the growing literature in organizational economics linking the importance of agents across and within organizations. For example, Bandiera, Barankay, and Rasul (2010) find that workers are more productive when they work with higher ability co-workers and less productive when they work with lower ability co-workers (see also Bandiera, Barankay, and Rasul (2005)).[6]

This paper contributes to the literature by analyzing the relationship between various measures of the management quality of a firm and its long-run future operating performance, current stock market valuations, and long-run stock returns. Moreover, this is the first paper to establish a causal relationship between management quality and operating performance, stock market valuation, and long-run stock returns. By doing so, we are able to identify a new determinant of firm performance that has not received significant attention in the literature.

The rest of the paper is organized as follows. Section 2 discusses the underlying theory and develops testable hypotheses. Section 3 outlines the data and the sample selection procedure. Section 4 provides a discussion of our empirical results. Section 5 concludes.

2 Theory and Hypothesis Development

In this section, we briefly discuss the underlying theory and develop hypotheses for our empirical tests. Consider a setting in which firms with higher quality management teams are able to select better projects and implement them more ably. If we define better projects as those characterized by a larger net present value for any given scale, and assume decreasing returns to scale, a firm with better management quality will be associated with a larger equilibrium scale of investment, since the equilibrium scale is characterized as that level of investment at which the net present value of the last dollar invested falls to zero (see Figure 1). A larger scale of investment will be reflected in

[5] The organizational behavior literature on the effect of managerial discretion on firm performance is also indirectly related to our paper: see Finkelstein and Hambrick (1996) for a review.

[6] In a somewhat different context, Chevalier and Ellison (1999) study the relationship between the performance of mutual funds and the characteristics (age, experience, education and Scholastic Aptitude Test (SAT) scores) of their fund managers. They find that managers who attended higher-SAT undergraduate institutions had significantly higher risk-adjusted excess returns.

higher levels of capital expenditure and R&D expenditure so that these will also be increasing in a firm's management quality. Further, if we assume that the firm is able to implement its projects only over multiple periods, it can also be shown that the increase in capital expenditure from one period to the next for growing firms will also be increasing in a firm's management quality.[7]

The above has implications for the relationship between management quality and the operating performance of the firm. If firms with higher management quality select better projects and are able to implement them more ably, then management quality will be positively associated with the operating performance of the firm. This is the first hypothesis (**H1**) that we test here.

The above also has implications for the relationship between management quality and the stock market value of a firm. If firms with higher management quality are associated with greater operating cash flows, then higher management quality firms will also have higher market values: recall that the market value of a firm is simply the present value of its future cash flows (in a symmetric information setting). This is the second hypothesis (**H2**) we test here.

The management quality of a firm will also be positively related to its long-run stock return performance under certain additional assumptions. Thus, if we assume that the stock market does not fully incorporate the effect of higher operating cash flows instantaneously but only gradually over time (as these cash flows are realized), then firms with higher ability management teams will also be characterized by greater future stock return. This is therefore the third hypothesis (**H3**) that we test here.[8]

We postulated above that one of the channels through which management quality affects the

[7] To see why this is the case, consider a firm investing in its project over time in order to reach its equilibrium scale. If higher management quality firms have larger equilibrium scales per project than low management quality firms, and assuming that each firm generates an additional project each period (i.e., the firm is growing), then it can be shown that the increase in investment across periods will also be higher for higher management quality firms compared to that for lower management quality firms.

[8] If outside investors are fully rational and the stock market is completely efficient, one should not observe any differences in the long-run stock return performance of firms with higher versus lower management quality. If, however, stock market investors do not fully anticipate the better operating performance of firms simply by observing their management quality (so that this superior performance is only partially reflected in their current market valuation), then one would expect firms with higher management quality to have better long-run stock return. Note that all long-run stock return studies around corporate events require an assumption similar to the one we make here. One may consider this to be a strong assumption, but, given the large empirical literature documenting the post-event drift following earnings announcements and many other corporate events (see, e.g., Foster, Olsen, and Shevlin (1984), Bernard and Thomas (1989)), one has to at least consider the possibility that the stock market may not fully incorporate the earnings (operating performance) implications of a firm's management quality in current firm valuations.

operating performance, market valuation, and stock returns of a firm is by affecting its investment level. We thus study the relationship between management quality and the investment level, as well as the relationship between a firm's management quality and the change in its investment per period. We expect that higher management quality firms will have higher levels of investments and greater increases in investment each year. This is our fourth hypothesis (**H4**).

If as we argued above, management quality is important in affecting the performance of a firm, then we would expect the effect of management quality on performance to be more pronounced in firms operating in industries where human capital is a crucial determinant of firm performance. One example of the above are firms operating in more R&D intensive industries. Thus, we expect that the impact of management quality on firm performance will be greater for firms operating in R&D intensive industries (**H5**). A second example of firms where management human capital can be expected to crucially affect performance are those operating in industries characterized by more intensive competition, since management quality may be important in giving the firm an edge over competitors. We expect that the impact of management quality on firm performance will be greater for firms in competitive industries (**H6**).

If, as we argued above, higher management quality firms are able to select better projects and implement them more ably, we would expect such firms to be able to weather recessions better. In other words, we would expect the relationship between management quality and firm performance to be stronger during recessions (**H7**). Finally, if higher management quality firms are able to implement their projects more efficiently, we would expect the relationship between management quality and firm performance to be stronger in more financially constrained firms (**H8**).[9]

[9] One alternative conjecture is that higher quality management teams may be more effective when they are not constrained by lack of financing. That is, high quality management teams may be able to select higher NPV projects given more resources than low quality management teams. This hypothesis assumes that managers will not affect costs, and thus cannot increase NPV of a project through improvement in the efficiency of their operations. Ultimately, which argument is stronger will be reflected in our empirical results.

3 Data and Sample Selection

3.1 Sample Selection

Our sample is derived from multiple data sources. Our primary data source for the biographical information of senior managers is the BoardEx database. The BoardEx database contains data on college education, graduate education, past employment history (including beginning and ending dates of various roles), current employment status (including primary employment and outside roles), and social activities (club memberships, positions held in various foundations and charitable groups, among others). The main information we are making use of in this paper is the education, employment history and demographic information. We obtain firm stock returns and price data from CRSP stock return files and accounting data from Compustat.

The unique company-level identification code in BoardEx is "Company ID". However, "Company ID" is unique to BoardEx and cannot be used to merge with other databases such as Compustat and CRSP. We link the BoardEx database to CRSP and Compustat in the following way. BoardEx provides CIK, the International Security Identification Number (ISIN), and the company name. The "Company ID" in BoardEx is matched with the PERMNO created by the Center for Research in Security Prices (CRSP) by either CIK or CUSIP (which is derived from ISIN). After matching by CIK or CUSIP, we checked the correctness by comparing the company names from BoardEx with company names from CRSP and Compustat. The matched BoardEx-Compustat-CRSP file leaves us with 6504 unique firms.

Using the BoardEx employment history file, we identify all the managers in each matched company for each year from 1999 to 2010. While BoardEx data starts from 1997, data prior to 1999 is sparse (e.g., see Engelberg, Gao and Parsons (2013)). We then obtain the sample of senior managers from BoardEx, which we define as managers with a title of VP or higher. The senior managers in our sample can be broadly categorized in seven groups: CEOs, presidents, chairman, other chief officers (CFO, CIO etc.), division head, VPs, and others.

We exclude all the firm-years that have the following characteristics: (i) There is only one senior manager in the management team (since it is unlikely that larger firms covered by BoardEx will only have one senior manager); (ii) There is no CEO for a firm in a certain year; (iii) there are more than 30 senior managers in the management team (suggesting that perhaps certain titles are misleading and we are overclassifying senior managers); (iv) financial and utility firms, defined by SIC code from 6000 to 6999 and from 4901 to 4999, respectively; and (v) firm-years with missing values for the relevant variables we need to use. After these exclusions, we are left with 34625 firm-year observations across 4635 unique firms.

We then obtain the demographic and education information for each senior manager from the BoardEx database. To obtain education-based connections, we classify all the graduate degrees into four different categories: business school (MBAs included), medical school, law school and general graduate (graduates of art or science) (see, Cohen, Frazzini, and Malloy (2008)).

3.2 Measures of Management Quality

For each management team in each year, we obtain the following six different measures as proxies for management quality (see, e.g., Chemmanur and Paeglis, 2005):

Team size: The number of senior managers in the management team.

MBA: The fraction of senior managers in the management team that have MBA degrees.

Prior work experience: The fraction of senior managers in the management team that previously worked as senior managers (i.e., VP or higher) in other firms.

Education connections: The number of education based connections of the top management team divided by *Team size*. Education based connection is number of graduate education connections that each senior manager in the management team has with other managers or directors in the BoardEx database. If individuals study in the same educational institution, have degrees in the same education category (described above), and graduate within one year of each other, they are defined as connected.

Employment connections: The number of employment connections of the top management team divided by *Team size*. The total number of employment connections that each senior manager in the management team has with other managers or directors in the BoardEx database. If individuals have worked together in the same company previously during an overlapping time period, they are defined as connected.

Prior board experience: The total number of outside boards that the top management team members have sat on prior to the current year divided by *Team size*.

These variables measure management team resources, which refers to the human capital and knowledge resources (including education and relevant work experience) available to firm management. In addition, we create *Average tenure* as the average number of years that each senior manager has worked in a firm, and use it as a control variable.

Table 1 provides some summary statistics on the management quality measures we describe above. For the median firm in our sample; there are seven senior managers in the management team, 20 percent of the senior management team has an MBA degree, 10 percent of the senior management team has prior work experience as a senior manager at another firm; and zero percent of the senior management team have sat on boards of other firms. Moreover, the median level of *Education connections* is zero and that of *Employment connections* is 15. The median number of years that each manager has worked in a firm is 5.25. Median firm size in our sample is $295 million, suggesting that our sample contains mid-size and large firms.

All the management quality measures are aggregated to the level of the management team, and are likely to be correlated with firm size. Therefore, in order to ensure that these measures are independent of firm size, we use firm-size and industry-adjusted variables in our common factor analysis. Specifically, we conduct the following regression for each of the six measures of management quality:

$$Measure_{i,t} = \ln(firm\_size)_{i,t} + [\ln(firm\_size)_{i,t}]^2 + industry\_dummies_i + year\_dummies_t + \varepsilon_{i,t} \tag{1}$$

Here, t indexes the year of the observation and i indexes the firm. We use the residuals from the above regression as the firm-size and industry adjusted measures of management quality.

Each of the variables described above is unlikely to be a comprehensive measure of management quality by itself. Therefore, we use common factor analysis to capture the common variation in these different management quality measures. We conduct a first-pass common factor analysis to obtain factors that account for as much of the total variance of the observed variables with as few factors as possible. Next, we rotate the initial factors so that each individual variable has substantial loadings on as few factors as possible. This methodology is consistent with the implementation of the common factor analysis in the literature.

Table 2 presents the results of the common factor analysis. The common factor analysis leads to six factors. Panel A of Table 2 reports the eigenvalues of each factor. Factors with higher eigenvalues account for a greater proportion of the variance of the observed variables. Only the first factor has the highest eigenvalue that is larger than one. This suggests that the first factor is the most important one, providing us with a distinct measure of management quality. We term this factor the management quality factor (MQF).[10]

Panel B of Table 2 reports the loadings on the first factor for each individual management quality variable. The loadings indicate that all individual management quality measures load positively on the first factor. Consistent with this, the second column of Panel B finds high positive correlations between the first factor and each of the six management quality measures. The third column of Panel B of Table 2 reports the communality of each of the variable with the common factor, which measures the proportion of the variance of each variable which is accounted for by the common factors. Communality should be between zero and one, and higher values indicate that a large proportion of the variation in the variable is captured by the common factors. We find that the communalities are typically large and vary from 0.13 for *MBA* to 0.649 for *Employment Connections*, suggesting that the common factor analysis is indeed able to capture a substantial portion of the common variation between these variables.

[10] In a robustness check that we describe later, we address the possibility that our results are driven by the presence of *Team Size* in the management quality factor, and not the other quality measures. To address this concern, we recalculate the management quality factor by excluding *Team Size* from the common factor analysis. We show that our results are similar when we use the first factor derived from this model.

3.3 Measures of Firm Performance

We use three measures of firm performance, namely, operating performance, market valuation and stock return. First, for operating performance, we use ROA over different horizons (both levels and changes), defined as operating income before depreciation divided by total assets. We obtain one, two, and three year ahead ROA to measure firm performance. We also conduct our analyses using the average of three year ahead ROA. Moreover, we conduct our analysis using the changes in ROA from the current year to one year, to two years, to three year and to the three year average after the current year.

Second, we use Tobin's Q to measure market valuation, and is defined as market value of assets divided by the book value of assets, where the market value of assets is computed as the book value of assets plus the market value of common stock less the book value of common stock.

Third, we use the long-run stock return as a measure of firm performance. Our primary stock return measure is the value-weighted market adjusted return of a firm. Specifically, for each month in a year, we obtain the monthly stock return and the value-weighted market return from the CRSP monthly return file for a given firm. The value-weighted market adjusted return is defined as the natural logarithm of the compounded value of the difference between raw return and value-weighted market return in each month for each firm. These monthly adjusted returns are then compounded for one and three years.

In addition, we use the methodology in Daniel, Grinblatt, Titman and Wermers (1997) to calculate benchmark-adjusted stock returns. We form 125 benchmark portfolios that capture the three stock characteristics of book-to-market, market capitalization, and momentum. The benchmark portfolios are formed by the following procedure. At the beginning of January of year t, the universe of NYSE, Amex, and NASDAQ common stocks are sorted into five portfolios based on each firm's capitalization in December of year t-1 using December NYSE quintile breakpoints (the size breakpoints are designed so that there will be an equal number of NYSE firms in each the five portfolios). Firms in each size quintile portfolio are further sorted into quintiles based on their book-to-market ratios from the end of year t-1. The book-to-market ratio is the ratio of the book-value (defined as the book value of common equity plus the balance-sheet deferred taxes as in

Fama and French (1992)) at the end of the firm's fiscal year during the calendar year preceding the formation date to the market value at the end of the preceding December. Finally, the firms in each of the 25 size and book-to-market portfolios are further sorted into quintiles based on their prior 12-month holding period returns estimated through the end of November of year t-1. Thus, we generate 125 benchmark portfolios. We calculate value-weighted monthly returns on each benchmark portfolio from January of year t through December of year t. The benchmark portfolios are rebalanced yearly, at the end of December. Our sample firms are assigned to a benchmark portfolio according to their rank on size, book-to-market, and one year lagged annual return as of the end of December of year t-1. The DGTW adjusted return is defined as the compounded value of the difference between the raw return and the DGTW portfolio return in each month. We use one year and three year compounded returns in our analyses.

4 Empirical Tests and Results

4.1 Methodology and Identification

We empirically test whether there is a link between firm's management quality and firm's performance. Therefore, we conduct OLS regressions of our management quality measures on various measures of firm performance described above. However, management quality of a firm can be endogenously related to firm performance. For instance, higher quality managers can choose to work for better quality firms. Another possibility is that there may be potentially unobservable factors related to both firm performance and management quality, which can bias our OLS results.

Thus, in order to establish a causal relationship between management quality and firm performance, we utilize an exogenously imposed motivation for many individuals in the U.S. to obtain higher education during the Vietnam war period to avoid being drafted into the military. During most of the Vietnam War, men who reached the age of 18 needed to report to their local draft board for classification. The board could issue deferments for a variety of reasons, including for obtaining undergraduate and graduate education. See, e.g., Card and Lemieux (2001), who find that draft avoidance raised college attendance rates substantially during the Vietnam war era. However, individuals who graduated from college during the Vietnam war period were still at risk of being drafted and many enrolled in graduate degree programs to avoid military service. This deferment was eliminated by the federal government on February 16th, 1968. Thus, managers in our sample are more likely to pursue a graduate degree education if they graduate from college during the Vietnam war period but before 1968 and thus were at risk of getting drafted into military service. As a result, these managers increased their human capital during this period for reasons unrelated to their intrinsic ability. Furthermore, such education can have a long-term impact on managers' careers, since greater education can provide a strong stepping stone for managers' future careers due to greater opportunities for higher quality starting job positions and a greater extent of education and employment-based connections.

Figure 2 provides a graphical depiction of this effect for all the managers in BoardEx for whom education data is available. Consistent with our expectations, there was a significant increase in the proportion of managers that obtained graduate degrees if they graduated from college during the Vietnam era war period (and before 1968, when the graduate exemption was removed). The portion of the graph between the two vertical solid black lines delineates this period between 1963 and 1967. We also overlay the levels of troop deployment in the Vietnam war (obtained from the Department of Defence online library) on this graph, and see that the increased graduate degree enrollment is indeed correlated with the greater extent of troop deployment in Vietnam during this period.

Since managers do not have control over which age cohort group they belong to, the Vietnam-era period related boost in educational attainment is exogenous. Moreover, given that firms are unlikely to select their top management team based on their inclusion in a given cohort, and the fact that we include controls for management team age in our IV models, we believe that the exclusion restriction criterion is satisfied. Note that, even if firms select managers based on having a graduate degree, managers in the Vietnam era cohort will not be oversampled as long as there are more graduate degree holders in the candidate pool than top management team jobs.[11]

This time-period provides us with an excellent laboratory for our analysis, since many of the

[11] Based on figures from the 2000 U.S. Census, we estimate that there were 4.5 million graduate degree holders in the U.S. in the year 2000 that are in the age range of 40 to 59, which is typically the age for top managers in our sample. In comparison, the number of large firms in the US (i.e., with at least 250 employees) was 36,746. Using a median top managment team size of 7 per firm in our sample of larger firms, we have only 257,000 top management jobs.

individuals who were in this group (at-risk for military service) are in their 50s and 60s during our sample period, which is a typical age for senior managers in the U.S. This provide us with considerable variation to use the graduate deferment during Vietnam war era as a source of exogenous variation in management quality. Second, only U.S. male managers were subject to the draft risk. In other words, neither female managers nor non-U.S. managers were subject to this rule, which provides us with an excellent placebo sample.

Based on the discussion above, the instrument we use is *Draft Risk,* which is defined as a dummy variable that is one when the number of U.S. male senior managers in the management team who graduated from college during the period 1963-1967 is higher than 75th percentile of the whole sample. Aggregating the instrument to the management team level (as opposed to the individual level) reduces the strength of the relation between the continuous variable and the management quality measure, and thus we use the higher end of the distribution as our instrument. In BoardEx, most of the graduation dates for the senior managers are missing. However, age is available for most managers, which we use to impute the college graduation year of managers for whom we don't have actual college graduation dates. We infer managers' graduation dates by assuming that they graduate from college at the age of 22.

In addition, to rule out the possibility that our instrument variable and the management quality factor are correlated purely due to a team size effect, we conduct our IV analyses with an alternative instrument construction, *Adjusted Draft Risk*, which is a dummy variable that equals one if $\frac{\text{1+ Number of Managers at Draft Risk}}{\text{1+Median Number of Managers at Draft Risk for Firm's Team Size}}$ is greater than the 75th percentile of the sample. The denominator in the latter expression essentially normalizes the number of a firm's managers at-draft risk by the number of managers at-draft risk for a given team size.

4.2 Management Quality and Operating Performance

This section tests the relationship between management quality and firm's operating performance, both levels and changes of firm's ROA, which corresponds to our hypothesis (**H1**). We test the following models:

$$\triangle ROA_{i,t+j} = \alpha + \beta_1 MQF_{i,t} + \beta_2 \ln(Assets)_{i,t} + \beta_3 \ln(M/B)_{i,t} + \beta_4 Average\_tenure_{i,t} + Industry\_dummies_i + Year\_dummies_t + \varepsilon_{i,t}, \quad (2)$$

$$Avg\_\triangle ROA_{i,t+3} = \alpha + \beta_1 MQF_{i,t} + \beta_2 \ln(Assets)_{i,t} + \beta_3 \ln(M/B)_{i,t} + \beta_4 Average\_tenure_{i,t} + Industry\_dummies_i + Year\_dummies_t + \varepsilon_{i,t}, \quad (3)$$

$$ROA_{i,t+j} = \alpha + \beta_1 MQF_{i,t} + \beta_2 \ln(Assets)_{i,t} + \beta_3 \ln(M/B)_{i,t} + \beta_4 ROA_{i,t} + \beta_5 Average\_tenure_{i,t} + Industry\_dummies_i + Year\_dummies_t + \varepsilon_{i,t}, \quad (4)$$

$$Avg\_ROA_{i,t+3} = \alpha + \beta_1 MQF_{i,t} + \beta_2 \ln(Assets)_{i,t} + \beta_3 \ln(M/B)_{i,t} + \beta_4 ROA_{i,t} + \beta_5 Average\_tenure_{i,t} + Industry\_dummies_i + Year\_dummies_t + \varepsilon_{i,t}. \quad (5)$$

Here, $\Delta ROA_{i,t+j}$ is the difference between the ROA in year $t+j$ and the ROA in the current year (year t is the current year), $Avg\_\triangle ROA_{i,t+3}$ is difference between the average ROA over the next three years and the ROA in the current year, $ROA_{i,t+j}$ is the ROA in year $t+j$, and $Avg\_ROA_{i,t+3}$ is the average ROA over the next three years. Industry dummies are defined as two digit SIC code dummies. Models (2) and (3) test the relationship between MQF and changes in ROA, whereas models (4) and (5) are testing the relationship between MQF and levels of ROA. If management quality does have a positive impact on performance, then β_1 is expected to be positive and significant. In all regressions throughout the paper, standard errors are clustered at the firm level.[12]

Panels A and B of Table 3 report the results for these regressions. In particular, the dependent variables in Panel A of Table 3 are the levels of operating performance for various time horizons, and the dependent variables in Panel B of Table 3 are the changes in operating performance for various time horizons. Across all specifications, the coefficient on *MQF* is positive and economically as well as statistically significant. For example, in Panel B of Table 3, a one inter-quartile range increase in *MQF* is associated with an increase of 1.3 percentage points in $Avg\_\triangle ROA_{i,t+3}$. This is economically significant given that the median sample ROA is 10.1 percent (and thus represents an 12.9 percent increase for the median firm). Thus, these results show that management quality is positively related to firm performance.

Table 4 reports the results for regressions where we regress $\triangle ROA_{i,t+1}$ and $Avg\_\triangle ROA_{i,t+3}$ on each individual management quality measure. Specifically, we use (size-unadjusted) values of *Team Size, MBA, Prior Work Experience, Education Connections, Employment Connections,* and *Prior Board Experience* as independent variables in Columns (1) through (6) in Panels A and B of Table 4.[13] In Panel A of Table 4, we find positive impact of *Team Size* and *Employment Connections* on one year ROA change. Further, in Panel B of Table 4, we find positive impact of *Team Size, MBA,* and *Employment Connections* on the average three year ROA change. Further, these effects are economically and statistically significant. For instance, in Panel B of Table 4, a one inter-quartile range increase in *MBA* increases $Avg\_\Delta ROA_{i,t+3}$ by 0.7 percentage points.

In order to address potential endogeneity issues in the above results, we conduct instrumental variables analyses. Note that our instrument, which is the risk of draft during the Vietnam War era, is more important when a substantial portion of the management team is composed of U.S. males, who were the group affected by Vietnam war draft. Thus, in our IV analysis, we restrict our sample to those firm-years where the management team has at least 80 percent U.S. males (which corresponds to the 25th percentile of the distribution).

[12] One concern with our results may be that estimation of the management quality factor from a common factor analysis of size-adjusted individual managment quality measures (which are themselves obtained as residuals from a regression) can introduce biases in the standard error estimates in OLS regressions. We also estimate the OLS model standard errors by cluster bootstrapping, and find that the effects we find in our reported tables are still statistically significant. Further, note that this issue will not affect our IV analysis, as the estimation error from the first stage is accounted for

[13] Our results are qualitatively similar when we use size-adjusted individual managment quality measures.

Table 5 reports the two stage least squares regression results with *Draft Risk* as instrument. To control for other potential cohort related effects that might affect our results, we control the regressions for the median age and square of median age of the management team. The first stage for the one year change in ROA regression is reported in Column (1) of Table 5. The instrument, i.e., *Draft Risk*, is positively related to *MQF* and is statistically significant at the 1 percent level. The first stage F-statistic is 154.92 and is significant at the one percent level, indicating that our instrument is a significant predictor of the management quality factor.

Column (2) of Table 5 report the result of the second stage of our two stage least squares model, where the dependent variable is $\Delta ROA_{i,t+1}$. We find that, controlling for potential endogeneity between *MQF* and firm performance, *MQF* still has significant positive effect on the firm's operating performance and this positive relation is statistically significant at the five percent level. Column (3) reports the results of the two stage least squares model for $Avg\_\triangle ROA_{i,t+3}$ as the dependent variable and indicate similar results as before. The economic magnitude of the IV coefficients are similar to those of the OLS coefficients, (i.e., 0.021 for the IV vs. 0.014 for the OLS).

One concern may be that our instrument is positively related to size, which causes a mechanical relation with the management quality factor. Another concern may be that the instrument reflects a cohort-specific effect, rather than the risk of getting drafted in the military. Thus, we run a placebo test, where we calculate the *Draft Risk* for top managers that are either non-U.S. citizen or female and re-run our analysis. If our instrument does not reflect a draft risk but rather a size effect, then the falsified IV should also be correlated to the MQF. In this test, we keep firm-years that have at least one non-U.S. or female manager. In Column (4) of Table 5, we report the result of the placebo regression, and find that the falsified instrument is not related to *MQF* (not statistically significant in the first stage). In unreported tests, we also normalize our *MQF* by team size and find that our results remain qualitatively similar to those reported here.[14]

We also rule out the size effect by using the *Adjusted Draft Risk,* which accounts for firm size, as our instrument. Columns (5) and (6) show the first and second stage IV results with $Avg\_\triangle ROA_{i,t+3}$ as the dependent variable. Our results are consistent with those reported above. In particular, the *Adjusted Draft Risk* has a strong and statistically significant relation with the

[14] These results are available from the authors upon request.

management quality factor. The first stage F-statistic for this IV analysis is 61.5 and is statistically significant at the 1 percent level. Moreover, controlling for potential endogeneity using the team size-adjusted instrument, we find a positive effect of management quality on operating performance.

Thus, we find that management quality is positively related to the firm's operating performance and that this relationship is not likely to be biased by potential endogeneity concerns. This is consistent with our hypothesis (**H1**) that higher quality managers can positively impact firm operating performance.

4.3 Management Quality and Firm Valuation

In this section, we test the relationship between management quality and firm valuation, i.e., the market to book ratio of its assets, which corresponds to hypothesis (**H2**). We estimate the following model:

$$
\begin{aligned}
\ln(M/B)_{i,t} \quad = \quad & \alpha + \beta_1 MQF_{i,t} + \beta_2 \ln(Assets)_{i,t-1} + \beta_3 \ln(M/B)_{i,t-1} + \beta_4 ROA_{i,t-1} \\
& + \beta_5 Average\_tenure_{i,t-1} + Industry\_dummies_i \ + Year\_dummies_t \\
& + \varepsilon_{i,t} \qquad (6)
\end{aligned}
$$

Where M/B is defined as market value of assets divided by the book value of assets. Note that we test the contemporaneous effect of management quality on firm's valuation. So both M/B and MQF are measured in the same year, whereas all other control variables are lagged by one year. If management quality does have a positive impact on performance, then β_1 is expected to be positive and significant. In all models, standard errors are clustered at the firm level.

Column (1) of Table 6 reports the regression result for specification (6) and finds that the coefficient on MQF is both economically and statistically significant for our model. Specifically, increasing MQF from the 25th to the 75th percentile increases the contemporaneous market to book ratio by 3.4 percent, which corresponds to a $16.1 million increase in stock market value for the median firm. Columns (2) to (7) of Table 7 report results for OLS regressions with firm valuation as the dependent variable as above, but using (size-unadjusted) individual measures of management quality as the right hand side variables. Consistent with expectation, we find that the individual management quality measures have a significant impact on the market to book ratio. For example, increasing *Team Size* from the 25th to the 75th percentile increases the contemporaneous valuation by 4.2 percent, which corresponds to a $20 million increase in the market value for the median firm.

Table 7 reports the IV second stage (2SLS) regression results for market to book ratio. The positive relation in the second stage regression between *MQF* and market to book ratio indicates a positive causal relationship between management quality and firm valuation. Column (1) reports the results with *Draft risk* as the instrument and Column (2) reports the results with *Adjusted draft risk* as the instrument. In both cases, the results indicate a positive impact of *MQF* on firm valuation. The above results support hypothesis (**H2**), i.e., management quality positively impacts a firm's market valuation.

4.4 Management Quality and Stock Return

In order to test the relationship between management quality and stock return, which corresponds to hypothesis (**H3**), we run the following model in this section:

$$\begin{aligned}\ln(R_{i,t+j}) \quad = \quad & \alpha + \beta_1 MQF_{i,t} + \beta_2 \ln(Assets)_{i,t} + \beta_3 \ln(M/B)_{i,t} + \beta_4 ROA_{i,t} \\ & + \beta_5 Average\_tenure_{i,t} + Industry\_dummies_i \ + Year\_dummies_t + \varepsilon_{i,t} \quad (7)\end{aligned}$$

Where, $\ln(R_{i,t+j})$ is defined as long-run value-weighted market adjusted stock returns. We show our results for stock returns measured for one year and for three years (i.e., $j = 1$ and $j = 3$, respectively). If management quality does have a positive impact on performance, then β_1 is expected to be positive and significant. As before, standard errors are clustered at the firm level.

Table 8 reports the OLS regression results for the above model. We find that firms with higher quality management teams have higher future stock returns and this effect is highly statistically and economically significant. The coefficient estimate on *MQF* is significant at the 1 percent level for both one year and three year stock returns (reported in Columns (1) and (2), respectively, in Table 8). Economically, increasing the management quality factor from the 25th to the 75th percentile increases the market adjusted returns for the next year by 3.3 percentage points, and increases the three year compounded return by 7.8 percentage points. In Columns (3) and (4) of Table 8, we report our stock return results using the long-run stock returns adjusted by DGTW benchmark portfolios as dependent variables. As in the first two columns, the third column is one year ahead stock return, and the fourth column is the three year compounded abnormal return. The coefficient estimates on MQF are positive and significant at the 1 percent level for both one year and three year stock returns, indicating that our results are robust to the return adjustment benchmark.[15]

In Table 9, we regress stock return on the individual (size-unadjusted) management quality measures that we use to construct the aggregate management quality factor. We report the results for one year stock returns in Panel A of Table 9 and those for three-year returns in Panel B of Table 9. The results indicate that, across all six measures of management quality, the effect on stock returns is large and significant. For instance, a one inter-quartile range increase in *Team size* increases one year stock returns by 3.6 percentage points and three year stock returns by 8.4 percentage points.

Table 10 reports results of the instrumental variable regression. From Columns (1) and (2), which correspond to the second stage of the IV regression with *Draft risk* as the instrument, we find that, after controlling for potential endogeneity between *MQF* and firm performance, *MQF* still has significant and positive effect on the firm's stock returns. Columns (3) and (4) report the results of the second stage of the IV regression with *Adjusted draft risk* as the instrument and indicate similar results as before.[16]

The results documented above support hypothesis (**H3**) which predicts a positive relationship between management quality and future long-run stock return. Overall, our results so far indicate that management quality has a positive effect on firm operating performance, valuation, and on stock returns. Moreover, our instrumental variables analyses support a causal interpretation of these

[15] In unreported tests, we also run regressions with additional control variables, namely, natural log of market capitalization, natural log of book-to-market ratio, and buy-and-hold return in the previous year. Our results are qualitatively similar to those reported here. These results are available upon request.

[16] We also run the analysis reported in Tables 9 and 10 using the DGTW method of stock return adjustment and find similar results. These results are unreported to save space and are available from the authors upon request.

results. Thus, we find support for managerial ability having a positive impact on firm performance. In the remaining part of this paper, we try to flesh out the mechanism behind this relationship.

4.5 Management Quality and Investment

Based on the theory outlined in Section 2, the relationship between management quality and all three measures of firm performance established above implied that there should be an impact of management quality on firms' investment decisions. In this section, to better understand the actual channel through which management quality affects firm performance, we test the relationship between management quality and future investment, which corresponds to hypothesis (**H4**). We thus estimate the following two models:

$$
\begin{aligned}
Avg\frac{Investment_{i,t+j}}{Assets_{i,t+j-1}} &= \alpha + \beta_1 MQF_{i,t} + \beta_2 \ln(Assets)_{i,t} + \beta_3 \ln(M/B)_{i,t} + \beta_4 ROA_{i,t} \\
&\quad + \beta_5 \frac{Investment_{i,t}}{Assets_{i,t}} + \beta_6 Average\_tenure_{i,t} + Industry\_dummies_i \\
&\quad + Year\_dummies_t + \varepsilon_{i,t}, \qquad (8)
\end{aligned}
$$

$$
\begin{aligned}
\Delta\frac{Investment_{i,t+1}}{Assets_{i,t}} &= \alpha + \beta_1 MQF_{i,t} + \beta_2 \ln(Assets)_{i,t} + \beta_3 \ln(M/B)_{i,t} + \beta_4 ROA_{i,t} \\
&\quad + \beta_5 Average\_tenure_{i,t} + Industry\_dummies_i + Year\_dummies_t \\
&\quad + \varepsilon_{i,t}. \qquad (9)
\end{aligned}
$$

Here, $\frac{Investment_{i,t+j}}{Asset_{i,t+j-1}}$ is defined as a firm's investment at time $t+j$ divided by the total assets in year $t+j-1$. $Avg\frac{Investment_{i,t+j}}{Assets_{i,t+j-1}}$ is the next three year average (i.e., for years $j = 1, 2,$and 3) value of $\frac{Investment_{i,t+j}}{Asset_{i,t+j-1}}$. We define investment in three different ways: Capital expenditure, R&D expenditure, and Capital expenditure plus R&D expenditure. We test the relationship between management quality and firm investment using two different specifications. In model (8) (the levels model), we use the future three year average of investment levels to firm total assets ratio as dependent variable. In model (9) (the changes model), we use changes in firm investment to total asset ratio from one year to the next as dependent variable. If management quality does have a positive impact on firm investment, then β_1 is expected to be positive and significant in both specifications. As before, standard errors are clustered at the firm level.

Table 11 reports the regression results for the above two models. From both the OLS regression (Panel A) and the instrumental variable regression (Panels B and C), firms with higher quality management teams have larger investment scale and this effect is highly statistically and economically significant. The OLS coefficient estimates on *MQF* in Panel A are significant at the 1 percent level (with column (2) as an exception) for both levels model (reported in Columns (1) to (3)) and changes model (reported in Columns (4) to (6)), respectively. Economically, increasing management quality factor from the 25th percentile to the 75th percentile is associated with a 0.5 percentage point increase in the changes of capital expenditure from one year to another. The median value for capital expenditure to total asset ratio in our sample is 0.035. The economic effect of management quality thus represents a 14.3 percent increase in capital expenditure to total asset ratio for a one inter-quantile range increase in management quality.

To establish the causal nature of our investment results, we conduct instrumental variable analyses as before. The results for the IV analyses with *Draft risk* as the instrument are reported in Panel B of Table 11, and indicates that, after correcting for any potential endogeneity issues, our results are similar to those in the OLS models. Panel C of Table 11 reports the results with *Adjusted draft risk* as the instrument, and the results, although weaker for average levels of capital expenditure to assets ratios, are similar to those reported above. Thus, our findings indicate that higher quality management teams invest at higher levels, and increase their investments at a greater pace than lower quality management teams, supporting hypothesis (**H4**).

4.6 Management Quality and Firm Performance: Interaction Tests

In this section, we dig deeper into whether management quality is positively related to firm performance due to better quality decisions made by managers. We thus conduct interaction tests based on the hypotheses that management team quality will have a stronger effect for firms in R&D intensive industries, more competitive industries, and financially constrained industries. We also analyze whether management team quality is more important during recessionary periods.

In order to test the above hypotheses, we interact *MQF* in our regressions with *R&D*, which is the median value of research and development expenditures to assets ratio in the firm's industry (also defined at the two digit SIC code level) in each year; with *HHI*, which is the value of Herfindahl–Hirschman Index in the firm's industry (defined at the two digit SIC code level) in each year; with *Constrained*, which is a dummy variable that equals to one when the firm operates in an industry whose median value of external finance dependence (as calculated in Rajan and Zingales (1998)) is positive; and with *Recession*, which is also a dummy variable that equals to one in years when the U.S. economy is in a recession for more than six months, as defined by the National Bureau of Economic Research (NBER).

Table 12 reports the results for these interaction tests. In Panel A of this table, Columns (1) to (3) report the regression results for the interaction of *R&D* and *MQF* as well as *R&D* as additional independent variables. The coefficient estimate on *MQF* is significantly positive for all three measures of firm performance, consistent with prior results. Moreover, the coefficients on the interaction term (*MQF*R&D*) are also significantly positive, indicating that management quality has a more positive effect on performance for firms in R&D intensive industries. Columns (4) to (6) report the regression results for *HHI* as the interaction variable. As before, the coefficient estimate on *MQF* is significantly positive for all three measures of firm performance. Further, the coefficient estimate on the interaction term (*MQF*HHI*) is negative, indicating that the positive effect of management quality diminishes as industry competition decreases.

In Panel B of Table 12, we report the interaction tests for recession and financial constraints. Columns (1) to (3) report the results for regressions where *MQF* is interacted with *Constrained*. The coefficients of interaction term are all significant at 1 percent level across three different specifications. Columns (4) to (6) report regression results for *MQF* interacted with *Recession*. Interaction terms in the operating performance and market valuation regression are significant at the 1 percent level, although the stock return result is a little weaker.

Thus, the results in this section provide further support for the idea that management quality positively affects firm performance. An important mechanism of this effect is the choice of better projects and the better implementation of such projects by higher quality management teams. This mechanism finds support in our empirical results that management quality is more positively related to firm performance in R&D intensive industries, in more competitive industries, in financially constrained industries, and in recession years.

5 Conclusion

We present evidence that management quality is related to firm value and performance. There is not much research that analyzes how management team quality affects firm value. There are two significant hurdles in such a study. First, measuring management quality and human capital involves subjective notions of what constitutes a high quality management team. Second, potential endogeneity can confound empirical findings on the relation between management quality and firm value. We overcome the first hurdle by creating a management team quality index from various measures used previously in the literature, such as management team size, fraction of managers with MBAs, the average employment- and education-based connections of each manager in the management team, fraction of members with prior working experience in the top management team, and the average number of board positions that each manager serves on. These measures are adjusted for firm size. We create a comprehensive index of management quality based on common factor analysis using the above-mentioned measures of management quality.

We overcome the second hurdle related to endogeneity by using Vietnam war draft deferment rules for graduate education. In particular, during the Vietnam war and until 1968, draft rules allowed draft deferment for a person who gets admitted to a graduate degree. This led to many individuals getting a higher education for reasons unrelated to their intrinsic quality and provided an exogenous variation in the human capital of managers. Using this as an instrument, we find a causal relationship between our management quality index and a firm's long-run future operating performance, market valuation, and long-run future stock returns. We also find that firms with higher management quality are characterized by larger levels of investment and investment growth. The relationship between management quality and firm value and performance is stronger for firms in R&D intensive industries, where knowledge and human capital of top managers is more important; and for firms in more competitive industries, where management quality may be more important in giving the firm an edge over competitors; and for recession years, when management quality is an important factor in helping firms select and better implement good projects to get through difficult times; and for firms in financially constrained industries, where investment efficiency is important. Overall, our results indicate that management team quality is indeed an important driver of value for firms.

References

[1] Adams, Renee, Heitor Almeida, and Daniel Ferreira, 2005, Powerful CEOs and Their Impact on Corporate Performance, Review of Financial Studies 18, 1403–1432.

[2] Bandiera, Oriana, Iwan Barankay, and Imran Rasul, 2005, Social Preferences and the Response to Incentives: Evidence From Personnel Data, Quarterly Journal of Economics 120, 917–962.

[3] Bandiera, Oriana, Iwan Barankay, and Imran Rasul, 2010, Social Incentives in the Workplace, Review of Economic Studies 77, 417-458.

[4] Bernard, Victor L., and Jacob K. Thomas, 1989, Post-earnings-announcement Drift: Delayed Price Response or Risk Premium, Journal of Accounting research 27, 1-36.

[5] Bertrand, Marianne, and Antoinette Schoar, 2003, Managing with Style: The Effect of Managers on Firm Policies, Quarterly Journal of Economics 118, 1169-1208.

[6] Bloom, Nicholas, Benn Eifert, Aprajit Mahajan, David McKenzie, and John Roberts, 2013, Does Management Matter? Evidence From India, Quarterly Journal of Economics 128, 1-51.

[7] Bloom, Nicholas, and John Van Reenen, 2007, Measuring and Explaining Management Practices Across Firms and Countries, Quarterly Journal of Economics 122, 1351-1408.

[8] Card, David, and Thomas Lemieux, 2001, Going to College to Avoid the Draft: The Unintended Legacy of the Vietnam War, American Economic Review 91, 97-102.

[9] Chemmanur, Thomas J., and Imants Paeglis, 2005, Management Quality, Certification and Initial Public Offerings, Journal of Financial Economics 76, 331–368.

[10] Chemmanur, Thomas J., Imants Paeglis, and Karen Simonyan, 2009, Management Quality, Financial and Investment Policies, and Asymmetric Information, Journal of Financial and Quantitative Analysis 44, 1045-1079.

[11] Chevalier, Judith, and Glenn Ellison, 1999, Are Some Mutual Fund Managers Better than Others? Cross-sectional Patterns in Behavior and Performance, Journal of Finance 54, 875-899.

[12] Cohen, Lauren, Andrea Frazzini, and Christopher Malloy, 2008, The Small World of Investing: Board Connections and Mutual Fund Returns, Journal of Political Economy 116, 951-979.

[13] Core, John E., Wayne R. Guay, and Tjomme O. Rusticus, 2006, Does Weak Governance Cause Weak Stock Returns? An Examination of Firm Operating Performance and Investors' Expectations, Journal of Finance 61, 655–687.

[14] Daniel, Kent, Mark Grinblatt, Sheridan Titman, and Russ Wermers, 1997, Measuring Mutual Fund Performance with Characteristic-based Benchmarks, Journal of Finance 52, 1035–1058.

[15] Engelberg, Joseph, Pengjie Gao, and Christopher A. Parsons, 2013, The Price of a CEO's Rolodex, Review of Financial Studies 26, 79–114.

[16] Fama, Eugene F., and Kenneth R. French, 1992, The Cross-section of Expected Stock Returns, Journal of Finance 47, 427–465.

[17] Finkelstein, Sydney, and Donald C. Hambrick, 1996, Top Executives and Their Effects on Organizations, West Publishing Company.

[18] Foster, George, Chris Olsen, and Terry Shevlin, 1984, Earnings releases, Anomalies, and The Behavior of Security Returns, Accounting Review, 574-603.

[19] Gompers, Paul A., Joy L. Ishii, and Andrew Metrick, 2003, Corporate Governance and Equity Prices, Quarterly Journal of Economics 118, 107–155.

[20] Hellmann, Thomas, and Manju Puri, 2002, Venture Capital and the Professionalization of Start-up Firms: Empirical Evidence, Journal of Finance 57, 169–197.

[21] Kaplan, Steven, Mark Klebanov, and Morten Sorensen, 2012, Which CEO Characteristics and Abilities Matter? Journal of Finance 67, 973–1007.

[22] Malmendier, Ulrike, and Geoffrey Tate, 2005, CEO Overconfidence and Corporate Investment, Journal of Finance 60, 2661–2700.

[23] Rajan, Raghuram G., and Luigi Zingales, 1998, Financial Dependence and Growth, American Economic Review 88, 559-586.

[24] Sah, Raaj Kumar, and Joseph E. Stiglitz, 1986, The Architecture of Economic Systems: Hierarchies and Polyarchies, American Economic Review 76, 716-727.

[25] Sah, Raaj Kumar, and Joseph E. Stiglitz, 1991, The Quality of Managers in Centralized versus Decentralized Organizations, Quarterly Journal of Economics 106, 289-295.

Table 1: Summary Statistics

This table reports summary statistics for our sample of public firms between 1999 and 2010. *Team Size* is how many managers (VP or higher) there are in a firm's management team; *MBA* is the fraction of those managers that have MBA degrees; *Prior Work Experience* is the fraction of top managers that have experience working as VP or higher in other companies; *Education Connections* is the average number of graduate connections that each manager has through education (if two managers graduate from the same university with the same degree within one year of each other, those two are defined as connected); *Employment Connections* is the average number of connections that each manager has through prior employment (if two managers worked in the same previous company during overlapping time periods, either as managers or directors, those two are defined as connected); *Prior Board Experience* is the average number of board positions that each manager has served on; *Total Assets* is the firm's total assets; *ROA* is defined as operating income before depreciation divided by total assets; *M/B* is Tobin's Q, defined as market value of assets divided by the book value of assets, where the market value of assets is computed as the book value of assets plus the market value of common stock less the book value of common stock; *Average Tenure* is the average number of years that each manager has worked as VP or higher in this firm.

Variable	Obs	Mean	Std. Dev.	Min	First Quartile	Median	Third Quartile	Max
Team Size	34,625	7.569	4.492	2.000	4.000	7.000	10.000	30.000
MBA	34,625	0.223	0.197	0.000	0.000	0.200	0.333	1.000
Prior Work Experience	34,625	0.142	0.176	0.000	0.000	0.100	0.250	1.000
Education Connections	34,625	1.326	3.193	0.000	0.000	0.000	1.000	55.500
Employment Connections	34,625	17.659	11.292	1.000	9.667	15.000	22.875	98.667
Prior Board Experience	34,625	0.114	0.232	0.000	0.000	0.000	0.167	6.667
Total Assets (Million)	34,625	2,816.531	12,894.040	0.003	72.157	295.004	1,250.126	304,594.000
ROA	34,625	0.027	0.304	-2.041	0.011	0.101	0.163	0.424
M/B	34,625	2.540	11.090	0.107	1.166	1.603	2.514	1,352.720
Average Tenure	34,625	5.906	3.437	1.000	3.556	5.250	7.429	36.500

Table 2: Common Factor Analysis

This table reports statistics related to common factor analysis. *Factor 1- Factor 6* are the common factors obtained by using common factor analysis on the firm-size and industry-adjusted *Team Size, MBA, Prior Work Experience, Education Connections, Employment Connections* and *Prior Board Experience*. *Team Size* is how many managers (VP or higher) there are in a firm's management team; *MBA* is the fraction of those managers that have MBA degrees; *Prior Work Experience* is the fraction of top managers that have experience working as VP or higher in other companies; *Education Connections* is the average number of graduate connections that each manager has through education (if two managers graduate from the same university with the same degree within one year of each other, those two are defined as connected); *Employment Connections* is the average number of connections that each manager has through prior employment (if two managers worked in the same previous company during overlapping time periods, either as managers or directors, those two are defined as connected); *Prior Board Experience* is the average number of board positions that each manager has served on. Panel A reports the eigenvalues for the six factors to mimic the correlation matrix of the original variables. Panel B reports the communality of the original variables and the correlation and loadings on the first factor. Panel C reports the descriptive statistics of the first factor.

Panel A: Eigenvalues

Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
1.176	0.567	0.202	-0.020	-0.165	-0.301

Panel B: Summary For Factor Analysis

Variable	Loadings on First Factor	Correlation with First Factor	Communality
Team Size	0.518	0.611	0.520
MBA	0.157	0.087	0.130
Prior Work Experience	0.365	0.216	0.250
Education Connections	0.150	0.083	0.130
Employment Connections	0.803	0.579	0.649
Prior Board Experience	0.286	0.082	0.266

Panel C: Summary Statistics of First Factor

Mean	Std. Dev.	Min	First Quartile	Median	Third Quartile	Max
0.000	0.768	-1.990	-0.479	-0.041	0.443	2.325

Table 3: The Effect of Management Quality on Operating Performance

This table reports the OLS regression results of management quality factor on firm's operating performance. Panel A reports regression results with levels of operating performance as dependent variable, and Panel B reports regression results with changes in operating performance as dependent variable. *ROA* is defined as operating income before depreciation over total assets; *Ln(Assets)* is the natural logarithm of the firm's total assets; *Ln(M/B)* is the natural logarithm of Tobin's Q, and Tobin's Q is defined as market value of assets divided by the book value of assets, where the market value of assets is computed as the book value of assets plus the market value of common stock less the book value of common stock; *Average Tenure* is the average number of years that each manager has worked as VP or higher in this firm; ROA_{t+1} is the *ROA* in the next year; ROA_{t+2} is the *ROA* in two years from now; ROA_{t+3} is the *ROA* in three years from now; AVG_ROA_{t+3} is the average *ROA* of the future three years, i.e., $\frac{1}{3}\sum_{i=1}^{3} ROA_{t+i}$; ΔROA_{t+1} is the changes in ROA between the current year and the next year, i.e., $ROA_{t+1} - ROA_t$; ΔROA_{t+2} is the changes in ROA between the current year and two years from now, i.e., $ROA_{t+2} - ROA_t$; ΔROA_{t+3} is the changes in *ROA* between the current year and three years from now, i.e., $ROA_{t+3} - ROA_t$; $AVG\_\Delta ROA_{t+3}$ is the changes in *ROA* between the current year and the future three year average, i.e., $\frac{1}{3}\sum_{i=1}^{3}(ROA_{t+i} - ROA_t)$. Constant, year fixed effects, and two digit SIC industry fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level, and p-values using these clustered standard errors are reported in parentheses below the coefficient estimates. ***, **, and * represent statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: Levels of Operating Performance				
	(1)	(2)	(3)	(4)
	ROA_{t+1}	ROA_{t+2}	ROA_{t+3}	AVG_ROA_{t+3}
MQF	0.002*	0.006***	0.009***	0.007***
	(0.064)	(0.000)	(0.000)	(0.000)
Ln(Assets)	0.011***	0.016***	0.017***	0.013***
	(0.000)	(0.000)	(0.000)	(0.000)
Ln(M/B)	0.000	-0.012***	-0.013***	-0.013***
	(0.884)	(0.002)	(0.001)	(0.000)
ROA	0.774***	0.664***	0.611***	0.730***
	(0.000)	(0.000)	(0.000)	(0.000)
Average Tenure	0.003***	0.003***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
Industry & Year FE	Yes	Yes	Yes	Yes
Observations	33,318	29,973	26,027	25,976
R-squared	0.678	0.567	0.504	0.649

Panel B: Changes in Operating Performance				
	(1)	(2)	(3)	(4)
	ΔROA_{t+1}	ΔROA_{t+2}	ΔROA_{t+3}	$AVG\_\Delta ROA_{t+3}$
MQF	0.008***	0.014***	0.019***	0.014***
	(0.000)	(0.000)	(0.000)	(0.000)
Ln(Assets)	-0.003***	-0.005***	-0.006***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.006)
Ln(M/B)	0.018***	0.013***	0.012**	0.004
	(0.000)	(0.002)	(0.017)	(0.287)
Average Tenure	0.001**	0.000	-0.000	0.000
	(0.022)	(0.310)	(0.745)	(0.278)
Industry & Year FE	Yes	Yes	Yes	Yes
Observations	33,318	29,973	26,027	25,976
R-squared	0.017	0.021	0.024	0.021

Table 4: The Effect of Individual Management Quality Variables on Changes in Operating Performance

This table reports the OLS regression results of individual management quality variables on changes in operating performance. Panel A reports the result about changes in *ROA* from current year to the next year, and panel B reports the result about changes in *ROA* from current to future three year averages. *Team Size* is how many managers (VP or higher) there are in a firm's management team; *MBA* is the fraction of those managers that have MBA degrees; *Prior Work Experience* is the fraction of top managers that have experience working as VP or higher in other companies; *Education Connections* is the average number of graduate connections that each manager has through education (if two managers graduate from the same university with the same degree within one year of each other, those two are defined as connected); *Employment Connections* is the average number of connections that each manager has through prior employment (if two managers worked in the same previous company during overlapping time periods, either as managers or directors, those two are defined as connected); *Prior Board Experience* is the average number of board positions that each manager has served on; *Ln(Assets)* is the natural logarithm of the firm's total assets; *Ln(M/B)* is the natural logarithm of Tobin's Q, and Tobin's Q is defined as market value of assets divided by the book value of assets, where the market value of assets is computed as the book value of assets plus the market value of common stock less the book value of common stock; *Average Tenure* is the average number of years that each manager has worked as VP or higher in this firm; ΔROA_{t+1} is the changes in ROA between the current year and the next year, i.e., $ROA_{t+1} - ROA_t$; $AVG\_\Delta ROA_{t+3}$ is the changes in *ROA* between the current year and the future three year average, i.e., $\frac{1}{3}\sum_{i=1}^{3}(ROA_{t+i} - ROA_t)$. Constant, year fixed effects, and two digit SIC industry fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level, and p-values using these clustered standard errors are reported in parentheses below the coefficient estimates. ***, **, and * represent statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: ΔROA_{t+1}						
	(1)	(2)	(3)	(4)	(5)	(6)
Team Size	0.002***					
	(0.000)					
MBA		0.006				
		(0.174)				
Prior Work Experience			-0.000			
			(0.933)			
Education Connections				0.000		
				(0.720)		
Employment Connections					0.001***	
					(0.000)	
Prior Board Experience						0.004
						(0.233)
Ln(Assets)	-0.006***	-0.003***	-0.003***	-0.003***	-0.007***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln(M/B)	0.017***	0.019***	0.019***	0.019***	0.017***	0.019***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average Tenure	0.000**	0.000	0.000	0.000	0.001**	0.000
	(0.035)	(0.127)	(0.220)	(0.183)	(0.014)	(0.191)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	33,318	33,318	33,318	33,318	33,318	33,318
R-squared	0.017	0.016	0.016	0.016	0.018	0.016

Panel B: $AVG\_\Delta ROA_{t+3}$						
	(1)	(2)	(3)	(4)	(5)	(6)
Team Size	0.003***					
	(0.000)					
MBA		0.020**				
		(0.022)				
Prior Work Experience			-0.004			
			(0.690)			
Education Connections				0.000		
				(0.931)		
Employment Connections					0.002***	
					(0.000)	
Prior Board Experience						0.000
						(0.943)
Ln(Assets)	-0.007***	-0.002**	-0.002**	-0.002**	-0.009***	-0.002**
	(0.000)	(0.016)	(0.036)	(0.035)	(0.000)	(0.036)
Ln(M/B)	0.003	0.006	0.006	0.006	0.003	0.006
	(0.354)	(0.117)	(0.104)	(0.107)	(0.351)	(0.105)
Average Tenure	0.000	0.000	0.000	0.000	0.000	0.000
	(0.429)	(0.576)	(0.995)	(0.876)	(0.314)	(0.875)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	25,976	25,976	25,976	25,976	25,976	25,976
R-squared	0.021	0.019	0.018	0.018	0.022	0.018

Table 5: The Effect of Management Quality on Changes in Operating Performance: Instrumental Variable Analysis

This table reports IV regression results of management quality factor on changes in operating performance. From column 1 to column 3, the instrument used is *Draft risk*, which is a dummy variable, defined as whether the number of U.S. male managers in the management team (VP or higher) that graduated from college during Vietnam War era (1963 to 1967) is higher than the 75th percentile of the whole sample (one for this case). Columns 5 and 6 use *Adjusted draft risk* as the instrument, which is a dummy variable, defined as whether the *team size adjusted* number of U.S. male managers in the management team (VP or higher) that graduated from college during Vietnam War era (1963 to 1967) is higher than the 75th percentile of the whole sample (two for this case), where we adjust the number of U.S. male managers in the management team (VP or higher) that graduated from college during Vietnam War era (1963 to 1967) by using the following formula: $\frac{1+number\ of\ managers\ at\ draft\ risk}{1+median\ number\ of\ managers\ at\ draft\ risk\ for\ firm's\ team\ size}$. In Column 4, the placebo *IV (Draft Risk)* is a dummy variable, defined as whether the number of non U.S. managers or female managers in the management team (VP or higher) that graduated from college during Vietnam War era (1963 to 1967) is higher than the 75th percentile of the whole sample (zero for this case). *ROA* is defined as operating income before depreciation over total assets; *Ln(Assets)* is the natural logarithm of the firm's total assets; *Ln(M/B)* is the natural logarithm of Tobin's Q, and Tobin's Q is defined as market value of assets divided by the book value of assets, where the market value of assets is computed as the book value of assets plus the market value of common stock less the book value of common stock; *Average Tenure* is the average number of years that each manager has worked as VP or higher in this firm; *Median Age* is the median age of all the managers in the management team in a given year; and *Median Age Square* is the square of the *Median age*; ΔROA_{t+1} is the changes in ROA between the current year and the next year, i.e., $ROA_{t+1} - ROA_t$; $AVG\_\Delta ROA_{t+3}$ is the changes in *ROA* between the current year and the future three year average, i.e., $\frac{1}{3}\sum_{i=1}^{3}(ROA_{t+i} - ROA_t)$. Industry is defined as two digits SIC. Constant, year fixed effects, and two digit SIC industry fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level, and p-values using these clustered standard errors are reported in parentheses below the coefficient estimates. ***, **, and * represent statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	First Stage (IV- Draft Risk)	Second Stage (IV- Draft Risk)	Second Stage (IV- Draft Risk)	Placebo First Stage (IV- Draft Risk)	First Stage (IV - Adjusted Draft risk)	Second Stage (IV - Adjusted Draft Risk)
	MQF	ΔROA_{t+1}	$AVG\_\Delta ROA_{t+3}$	MQF	MQF	$AVG\_\Delta ROA_{t+3}$
Draft risk	0.385***			0.086		
	(0.000)			(0.195)		
Adjusted Draft Risk					0.231***	
					(0.000)	
MQF		0.014**	0.021**			0.030*
		(0.031)	(0.035)			(0.086)
Ln(Assets)	0.007	-0.004***	-0.003***	0.047***	0.016**	-0.003***
	(0.301)	(0.000)	(0.009)	(0.000)	(0.032)	(0.008)
Ln(M/B)	0.135***	0.016***	-0.000	0.156***	0.138***	-0.002
	(0.000)	(0.000)	(0.907)	(0.000)	(0.000)	(0.699)
Average Tenure	-0.027***	0.001*	0.001	-0.040***	-0.028***	0.001
	(0.000)	(0.055)	(0.275)	(0.000)	(0.000)	(0.221)
Median Age	0.214***	0.002	-0.004	0.276***	0.210***	-0.006
	(0.000)	(0.519)	(0.412)	(0.000)	(0.000)	(0.311)
Median Age Square	-0.002***	-0.000	0.000	-0.003***	-0.002***	0.000
	(0.000)	(0.477)	(0.487)	(0.000)	(0.000)	(0.364)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	25,480	25,480	20,021	18,431	25,480	20,021
R-squared	0.085	0.017	0.023	0.074	0.068	0.021

Table 6: The Effect of Management Quality and Individual Variables on Valuation

This table reports the OLS regression results of management quality factor and individual management quality variables on firm's contemporaneous valuation. The dependent variable across all 7 columns is $\ln(M/B)_{t.}$ *Ln(M/B)* is the natural logarithm of Tobin's Q, and Tobin's Q is defined as market value of assets divided by the book value of assets, where the market value of assets is computed as the book value of assets plus the market value of common stock less the book value of common stock; *Team Size* is how many managers (VP or higher) there are in a firm's management team; *MBA* is the fraction of those managers that have MBA degrees; *Prior Work Experience* is the fraction of top managers that have experience working as VP or higher in other companies; *Education Connections* is the average number of graduate connections that each manager has through education (if two managers graduate from the same university with the same degree within one year of each other, those two are defined as connected); *Employment Connections* is the average number of connections that each manager has through prior employment (if two managers worked in the same previous company during overlapping time periods, either as managers or directors, those two are defined as connected); *Prior Board Experience* is the average number of board positions that each manager has served on; *Ln(Assets)* is the natural logarithm of the firm's total assets; *Average Tenure* is the average number of years that each manager has worked as VP or higher in this company. Constant, year fixed effects, and two digit SIC industry fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level, and p-values using these clustered standard errors are reported in parentheses below the coefficient estimates. ***, **, and * represent statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MQF_t	0.037***						
	(0.000)						
Team Size_t		0.007***					
		(0.000)					
MBA_t			0.019				
			(0.162)				
Prior Work $\mathrm{Experience}_t$				0.027*			
				(0.084)			
Education $\mathrm{Connections}_t$					0.003***		
					(0.007)		
Employment $\mathrm{Connections}_t$						0.003***	
						(0.000)	
Prior Board $\mathrm{Experience}_t$							0.005
							(0.617)
$\mathrm{Ln(Assets)}_{t-1}$	-0.006***	-0.015***	-0.004**	-0.004**	-0.004***	-0.019***	-0.003**
	(0.000)	(0.000)	(0.012)	(0.012)	(0.004)	(0.000)	(0.018)
ROA_{t-1}	-0.178***	-0.182***	-0.189***	-0.189***	-0.188***	-0.171***	-0.190***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\mathrm{Ln(M/B)}_{t-1}$	0.700***	0.697***	0.703***	0.703***	0.702***	0.698***	0.703***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Avgerage Tenure_{t-1}	0.002**	0.001	0.001	0.001	0.000	0.001*	0.001
	(0.024)	(0.134)	(0.370)	(0.253)	(0.537)	(0.072)	(0.483)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	29,308	29,308	29,308	29,308	29,308	29,308	29,308
R-squared	0.647	0.647	0.645	0.645	0.645	0.647	0.645

Table 7: The Effect of Management Quality on Valuation: Instrumental Variable Analysis

This table reports IV regression results of management quality factor on firm's contemporaneous valuation. In column 1, the instrument used is *Draft risk,* which is a dummy variable, defined as whether the number of U.S. male managers in the management team (VP or higher) that graduated from college during Vietnam War era (1963 to 1967) is higher than the 75^{th} percentile of the whole sample (one for this case). Column 2 uses *Adjusted draft risk* as the instrument, which is a dummy variable, defined as whether the *team size adjusted* number of U.S. male managers in the management team (VP or higher) that graduated from college during Vietnam War era (1963 to 1967) is higher than the 75^{th} percentile of the whole sample (two for this case), where we adjust the number of U.S. male managers in the management team (VP or higher) that graduated from college during Vietnam War era (1963 to 1967) by using the following formula: $\frac{1+number\ of\ managers\ at\ draft\ risk}{1+median\ \ number\ of\ \ managers\ at\ draft\ risk\ for\ firm's\ team\ size}$. *ROA* is defined as operating income before depreciation over total assets; *Ln(Assets)* is the natural logarithm of the firm's total assets as listed in Compustat; *Ln(M/B)* is the natural logarithm of Tobin's Q, and Tobin's Q is defined as market value of assets divided by the book value of assets, where the market value of assets is computed as the book value of assets plus the market value of common stock less the book value of common stock; *Average Tenure* is the average number of years that each manager has worked as VP or higher in this company; *Median Age* is the median age of all the managers in the management team in a given year; and *Median Age Square* is the square of the *Median age*. Constant, year fixed effects, and two digit SIC industry fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level, and p-values using these clustered standard errors are reported in parentheses below the coefficient estimates. ***, **, and * represent statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)
	Second Stage (IV- Draft risk)	Second Stage (IV - Adjusted Draft Risk)
	$\ln(M/B)_t$	$\ln(M/B)_t$
MQF_t	0.057***	0.077**
	(0.006)	(0.041)
$\mathrm{Ln(Assets)}_{t-1}$	-0.009***	-0.010***
	(0.000)	(0.000)
ROA_{t-1}	0.694***	0.692***
	(0.000)	(0.000)
$\mathrm{Ln(M/B)}_{t-1}$	-0.189***	-0.183***
	(0.000)	(0.000)
$\mathrm{Avgerage\ Tenure}_{t-1}$	0.003**	0.003**
	(0.014)	(0.026)
$\mathrm{Median\ Age}_{t-1}$	0.015*	0.011
	(0.077)	(0.276)
$\mathrm{Median\ Age\ Square}_{t-1}$	-0.000*	-0.000
	(0.058)	(0.229)
Industry & Year FE	Yes	Yes
Observations	22,512	22,512
R-squared	0.645	0.644

Table 8: The Effect of Management Quality on Stock Returns

This table reports OLS regression results of management quality factor on stock return. Stock return is adjusted by value-weighted market return (column 1 and 2) and DGTW benchmark portfolios (column 3 and 4). Column 1 and 3 report result with the annual abnormal return of next year. Column 2 and 4 report the result about the compounded abnormal return in future three years. *ROA* is defined as operating income before depreciation over total assets; *Ln(Assets)* is the natural logarithm of the firm's total assets; *Ln(M/B)* is the natural logarithm of Tobin's Q, and Tobin's Q is defined as market value of assets divided by the book value of assets, where the market value of assets is computed as the book value of assets plus the market value of common stock less the book value of common stock; *Average Tenure* is the average number of years that each manager has worked as VP or higher in this firm. Constant, year fixed effects, and two digit SIC industry fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level, and p-values using these clustered standard errors are reported in parentheses below the coefficient estimates. ***, **, and * represent statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)	(4)
	Market Benchmark Adjusted		DGTW Benchmark Adjusted	
	One Year	Three Year	One Year	Three Year
MQF	0.033***	0.078***	0.021***	0.035***
	(0.000)	(0.000)	(0.000)	(0.000)
Ln(Assets)	0.002	0.017***	0.021***	0.053***
	(0.267)	(0.000)	(0.000)	(0.000)
Ln(M/B)	-0.121***	-0.287***	-0.031***	-0.049***
	(0.000)	(0.000)	(0.000)	(0.000)
ROA	0.256***	0.523***	0.170***	0.269***
	(0.000)	(0.000)	(0.000)	(0.000)
Average Tenure	0.007***	0.018***	0.003***	0.005***
	(0.000)	(0.000)	(0.000)	(0.000)
Industry & Year FE	Yes	Yes	Yes	Yes
Observations	33,489	28,663	29,208	23,650
R-squared	0.118	0.164	0.054	0.110

Table 9: The Effect of Individual Variables on Stock Returns

This table reports the OLS regression results of individual management quality variables on stock return. Stock return is adjusted by value-weighted market return. Panel A reports the result about stock return in the next year, and Panel B reports the result about compounded return for the next three years. *Team Size* is how many managers (VP or higher) there are in a firm's management team; *MBA* is the fraction of those managers that have MBA degrees; *Prior Work Experience* is the fraction of top managers that have experience working as VP or higher in other companies; *Education Connections* is the average number of graduate connections that each manager has through education (if two managers graduate from the same university with the same degree within one year of each other, those two are defined as connected); *Employment Connections* is the average number of connections that each manager has through prior employment (if two managers worked in the same previous company during overlapping time periods, either as managers or directors, those two are defined as connected); *Prior Board Experience* is the average number of board positions that each manager has served on; *ROA* is defined as operating income before depreciation over total assets; *Ln(Assets)* is the natural logarithm of the firm's total assets; *Ln(M/B)* is the natural logarithm of Tobin's Q, and Tobin's Q is defined as market value of assets divided by the book value of assets, where the market value of assets is computed as the book value of assets plus the market value of common stock less the book value of common stock; *Average Tenure* is the average number of years that each manager has worked as VP or higher in this firm. Constant, year fixed effects, and two digit SIC industry fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level, and p-values using these clustered standard errors are reported in parentheses below the coefficient estimates. ***, **, and * represent statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: One Year Market Benchmark Adjusted Return						
	(1)	(2)	(3)	(4)	(5)	(6)
Team Size	0.006***					
	(0.000)					
MBA		0.031*				
		(0.060)				
Prior Work Experience			-0.016			
			(0.432)			
Education Connections				0.002**		
				(0.046)		
Employment Connections					0.004***	
					(0.000)	
Prior Board Experience						0.024**
						(0.046)
Ln(Assets)	-0.006***	0.003*	0.004**	0.003*	-0.012***	0.003*
	(0.008)	(0.057)	(0.020)	(0.075)	(0.000)	(0.064)
Ln(M/B)	-0.121***	-0.117***	-0.117***	-0.118***	-0.121***	-0.117***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ROA	0.254***	0.246***	0.244***	0.246***	0.265***	0.247***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average Tenure	0.007***	0.006***	0.006***	0.006***	0.007***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	33,489	33,489	33,489	33,489	33,489	33,489
R-squared	0.117	0.116	0.116	0.116	0.118	0.116

Panel B: Three Year Market Benchmark Adjusted Compounded Return						
	(1)	(2)	(3)	(4)	(5)	(6)
Team Size	0.014***					
	(0.000)					
MBA		0.053				
		(0.197)				
Prior Work Experience			-0.055			
			(0.277)			
Education Connections				0.003		
				(0.168)		
Employment Connections					0.008***	
					(0.000)	
Prior Board Experience						0.046
						(0.124)
Ln(Assets)	-0.001	0.021***	0.022***	0.021***	-0.013**	0.021***
	(0.827)	(0.000)	(0.000)	(0.000)	(0.041)	(0.000)
Ln(M/B)	-0.286***	-0.277***	-0.277***	-0.278***	-0.286***	-0.277***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ROA	0.517***	0.500***	0.496***	0.501***	0.541***	0.502***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average Tenure	0.017***	0.017***	0.016***	0.016***	0.018***	0.016***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	28,663	28,663	28,663	28,663	28,663	28,663
R-squared	0.162	0.160	0.160	0.160	0.164	0.160

Table 10: The Effect of Management Quality on Stock Returns: Instrumental Variable Analysis

This table reports IV regression results of management quality factor on stock return. Stock return is adjusted by value-weighted market return. In column 1 and column 2, the instrument used is *Draft risk*, which is a dummy variable, defined as whether the number of U.S. male managers in the management team (VP or higher) that graduated from college during Vietnam War era (1963 to 1967) is higher than the 75th percentile of the whole sample (one for this case). Columns 3 and 4 use *Adjusted draft risk* as the instrument, which is a dummy variable, defined as whether the *team size adjusted* number of U.S. male managers in the management team (VP or higher) that graduated from college during Vietnam War era (1963 to 1967) is higher than the 75th percentile of the whole sample (two for this case), where we adjust the number of U.S. male managers in the management team (VP or higher) that graduated from college during Vietnam War era (1963 to 1967) by using the following formula: $\frac{1+number\ of\ managers\ at\ draft\ risk}{1+median\ \ number\ of\ \ managers\ at\ draft\ risk\ for\ firm's\ team\ size}$. *ROA* is defined as operating income before depreciation over total assets; *Ln(Assets)* is the natural logarithm of the firm's total assets; *Ln(M/B)* is the natural logarithm of Tobin's Q, and Tobin's Q is defined as market value of assets divided by the book value of assets, where the market value of assets is computed as the book value of assets plus the market value of common stock less the book value of common stock; *Average Tenure* is the average number of years that each manager has worked as VP or higher in this firm; *Median Age* is the median age of all the managers in the management team in a given year; and *Median Age Square* is the square of the *Median age*. Constant, year fixed effects, and two digit SIC industry fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level, and p-values using these clustered standard errors are reported in parentheses below the coefficient estimates. ***, **, and * represent statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)	(4)
	Second Stage (IV –Draft Risk)	Second Stage (IV – Draft Risk)	Second Stage (IV – Adjusted Draft Risk)	Second Stage (IV – Adjusted Draft Risk)
	One Year Return	Three Year Compounded	One Year Return	Three Year Compounded
MQF	0.071***	0.120**	0.111**	0.194*
	(0.005)	(0.040)	(0.012)	(0.055)
Ln(Assets)	-0.002	0.007	-0.003	0.005
	(0.479)	(0.194)	(0.266)	(0.491)
Ln(M/B)	-0.132***	-0.306***	-0.137***	-0.317***
	(0.000)	(0.000)	(0.000)	(0.000)
ROA	0.263***	0.546***	0.276***	0.569***
	(0.000)	(0.000)	(0.000)	(0.000)
Average Tenure	0.009***	0.019***	0.010***	0.021***
	(0.000)	(0.000)	(0.000)	(0.000)
Median Age	0.025**	0.051*	0.016	0.035
	(0.029)	(0.054)	(0.249)	(0.276)
Median Age Square	-0.000**	-0.001**	-0.000	-0.000
	(0.019)	(0.044)	(0.195)	(0.245)
Industry & Year FE	Yes	Yes	Yes	Yes
Observations	25,663	22,061	25,663	22,061
R-squared	0.117	0.167	0.111	0.161

Table 11: The Effect of Management Quality on Firm Investment

This table reports the regression results about capital expenditure and R&D expenditure. In Panel A, we report OLS regression results. In Panel B, we report the second-stage instrumental variable regressions with *Draft risk* as the instrument. Draft risk is a dummy variable, defined as whether the number of U.S. male managers in the management team (VP or higher) that graduated from college during Vietnam War era (1963 to 1967) is higher than the 75th percentile of the whole sample (one for this case). In Panel C, we report the second-stage instrumental variable regressions with *Adjusted draft risk* as the instrument. *Adjusted draft risk* is a dummy variable, defined as whether the *team size adjusted* number of U.S. male managers in the management team (VP or higher) that graduated from college during Vietnam War era (1963 to 1967) is higher than the 75th percentile of the whole sample (two for this case), where we adjust the number of U.S. male managers in the management team (VP or higher) that graduated from college during Vietnam War era (1963 to 1967) by using the following formula: $\frac{1+number\ of\ managers\ at\ draft\ risk}{1+median\ \ number\ of\ \ managers\ at\ draft\ risk\ for\ firm's\ team\ size}$. *ROA* is defined as operating income before depreciation over total assets; *Ln(Assets)* is the natural logarithm of the firm's total assets; *Ln(M/B)* is the natural logarithm of Tobin's Q, and Tobin's Q is defined as market value of assets divided by the book value of assets, where the market value of assets is computed as the book value of assets plus the market value of common stock less the book value of common stock; *Average Tenure* is the average number of years that each manager has worked as VP or higher in this firm; *Median Age* is the median age of all the managers in the management team in a given year; and *Median Age Square* is the square of the *Median age*; $\frac{(Capex+R\&D)_t}{Assets_{t-1}}$ is capital expenditure and R&D expenses scaled by one year lagged firm assets; $AVG_{i=1}^{3}\frac{(Capex+R\&D)_{t+i}}{Assets_{t+i-1}}$ is future three year average of capital expenditure and R&D expenses scaled by one year lagged firm assets, i.e., $\frac{1}{3}\sum_{i=1}^{3}\frac{(Capex+R\&D)_{t+i}}{Assets_{t+i-1}}$; $\Delta\frac{(Capex+R\&D)_{t+1}}{Assets_t}$ is the changes in capital expenditure and R&D expenses scaled by one year lagged firm assets between the current year and the next year, i.e., $\frac{(Capex+R\&D)_{t+1}}{Assets_t}-\frac{(Capex+R\&D)_t}{Assets_{t-1}}$; $\frac{Capex_t}{Assets_{t-1}}$ is capital expenditure scaled by one year lagged firm assets; $AVG_{i=1}^{3}\frac{Capex_{t+i}}{Assets_{t+i-1}}$ is future three year average of capital expenditure scaled by one year lagged firm assets, i.e., $\frac{1}{3}\sum_{i=1}^{3}\frac{Capex_{t+i}}{Assets_{t+i-1}}$; $\Delta\frac{Capex_{t+1}}{Assets_t}$ is the changes in capital expenditure scaled by one year lagged firm assets between the current year and the next year, i.e., $\frac{Capex_{t+1}}{Assets_t}-\frac{Capex_t}{Assets_{t-1}}$; $\frac{R\&D_t}{Assets_{t-1}}$ is R&D expenses scaled by one year lagged firm assets; $AVG_{i=1}^{3}\frac{R\&D_{t+i}}{Assets_{t+i-1}}$ is future three year average of R&D expenses scaled by one year lagged firm assets, i.e., $\frac{1}{3}\sum_{i=1}^{3}\frac{R\&D_{t+i}}{Assets_{t+i-1}}$; $\Delta\frac{R\&D_{t+1}}{Assets_t}$ is the changes in R&D expenses scaled by one year lagged firm assets between the current year and the next year, i.e., $\frac{R\&D_{t+1}}{Assets_t}-\frac{R\&D_t}{Assets_{t-1}}$. Constant, year fixed effects, and two digit SIC industry fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level, and p-values using these clustered standard errors are reported in parentheses below the coefficient estimates. ***, **, and * represent statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: OLS Regression

VARIABLES	(1) $AVG_{i=1}^{3}\frac{(Capex+R\&D)_{t+i}}{Assets_{t+i-1}}$	(2) $AVG_{i=1}^{3}\frac{Capex_{t+i}}{Assets_{t+i-1}}$	(3) $AVG_{i=1}^{3}\frac{R\&D_{t+i}}{Assets_{t+i-1}}$	(4) $\Delta\frac{(Capex+R\&D)_{t+1}}{Assets_{t}}$	(5) $\Delta\frac{Capex_{t+1}}{Assets_{t}}$	(6) $\Delta\frac{R\&D_{t+1}}{Assets_{t}}$
MQF_t	0.009***	0.001	0.007***	0.010***	0.005***	0.003***
	(0.000)	(0.167)	(0.000)	(0.000)	(0.000)	(0.000)
$\ln(Assets)_t$	-0.006***	-0.002***	-0.003***	-0.001**	-0.001***	0.000
	(0.000)	(0.000)	(0.000)	(0.036)	(0.000)	(0.480)
$\ln(M/B)_t$	0.029***	0.008***	0.009***	-0.008***	0.000	-0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.985)	(0.000)
$Operating\ ROA_t$	-0.137***	0.018***	-0.101***	-0.033***	0.003	-0.009**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.162)	(0.036)
Average Tenure$_t$	0.000	0.000*	0.000	0.003***	0.001***	0.001***
	(0.858)	(0.074)	(0.876)	(0.000)	(0.000)	(0.000)
$\frac{(Capex+R\&D)_t}{Assets_{t-1}}$	0.320***					
	(0.000)					
$\frac{Capex_t}{Assets_{t-1}}$		0.332***				
		(0.000)				
$\frac{R\&D_t}{Assets_{t-1}}$			0.476***			
			(0.000)			
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	25,717	25,717	27,290	33,055	33,055	34,507
R-squared	0.619	0.580	0.738	0.032	0.031	0.021

Panel B: IV Regression (Second Stage, IV – Draft Risk)						
	(1)	(2)	(3)	(4)	(5)	(6)
	$AVG_{i=1}^{3}\frac{(Capex+R\&D)_{t+i}}{Assets_{t+i-1}}$	$AVG_{i=1}^{3}\frac{Capex_{t+i}}{Assets_{t+i-1}}$	$AVG_{i=1}^{3}\frac{R\&D_{t+i}}{Assets_{t+i-1}}$	$\Delta\frac{(Capex+R\&D)_{t+1}}{Assets_{t}}$	$\Delta\frac{Capex_{t+1}}{Assets_{t}}$	$\Delta\frac{R\&D_{t+1}}{Assets_{t}}$
MQF_t	0.012*	0.002	0.009*	0.022***	0.006**	0.011***
	(0.070)	(0.584)	(0.060)	(0.000)	(0.015)	(0.000)
$\ln(Assets)_t$	-0.007***	-0.002***	-0.003***	-0.002***	-0.002***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.175)
$\ln(M/B)_t$	0.028***	0.007***	0.008***	-0.010***	0.000	-0.010***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.630)	(0.000)
$Operating\ ROA_t$	-0.142***	0.018***	-0.103***	-0.029***	0.004	-0.005
	(0.000)	(0.000)	(0.000)	(0.000)	(0.123)	(0.305)
Average Tenure$_t$	0.000	0.000*	0.000	0.003***	0.001***	0.001***
	(0.394)	(0.052)	(0.391)	(0.000)	(0.000)	(0.000)
$Median\ Age_t$	0.014***	0.003*	0.010***	0.012***	0.006***	0.003**
	(0.000)	(0.062)	(0.000)	(0.000)	(0.000)	(0.027)
$Median\ Age\ Square_t$	-0.000***	-0.000*	-0.000***	-0.000***	-0.000***	-0.000**
	(0.000)	(0.052)	(0.000)	(0.000)	(0.000)	(0.039)
$\frac{(Capex+R\&D)_t}{Assets_{t-1}}$	0.325***					
	(0.000)					
$\frac{Capex_t}{Assets_{t-1}}$		0.347***				
		(0.000)				
$\frac{R\&D_t}{Assets_{t-1}}$			0.480***			
			(0.000)			
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	19,820	19,820	21,036	25,279	25,279	26,374
R-squared	0.621	0.584	0.738	0.033	0.035	0.020

Panel C: IV Regression (Second Stage, IV – Adjusted Draft Risk)

	(1) $AVG_{i=1}^{3}\frac{(Capex+R\&D)_{t+i}}{Assets_{t+i-1}}$	(2) $AVG_{i=1}^{3}\frac{Capex_{t+i}}{Assets_{t+i-1}}$	(3) $AVG_{i=1}^{3}\frac{R\&D_{t+i}}{Assets_{t+i-1}}$	(4) $\Delta\frac{(Capex+R\&D)_{t+1}}{Assets_{t}}$	(5) $\Delta\frac{Capex_{t+1}}{Assets_{t}}$	(6) $\Delta\frac{R\&D_{t+1}}{Assets_{t}}$
MQF_t	0.019	0.002	0.013*	0.034***	0.008*	0.017***
	(0.112)	(0.697)	(0.092)	(0.000)	(0.055)	(0.003)
$\ln(Assets)_t$	-0.007***	-0.002***	-0.004***	-0.002***	-0.002***	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.089)
$\ln(M/B)_t$	0.027***	0.007***	0.008***	-0.011***	0.000	-0.011***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.852)	(0.000)
$Operating\ ROA_t$	-0.141***	0.018***	-0.102***	-0.027***	0.004*	-0.004
	(0.000)	(0.000)	(0.000)	(0.000)	(0.096)	(0.461)
Average Tenure$_t$	0.000	0.000*	0.000	0.004***	0.001***	0.002***
	(0.291)	(0.093)	(0.280)	(0.000)	(0.000)	(0.000)
$Median\ Age_t$	0.013***	0.003	0.009***	0.009***	0.005***	0.002
	(0.000)	(0.123)	(0.000)	(0.003)	(0.000)	(0.224)
$Median\ Age\ Square_t$	-0.000***	-0.000	-0.000***	-0.000***	-0.000***	-0.000
	(0.000)	(0.106)	(0.000)	(0.004)	(0.000)	(0.273)
$\frac{(Capex+R\&D)_t}{Assets_{t-1}}$	0.326***					
	(0.000)					
$\frac{Capex_t}{Assets_{t-1}}$		0.347***				
		(0.000)				
$\frac{R\&D_t}{Assets_{t-1}}$			0.479***			
			(0.000)			
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	19,820	19,820	21,036	25,279	25,279	26,374
R-squared	0.619	0.584	0.737	0.022	0.034	0.012

Table 12: The Effect of Management Quality on Firm Performance: Interaction Tests

This table reports our main regression results interacted with relevant variables. In Panel A, we report regression result with management quality interacted with R&D intensity and industry competition. Columns 1 to 3 report results interacting with *R&D*. *R&D* is the median R&D to assets ratio for each two-digit SIC industry in a year. *MQF*, *MQF *R&D* and *R&D* are current year values in column 1 and column 3, and are values in the next year for column 2. Columns 4 to 6 report results interacting with industry Herfindahl–Hirschman Index (*HHI*). *HHI* for an industry (defined at two SIC digits level) in a given year is defined by the following formula: $\sum_{i=1}^{number\ of\ firms\ in\ same\ 2-digit\ SIC\ industry} \frac{(firm\ sales_i)^2}{(industry\ sales)^2}$. *MQF*, *MQF *HHI* and *HHI* are current year values in Column 4 and Column 6, and are values in the next year for Column 5. In Panel B, we report regression result with management quality interacted with recession and financial constraint. Columns 1 to 3 report results interacting with *Recession* dummy, which is one if more than 6 months in a given year are NBER recession months. *MQF* and *MQF *Recession* are current year values in column 1 and column 3, and are values in the next year for column 2. Columns 4 to 6 report results interacting with industry financial constraints. *Constrained is* a dummy variable. It equals one when the value of external finance dependence is larger than zero. External finance dependence for an industry (defined at two SIC digits level) in a given year is defined by the method outlined in Rajan and Zingales (1998). *MQF*, *MQF *Constrained* and *Constrained* are current year values in Column 4 and Column 6, and are values in the next year for column 5. In both Panels, Column 1 and Column 4 report results with changes in *ROA* from current year to future three year average as dependent variable; Column 2 and Column 5 report result with natural log of next year market to book ratio as dependent variable; Column 3 and Column 6 report result with three year compounded return as dependent variable. Stock return is adjusted by value-weighted market return; *ROA* is defined as operating income before depreciation over total assets; $AVG\_\Delta ROA_{t+3}$ is the changes in *ROA* between the current year and the future three year average, i.e., $\frac{1}{3}\sum_{i=1}^{3}(ROA_{t+i} - ROA_t)$; *Ln(Assets)* is the natural logarithm of the firm's total assets; *Ln(M/B)* is the natural logarithm of Tobin's Q, and Tobin's Q is defined as market value of assets divided by the book value of assets, where the market value of assets is computed as the book value of assets plus the market value of common stock less the book value of common stock; *Average Tenure* is the average number of years that each manager has worked as VP or higher in this firm. Constant, year fixed effects, and two digit SIC industry fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level, and p-values using these clustered standard errors are reported in parentheses below the coefficient estimates. ***, **, and * represent statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: R&D Intensity and Competition						
	(1)	(2)	(3)	(4)	(5)	(6)
	$AVG\_\Delta ROA_{t+3}$	Ln(M/B)	Three Year Return	$AVG\_\Delta ROA_{t+3}$	Ln(M/B)	Three Year Return
MQF	0.005***	0.024***	0.059***	0.019***	0.048***	0.101***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MQF*R&D	0.237***	0.375***	0.562**			
	(0.000)	(0.000)	(0.020)			
R&D	0.548**	-1.150***	0.126			
	(0.034)	(0.000)	(0.890)			
MQF*HHI				-0.081***	-0.176***	-0.378**
				(0.000)	(0.000)	(0.017)
HHI				-0.017	-0.293***	-0.576
				(0.668)	(0.001)	(0.106)
Ln(Assets)	-0.003***	-0.006***	0.016***	-0.003***	-0.006***	0.017***
	(0.005)	(0.000)	(0.000)	(0.006)	(0.000)	(0.000)
Ln(M/B)	0.003	0.699***	-0.289***	0.004	0.700***	-0.288***
	(0.368)	(0.000)	(0.000)	(0.316)	(0.000)	(0.000)
ROA		-0.178***	0.529***		-0.178***	0.523***
		(0.000)	(0.000)		(0.000)	(0.000)
Average Tenure	0.000	0.002**	0.018***	0.000	0.002**	0.018***
	(0.252)	(0.026)	(0.000)	(0.295)	(0.025)	(0.000)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	25,976	29,308	28,663	25,976	29,308	28,663
R-squared	0.023	0.648	0.164	0.021	0.648	0.164

Panel B: Financial Constraints and Recession						
	(1)	(2)	(3)	(4)	(5)	(6)
	$AVG\_\Delta ROA_{t+3}$	Ln(M/B)	Three Year Return	$AVG\_\Delta ROA_{t+3}$	Ln(M/B)	Three Year Return
MQF	0.008***	0.027***	0.056***	0.012***	0.033***	0.077***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MQF*Constrained	0.019***	0.034***	0.074***			
	(0.000)	(0.000)	(0.000)			
Constrained	0.020***	-0.082***	-0.062***			
	(0.000)	(0.000)	(0.005)			
MQF*Recession				0.010***	0.020***	0.008
				(0.003)	(0.005)	(0.543)
Ln(Assets)	-0.002**	-0.005***	0.018***	-0.003***	-0.006***	0.017***
	(0.010)	(0.000)	(0.000)	(0.006)	(0.000)	(0.000)
Ln(M/B)	0.003	0.701***	-0.289***	0.004	0.700***	-0.288***
	(0.354)	(0.000)	(0.000)	(0.287)	(0.000)	(0.000)
ROA		-0.179***	0.521***		-0.178***	0.523***
		(0.000)	(0.000)		(0.000)	(0.000)
Average Tenure	0.000	0.002**	0.018***	0.000	0.002**	0.018***
	(0.320)	(0.040)	(0.000)	(0.296)	(0.027)	(0.000)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	25,972	29,304	28,659	25,976	29,308	28,663
R-squared	0.023	0.649	0.165	0.021	0.647	0.164

Table 13: Robustness Test: MQF without Team Size

In this table, we report the regressions results for firm performance and investment, with management quality factor without team size as the key independent variable. *MQF-No Team Size* is defined in the same way as *MQF* except that we exclude team size in the factor analysis. Panel A reports the results of OLS regressions, while Panel B reports the results of second stage IV regressions. *Draft risk*, which is a dummy variable, defined as whether the number of U.S. male managers in the management team (VP or higher) that graduated from college during Vietnam War era (1963 to 1967) is higher than the 75^{th} percentile of the whole sample (one for this case). *ROA* is defined as operating income before depreciation over total assets; *Ln(Assets)* is the natural logarithm of the firm's total assets; *Ln(M/B)* is the natural logarithm of Tobin's Q, and Tobin's Q is defined as market value of assets divided by the book value of assets, where the market value of assets is computed as the book value of assets plus the market value of common stock less the book value of common stock; *Average Tenure* is the average number of years that each manager has worked as VP or higher in this firm; $AVG\_\Delta ROA_{t+3}$ is the changes in ROA between the current year and the future three year average, i.e., $\frac{1}{3}\sum_{i=1}^{3}(ROA_{t+i} - ROA_t)$; $\frac{(Capex+R\&D)_t}{Assets_{t-1}}$ is capital expenditure and R&D expenses scaled by one year lagged firm assets; $AVG_{i=1}^{3}\frac{(Capex+R\&D)_{t+i}}{Assets_{t+i-1}}$ is future three year average of capital expenditure and R&D expenses scaled by one year lagged firm assets, i.e., $\frac{1}{3}\sum_{i=1}^{3}\frac{(Capex+R\&D)_{t+i}}{Assets_{t+i-1}}$; $\Delta\frac{(Capex+R\&D)_{t+1}}{Assets_t}$ is the changes in capital expenditure and R&D expenses scaled by one year lagged firm assets between the current year and the next year, i.e., $\frac{(Capex+R\&D)_{t+1}}{Assets_t} - \frac{(Capex+R\&D)_t}{Assets_{t-1}}$. Constant, year fixed effects, and two digit SIC industry fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level, and p-values using these clustered standard errors are reported in parentheses below the coefficient estimates. ***, **, and * represent statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: OLS Regression					
	(1)	(2)	(3)	(4)	(5)
	$\text{AVG\_}\Delta\text{ROA}_{t+3}$	Ln(M/B)	Three Year Return	$AVG_{i=1}^{3}\frac{(Capex+R\&D)_{t+i}}{Assets_{t+i-1}}$	$\Delta\frac{(Capex+R\&D)_{t+1}}{Assets_{t}}$
MQF-No Team Size	0.007***	0.026***	0.045***	0.009***	0.007***
	(0.005)	(0.000)	(0.000)	(0.000)	(0.000)
Ln(Assets)	-0.002**	-0.005***	0.020***	-0.006***	-0.000
	(0.023)	(0.002)	(0.000)	(0.000)	(0.222)
Ln(M/B)		-0.182***	0.512***	-0.137***	-0.034***
		(0.000)	(0.000)	(0.000)	(0.000)
ROA	0.005	0.703***	-0.279***	0.029***	-0.007***
	(0.132)	(0.000)	(0.000)	(0.000)	(0.000)
Average Tenure	0.000	0.001*	0.018***	0.000	0.003***
	(0.474)	(0.061)	(0.000)	(0.679)	(0.000)
$\frac{(Capex+R\&D)_{t}}{Assets_{t-1}}$				0.319***	
				(0.000)	
Industry & Year FE	Yes	Yes	Yes	Yes	Yes
Observations	25,976	29,308	28,663	25,717	33,055
R-squared	0.019	0.646	0.161	0.619	0.030

Panel B: IV Regression (Second Stage, IV- Draft Risk)					
	(1)	(2)	(3)	(4)	(5)
	AVG_ΔROA$_{t+3}$	Ln(M/B)	Three Year Return	$AVG_{i=1}^{3}\frac{(Capex+R\&D)_{t+i}}{Assets_{t+i-1}}$	$\Delta\frac{(Capex+R\&D)_{t+1}}{Assets_{t}}$
MQF-No Team Size	0.111*	0.299**	0.627*	0.068	0.034***
	(0.081)	(0.035)	(0.083)	(0.114)	(0.000)
Ln(Assets)	-0.003**	-0.015***	-0.002	-0.008***	-0.002***
	(0.019)	(0.003)	(0.841)	(0.000)	(0.000)
Ln(M/B)	-0.004	0.693***	-0.320***	0.026***	-0.011***
	(0.457)	(0.000)	(0.000)	(0.000)	(0.000)
ROA		-0.116**	0.704***	-0.128***	-0.027***
		(0.016)	(0.000)	(0.000)	(0.000)
Average Tenure	0.004*	0.013**	0.039***	0.002	0.004***
	(0.087)	(0.026)	(0.004)	(0.126)	(0.000)
Median Age	-0.010	-0.001	0.011	0.011**	0.009***
	(0.185)	(0.963)	(0.813)	(0.023)	(0.003)
Median Age Square	0.000	-0.000	-0.000	-0.000***	-0.000***
	(0.249)	(0.796)	(0.628)	(0.007)	(0.004)
$\frac{(Capex+R\&D)_{t}}{Assets_{t-1}}$				0.324***	
				(0.000)	
Industry & Year FE	Yes	Yes	Yes	Yes	Yes
Observations	20,021	22,512	22,061	19,820	25,279
R-squared		0.573	0.033	0.574	0.022

Figure 1: Relationship Between Management Quality and Investment

If better and more reputable managers are able to select better projects for their firms (characterized by a larger NPV for any given scale), and assuming decreasing returns to scale, a firm with better management quality will be associated with a larger equilibrium scale of investment, since the incremental NPV will fall to 0 only for a larger scale for better projects. Therefore, as management quality increases from low (L) to high (H), the equilibrium scale of the firm's investment increases from I_L^* to I_H^*.

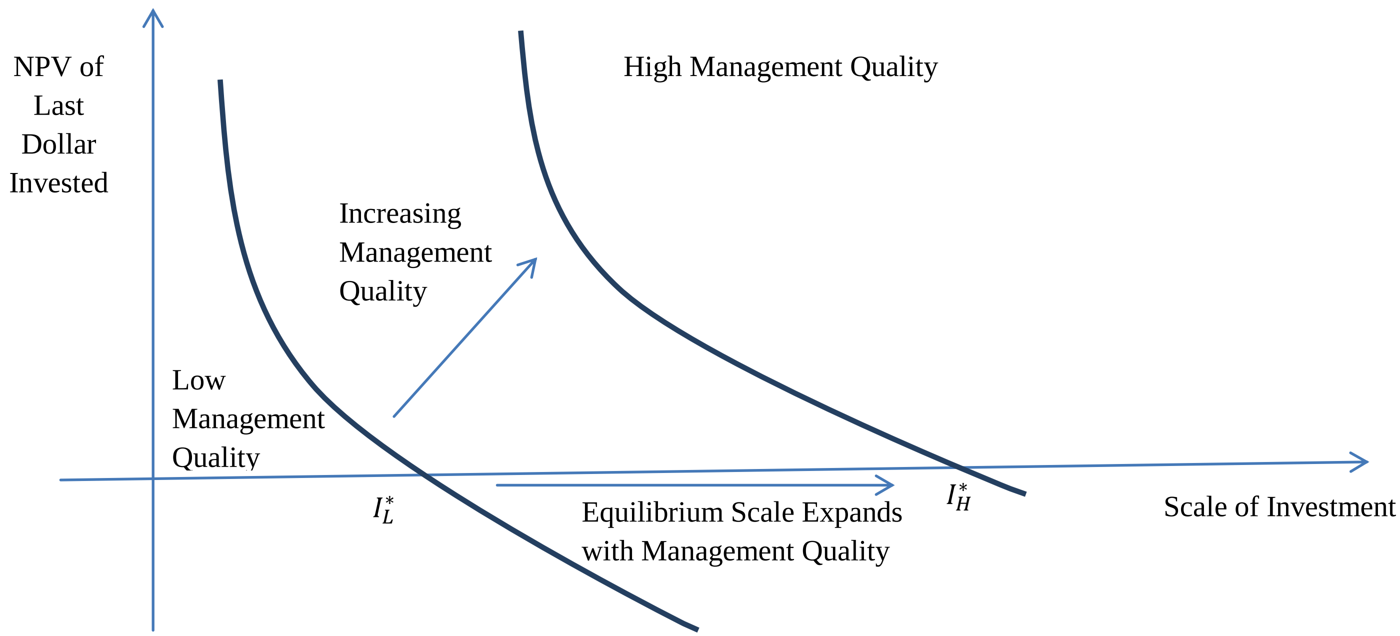

Figure 2: Fraction of Managers in Boardex with Graduate Degrees and Troop Deployment in Vietnam