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Managerial Ability and Value Relevance of Earnings *

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Abstract

We examine how management ability affects the extent to which capital markets rely on earnings to value equity. Using a measure of ability that captures a management team's capacity for generating revenues with a given level of resources compared to other industry peers, we find a strong positive association between managerial ability and the value relevance of earnings. Additional tests show that our results are robust to controlling for earnings attributes and investment efficiency. We use propensity score matching and the 2SLS instrumental variable approach to deal with the issue of endogeneity. For further identification, we examine CEO turnover and find that newly hired CEOs with better managerial abilities than the replaced CEOs increase the value relevance of earnings. We identify weak corporate governance and product market power as the two important channels through which superior management practices play an important role in the corporate decision-making process that positively influence the value relevance of earnings. Overall, our findings suggest that better managers make accounting information significantly more relevant in the market valuation of equity.

***Keywords*:** Managerial Ability, Value Relevance, Corporate Governance, Market Power

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公司高管管理能力与盈余的价值相关性

摘要

本文探讨管理层的能力如何影响资本市场倚赖盈余以评估股本价值的程度。我们采用的能力度量反映管理团队在给定的资源水平下，与同业比较下创造收入的能力。藉由这个度量，我们发现管理能力与盈余的价值相关性呈现强烈的正向关联。进一步检测显示，本研究结果在控制盈余属性和投资效益后具稳健性。我们使用倾向评分匹配及 2SLS 工具变量方法，以处理内生性问题。我们进一步探讨 CEO 变更，并发现如新任 CEO 的管理能力优于前任 CEO，可提高盈余的价值相关性。我们识别公司治理和产品市场竞争力为两个重要渠道，让公司高管管理能力在公司决策过程中发挥重要作用，从而对盈余的价值相关性产生正面影响。整体而言，本研究结果显示管理人员能力更佳，可显著提高会计信息对市场评估股本价值的相关性。

关键词：管理能力、价值相关性、公司治理、市场竞争力

I. Introduction

Managerial ability, which is a reflection of human capital (Francis *et al.*, 2008), is "one of the most important intangible assets that a firm has" (Gaines-Ross, 2003).[5] In fact, prior studies find that it has significant effects on corporate finance and investment policies that are crucial to the success of corporations (e.g. Rose and Shepard, 1997; Bertrand and Schoar, 2003). A new stream of studies has introduced the managerial ability construct into the accounting literature and has found that managerial ability affects earnings quality (Demerjian *et al.*, 2013), earnings forecasts (Baik *et al.*, 2011), tax avoidance (Francis *et al.*, 2013), and future performance (Demerjian *et al.*, 2012). How this intangible capital affects the value relevance of earnings is a question that we explore in this paper.

Intangible capital is the hallmark of modern economics and business enterprises (Lev *et al.*, 2009). Hall (2001) estimates that the total value of intangible capital is about half to two thirds of the total market value of publicly traded corporations. Given the increasing importance of intangible capital in determining a firm's value, a growing number of studies have examined the value relevance of non-financial information in the capital markets (e.g. Amir and Lev, 1996) because "nonfinancial measures can help equity investors (and creditors) value intangible assets that are not recognised in historical cost-based accounting reports" (Hughes, 2000). According to current accounting practices (e.g. Generally Accepted Accounting Principles (GAAP)), human capital is not defined as an asset of a company and does not appear on the left side of the balance sheet.

To appreciate the importance of managerial ability in the framework of value relevance, we need to understand the role of management in the value creation process of a company. The early economics literature recognises managerial ability as a technology influencing the effectiveness of the inputs of a firm (e.g. Walker, 1887; Leibenstein, 1966; Lucas, 1978; Rosen, 1982). Essentially, management plays the key role in generating competitive advantages through creating an optimal mix of resources and synchronising them (e.g. Peteraf and Barney, 2003; Sirmon *et al.*, 2007), which is an ability that is tacit in nature (e.g. Schultz, 1961; Becker, 1964). In a recent paper, Bloom *et al.* (2017) depict management as an intangible capital in a formal model of production and empirically show that management practices significantly influence the productivity of inputs.

Practitioners also highly regard managerial ability in estimating a firm's future performance. For example, survey evidence shows that market participants overwhelmingly rely on CEO reputation when they evaluate a firm's value (Hill and Knowlton Corporate Reputation Watch, 2002; Burson-Marsteller, 2003). A more recent survey conducted jointly by Deloitte and YouGov on around 445 analysts of top financial institutions in six leading

[5] For example, some important non-financial factors that are significantly related to the market valuation of equity are Internet traffic (Trueman *et al.*, 2000), network advantages (Rajgopal *et al.*, 2003), environmental performance (Hassel *et al.*, 2005), technological conditions (Matolcsy and Wyatt, 2008), and eco-efficiency (Sinkin *et al.*, 2008).

countries, including the USA, found that in valuing a firm, the analysts took senior leadership effectiveness into consideration ahead of earnings forecasts and ratio analysis (Canwell and Isles, 2012).[6] Moreover, about 52 percent of the analysts surveyed disclosed that they regularly assess the effectiveness of senior leadership and its probable impact on valuation. Importantly, 80% of the analysts indicated that in practice, they tend to put a valuation premium on a particular company that demonstrates efficient management practices by the senior leadership team.

Given that managerial ability is a key intangible capital that can ensure the most efficient use of resources and create value, we predict that there is a positive relationship between managerial ability and the value relevance of accounting information. More specifically, we expect that investors put higher values on earnings generated by companies with high-ability managers than on earnings generated by low-ability managers. Consider two firms: Firm A run by high-ability managers and Firm B run by low-ability managers. Assuming all else being equal, and because Firm A's managers are more likely to be more efficient in creating value with a given level of resources than Firm B's managers, every dollar Firm A earns should be more sustainable and trigger better growth than every dollar Firm B earns. Eventually, earnings reported by Firm A would reflect into the market price more strongly than earnings reported by Firm B. In other words, managerial quality itself, as an intangible capital, should influence investors' valuation of earnings. Note that in this paper, in assessing value relevance, we focus on earnings since it is a temporary accounting item that can reflect management quality in a timelier fashion. More specifically, we are interested in finding out whether and how the market evaluates the performance of a company as regards its management practices. Given that objective, our focus is on earnings representing the operational performance of a company.

The primary metric of managerial ability that we use in this paper is based on the measure developed by Demerjian *et al.* (2013) which captures a management team's efficiency in generating revenues compared to other industry peers. Thus, this measure of ability is not confined to CEO- or CFO-centric ability; rather, it represents a whole management team's ability to conduct the operational activities of a firm.

In our empirical analysis, we find that the value relevance of accounting information is higher for firms with better managerial ability. We use the coefficients of both earnings and adjusted R^2 as measures of value relevance.[7] Our empirical results show that both the

[6] The survey was conducted between August 2011 and January 2012. The participant countries included the USA, the UK, China, India, Japan, and Brazil.

[7] Demerjian *et al.*'s (2012) measure of management ability, which we discuss in more detail in Section III, is not limited to measuring CEO or CFO ability; it recognises the managerial capacity of a whole management team. They first use data-envelopment analysis to estimate total firm efficiency and then identify the contribution of firm-level characteristics not directly related to management quality, such as size. They identify the unexplained portion of firm efficiency as the contribution of managerial ability to efficiency.

continuous measure of managerial ability, *MA_Score*, and the industry-year decile ranking of managerial ability, *MA_Rank*, are highly value relevant on their own individual strengths. On average, for each decile increase in managerial ability, the market price increases by $3.14, which could represent a $139.82 million increase in market value.

To gain a better understanding of the economic significance of managerial ability to the value relevance of accounting information, we divide the sample into two groups. The "High Ability" group contains observations in the upper half of the decile rankings of managerial ability, and the "Low Ability" group consists of observations in the lower half of the managerial ability rankings. By running empirical tests for each sample group, we find that the earnings coefficient on the "High Ability" group (=5.854) is significantly higher than the earnings coefficient on the "Low Ability" group (=4.244). The results suggest that the EPS relevance of the firms with high-ability managers is, on average, 38% higher than that of the firms with low-ability managers.

Demerjian *et al.* (2013) find that earnings quality is positively related to managerial ability, which might lead to the alternative interpretation that higher earnings quality drives the positive impact superior management capacity has on value relevance, making accounting information more value relevant. To address this concern, we test whether the greater value relevance associated with high management ability persists regardless of earnings quality. A lack of association, especially in the presence of low earnings quality (where it is reasonable to believe that value relevance should be weak), might imply that management ability has no special influence on value relevance. Using Dechow and Dichev's (2002) measure of earnings quality, we test the subsamples of high versus low quality earnings. We find that regardless of earnings quality, the value relevance of accounting information for firms with high management ability is significantly higher than that for firms with low management ability, especially—and more importantly—when earnings quality is low. Furthermore, in a similar way, we test whether our results are driven by the differential practices of accounting conservatism by high versus low ability managers, but the results do not show any influence of conservatism. Moreover, in the test to ascertain whether efficient investment practices by highly able managers lead to a higher earnings relevance, we find that in circumstances of both high and low investment efficiency, earnings relevance is significantly higher for better managers.

One endogeneity concern is the potential relationship between firms' past performance and the perception of management quality (e.g. McGuire *et al.*, 1990), which might produce biased OLS coefficients and contaminate the validity of our results. We address this concern in several ways. First, one can argue that firm characteristics could influence past performance and therefore we should be more concerned about the potential relationship between firm characteristics and management ability. On the other hand, firm characteristics and management ability affect firm efficiency. In identifying how these factors affect the

relative efficiency of firms, Demerjian *et al.* (2012) separate the management team effects from firm-specific effects to measure management ability. Thus, the methodology used for deriving managerial quality should mitigate the possibility of an association between management ability and firm characteristics.

Second, to gain a better understanding of how the efficiency of a management team could contribute to earnings relevance, we focus on different subsamples based on the types of transitions that firms experience in the time-series movement of their management quality. We find that firms in the "Low Ability" group show very strong and significant value relevance when they experience any improvement in management ability from one period to the next. Also, earnings become highly relevant for the firm-years in which the performance of firms, in both the current and previous periods, persistently demonstrates superior management capacity. Further, our results indicate that among the observations in the highest decile ranking of managerial ability, the adjusted R^2 of top-performing firm-years could be 4 to 10 percentage points higher than the adjusted R^2 of firm-years that experience a decrease in ability.

Third, to rule out the possibility of unaccounted firm characteristics influencing our results, we study a sample of CEO turnovers and employ an identification strategy to examine how a new CEO's managerial ability, compared that of the replaced CEO, could affect the value relevance of accounting information. Using a sample of 101 observations from 91 unique firms that hire outsider CEOs, we find that when new CEOs' management capacity exceeds that of old CEOs, the value relevance of accounting information is significantly higher.

Fourth, we separately use propensity score matching and the instrumental variable approach to address the issue of endogeneity. Since our descriptive statistics show that better managed firms usually operate in a better financial position, we use firm characteristics to create a propensity score matched sample and find that our results still persist. Further, for the instrumental variable-based 2SLS, we use the average ability score in the city where a firm is headquartered as the instrument variable of managerial ability, which should be highly correlated with an individual firm's ability score but should not be correlated with the firm's earnings. Confirming our primary findings, we find that higher management quality significantly increases earnings relevance.

We find two important channels through which managerial ability can influence the value relevance of earnings: corporate governance and product market power. We argue that in the presence of weak corporate governance, the managerial role becomes more important in the corporate decision-making process. Similarly, firms that have significant product power could provide flexibility in operating environments in which managers can exercise considerable control and apply managerial skill and knowledge. In our empirical tests, we find that the positive association between managerial ability and the value relevance of

earnings is high predominantly when firms exhibit weak corporate governance and hold strong product market power.

Our paper contributes to the growing literature on the determinants of the value relevance of accounting information. Since Amir and Lev (1996), non-financial information, such as corporate social responsibility and customer satisfaction, has been deemed an important determinant of the value relevance of accounting information (e.g. Ittner and Larcker, 1998). In this paper, we relate value relevance to managerial ability, one of the most important intangible assets that does not appear on a balance sheet. We provide empirical evidence that the capital market does recognise and evaluate managerial ability as it has a significant impact on the value relevance of accounting information, thereby furthering our understanding of its determinants.

The results of our paper provide additional evidence of how management, as an intangible capital, matters in the valuation process. While prior research both theoretically and empirically establishes the role of managerial capital in increasing the productivity of inputs (e.g. Walker, 1987; Lucas, 1978; Bruhn *et al.*, 2010; Bloom *et al.*, 2017), our paper is the first to show that not only the production function but also the market valuation of a firm's performance can be influenced by variation in managerial ability. Furthermore, our finding that superior managerial ability, as an intangible capital, enhances the value relevance of earnings contributes to the literature on the value relevance of non-financial measures.

Our paper also contributes to the growing research on the attributes of managers, particularly managerial ability. Managerial ability has been an important topic of extensive research in the economic and management literature. More recent studies have introduced this topic into accounting research and have found that managerial ability is an important factor that affects firm performance and corporate accounting decisions (e.g. Baik *et al.*, 2011; Demerjian *et al.*, 2012, 2013). Instead of looking at corporate decisions, our study examines this issue from the capital market perspective and finds that managerial ability also significantly affects the value relevance of accounting information. Thus, our finding has important implications for investors in capital markets.

The rest of the paper is organised as follows. We discuss our hypothesis in Section II. Section III presents a discussion on our data and methodology. Our main results are presented in Section IV. Section V discusses the robustness tests, and Section VI discusses the channels through which managerial ability can influence the value relevance of earnings. Section VII concludes the paper.

II. Literature Review and Hypotheses

2.1 Managerial Ability and Corporate Outcomes

Neoclassical economic theory suggests that top managers, being homogeneous and

rational optimisers, have very limited individual influence on corporate outcomes or decisions (e.g. Weintraub, 2002; Bertrand and Schoar, 2003). Similarly, agency theory suggests that given an efficient system of monitoring and incentives, managers make similar choices and act as "representative" agents.

Contrary to these theories, Hambrick and Mason's (1984) upper echelons theory argues that individual managers are heterogeneous in quality and that their characteristics do influence corporate decisions and outcomes. This theory emphasises the importance of managerial abilities such as integrity and the ability to sustain uncertainty — much-needed qualities in complex and ambiguous environments that could make significant differences to corporate outcomes. The theories of Rosen (1981) and Gabaix and Landier (2008) also support the notion that managerial characteristics play an important role in shaping firms' policies and performance.

Empirically, a foundational paper in this area of research is Bertrand and Schoar (2003), which empirically shows that managerial traits are significant in accounting for the variation in firms' investment and financial policies. Also, higher management quality tends to attract greater participation from institutional investors and to reduce the under-pricing of IPOs (Chemmanur and Pagelis, 2005) and to decrease information asymmetry in the equity market (Chemmanur *et al.*, 2009, 2011).[8]

Studies by practitioners are also rich in showing how CEO reputation affects nearly every aspect of firm valuation. For example, according to the findings of the 2002 Hill and Knowlton Corporate Reputation Watch survey, 80% of the respondents in the United States believed that CEO reputation does matter for an entire corporation. The results from a Burson-Marsteller 2003 study of 1,155 CEOs, managers, and other stakeholder groups in the United States show that 80% to 95% of the respondents, including shareholders, financial and industrial analysts, and others, were likely to favour a firm exclusively because of a positive CEO reputation.

Besides the positive impact of management quality on corporate policies and outcomes, empirical papers also document the managerial effect on accounting choices. Evidence suggests that more able CEOs can significantly affect various accounting policies (Bamber *et al.*, 2010; Ge *et al.*, 2011; DeJong and Ling, 2013), increase information flow to the market (Baik *et al.*, 2011), reduce the cost of debt capital (Francis *et al.*, 2017), and portray a stronger association between current accruals and cash flows (Choi *et al.*, 2015). Using a measure of ability that captures top management team's efficiency in generating revenue, Demerjian *et al.* (2013) document that the presence of more able managers is associated with higher persistence in earnings and accruals, fewer earnings restatements, and lower

[8] From further empirical evidence, although managerial skill is negatively related to distress periods and the likelihood and cost of firm failure (Leverty and Grace, 2012), it is positively related to acquisition returns (Custódio and Metzger, 2013; Jaffe *et al.*, 2013), successful innovation (Custódio *et al.*, 2017; Chen *et al.*, 2015), and performance in buyout and venture capital transactions (Kaplan *et al.*, 2012).

estimation errors in the provision for bad debt.[9]

2.2 Managerial Ability as an Intangible Capital and Value Relevance

What we try to achieve through the value relevance test is to measure the relevance and reliability of an accounting amount (Barth *et al.*, 2001). In other words, we can think of an accounting amount as value relevant if it becomes an important part of valuing a company and is significantly relied upon by investors.[10] Since the accounting amount that we focus on in this paper is earnings, our research question is whether and how management quality can create differences in the value relevance of earnings.

Given that management plays an important role in the value creation process of a company, how knowledge of management quality would affect the value relevance of accounting information is an empirical question. To discover the plausible relationship between managerial ability and the value relevance of earnings, we first might need to understand what management quality represents in the framework of a company's valuation process.

In this paper, our primary metric of management quality is a measure of managerial ability developed by Demerjian *et al.* (2012) which shows a management team's efficiency in generating revenue compared to other peers within an industry. On the basis of prior literature, we can argue that such management efficiency, which is not readily imitable across firms, is an intangible capital in the value creation process of a firm. While it is true that the innate ability of a CEO is mostly time-invariant, the ability of a top management team is not necessarily so. More specifically, managerial ability does not result from the sum of the individual abilities of the executives but from mutual understanding, cooperation, and synchronisation among executives that can result in a valuable managerial capital that cannot easily be imitated by other firms.[11]

While a firm creates opportunities by combining valuable resources, it is essential to have effective management and synchronisation of resources to gain competitive advantages in the market (e.g. Peteraf and Barney, 2003; Hansen *et al.*, 2004; Kor and Mahoney, 2005; Sirmon *et al.*, 2007). But the ability of a management team that helps utilise resources is itself a valuable resource in the process of value creation.[12] The ability to effectively utilise

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[9] Using the same measure of management ability, Demerjian *et al.* (2017) show that highly capable managers tend to smooth earnings intentionally in a way likely to benefit shareholders.

[10] According to SFAC No.5 (FASB, 1984), an accounting amount's relevance results from its ability to make a difference in the decision-making process of the financial statement users and its reliability results from its ability to convey the information that it is supposed to represent.

[11] Hermalin and Weisbach (2017) argue that a management team derives its value from the quality of its match with the firm.

[12] In the words of Penrose (1959): "the resources with which a particular firm is accustomed to working will shape the productive services its management is capable of rendering … but also that the experience of management will affect the productive services that all its other resources are capable of rendering." Barney (1991) also recognises management quality as a valuable resource that can create competitive advantages.

resources to attain optimal performance is the result of knowledge, skills, and experience that is tacit in nature (e.g. Schultz, 1961; Becker, 1964; Kor, 2003). This skill of creating a unique combination of resources inside a firm and synchronising the use of resources for generating revenue can, nonetheless, work as the real engine of growth. That is why, while top leaders in a company, such as the CEO or CFO, are not permanent, the management culture practised by senior executives tends to remain and endure within the company for a long time (Bersin, 2012).

In fact, the early economics literature depicts managerial ability as a technology that plays a crucial part in influencing the overall productivity of a firm's inputs (e.g. Walker, 1887; Leibenstein, 1966; Lucas, 1978; Rosen, 1982). According to Bruhn *et al.* (2010), managerial ability as a capital streamlines two important aspects of the functioning of a firm: a mixture of the inputs and their marginal productivity. Bloom *et al.* (2017) present a formal model showing management as an intangible capital that creates value. Further, using rich survey data of 11,000 firms in 34 countries, they show that management practices can explain about 30% of total input productivity differences across firms.

A practical example of how managerial ability does matter in the value creation process is illustrated by the management practices of General Motors (GM) and Toyota. GM, which used to be the best managed and best performing company in the world, went bankrupt in 2009 after experiencing a sharp decrease in its share of the US market, from 46 to 20 per cent, between 1980 and 2009. As Helper and Henderson (2004) detail, GM started losing its market share to Japanese competitors, such as Toyota, which introduced better quality cars but at a lower cost by adopting superior management practices.[13] This example could give us an idea of how influential management practices could be in the long-term process of value creation. Therefore, investors, knowing *ex ante* the long-term influence of management, should put a premium on superior management practices.

Another example is Amazon, whose management practices of "customer obsession" and "bias for action", with a philosophy of "it's always Day 1 at Amazon", are strongly perceived to be one of the key catalysts behind its surprising growth rate (Mattioli, 2019). In other words, management practices with a shared belief and culture are what create the efficiency of the management team within a company. Unique to each company, such management capacity, even though intangible in nature, can gradually be revealed to investors through its manifestation in time-tested performance.

Given that managerial ability is an essential intangible capital, how should it affect the value relevance of earnings? This is an empirical question since better managerial ability does not necessarily lead to managerial actions conducive for long-term growth. Managers

[13] GM even established a joint venture with Toyota in California from the mid-1980s to gain direct experience of the superior management practices of Toyota. Eventually, that venture did little for GM's efforts to improve its management, which further suggests that unlike other inputs or capital, management practices are not readily imitable or replaceable.

can use their superior knowledge to extract benefits for themselves while destroying the value of shareholders (Hendry, 2002; Tian, 2014; Cheung *et al.*, 2017). In fact, prior empirical evidence suggests that high-ability managers are likely to be involved in a higher level of insider selling activities (Wang, 2013), conduct manipulation in loan terms (Frank and Obloj, 2014), and exploit fraud opportunities while concealing the fraudulent activities (Wolfe and Hermanson, 2004; Dellaportas, 2013). In a more recent study, using Demerjian *et al.*'s (2013) measure of managerial ability, Gul *et al.* (2018) find that when firms are financially distressed, high-ability managers tend to be involved in opportunistic financial reporting practices leading to lower accruals quality and a higher possibility of a financial restatement. Thus, considering the possibility that highly able managers might use their superior understanding of business and capacity to benefit themselves at the cost of shareholders, investors might rely less on the earnings disclosed by firms with better managerial quality.

On the other hand, on the basis of our discussion that managerial ability could create value in the long term, investors should positively evaluate the value of a firm with a better management team. Therefore, our prediction is as follows:

H1: The value relevance of earnings is higher for firms with higher managerial abilities.

Further, since managerial capacity as an intangible capital could play a differential role in different firms, we could further argue that such a positive impact of managerial ability on earnings relevance is not necessarily homogenous across firms. For example, in firms where the mechanisms of corporate governance are weak, the managerial role of figuring out the best management practices could play a more influential role in the absence of strong outside guidance and monitoring. Therefore, our next hypothesis is as follows:

H2: The positive impact of managerial ability on the value relevance of earnings would be higher for firms with weak corporate governance.

Another important channel through which management capacity could play an influential role is market competitiveness. If a firm operates in an environment that is too competitive, the discretionary role of managers has little role to play as there is insignificant control over the market. On the other hand, since prior research suggests that greater product market power provides a more flexible operating environment which enables firms to achieve higher and more stable profitability (e.g. Peress, 2010; Irvine and Pontiff, 2009), we argue that superior management capacity can have a greater role to play in the presence of more control over the market. Thus, our next hypothesis regarding the channel through which managerial ability might affect earnings relevance is as follows:

H3: The positive impact of managerial ability on the value relevance of earnings would be higher for firms with greater product market power.

III. Data and Methodology

3.1 Data

We use the CRSP database to collect information about monthly stock prices and returns between 1980 and 2010. Firms' accounting information comes from the Compustat Annual database. We use the measure of managerial ability developed by Demerjian *et al.* (2012) and employ *MA_SCORE_2011* from the 2011 version provided by the authors.[14] We present a more detailed discussion on the ability measure in the following subsection. To be included in the final sample, all firm-years must have available data on stock prices, managerial ability scores, and other accounting information used in our empirical specifications. We remove the top and bottom 1% of observations for the continuous accounting variables. For additional tests, we collect corporate board members data from Boardex, institutional ownership data from Thomson Reuters, anti-takeover defence data from RiskMetrics, and historical data on corporate headquarter location from Compustat, Execucomp, and Hoover's. The final sample includes 127,597 firm-year observations for 14,302 unique firms.

3.2 Methodology

3.2.1 The measure of managerial ability

To measure managerial ability, we rely on Demerjian *et al.* (2012), which is based on a two-stage model to estimate the managerial efficiency of converting a firm's resources into outputs and generating revenues. They posit that high-quality managers generate higher production rates from a given amount of resources than low-quality managers. Essentially, using the technique of data-development analysis (DEA), they create an efficient frontier representing the maximal level of revenue that can be generated with a given level and mixture of resources by firms within each industry. Firms running on the efficient frontier are assumed to have better ability to generate revenues given their resources compared to their peers and are assigned a managerial ability score of one. The further a firm is from its frontier, the lower the score it is assigned.

In the second stage, Demerjian *et al.* (2012) use Tobit regression to explain why management score varies within each industry using key firm characteristics as the explanatory variables. The unexplained portion of the regression, or the residual of a firm, is

[14] We are thankful to Peter Demerjian for making data available for public use at http://faculty.washington.edu/pdemerj/data.html

then used as the measure of the *MA_Score* for the managerial ability of that firm.[15]

Compared to other measures of managerial ability in the conventional literature, the measure developed by Demerjian *et al.* (2012) has some advantages that make it a more reliable and accurate measure of management quality. For example, some measures used in previous studies are historical industry-adjusted stock returns, historical industry-adjusted return on assets, media citations as a representation of CEO press visibility, CEO appointments from outside the firm, CEO pay, CEO tenure, and managerial fixed effects (Fee and Hadlock, 2003; Milbourn, 2003; Rajgopal *et al.*, 2006; Tervio, 2008; Carter *et al.*, 2010; Bamber *et al.*, 2010; Ge *et al.*, 2011). These existing measures of managerial ability are not free from noise and cannot be attributed to manager-specific measures. For example, media mentions and CEO compensation tend to be higher for larger firms. Another frequently used measure of ability is abnormal stock returns, which contain information not related to management capacity. Also, the measure of manager fixed effects, or individual CEO styles that remain unchanged when the CEOs move from one firm to another, could be contaminated with their correlation with firm performance.

Note that the measure of managerial ability captures a firm's efficiency in generating revenue with a given set of inputs relative to its peers within the same industry in each year. The very nature of its construction gives us variation in the efficiency of a firm across years since even though a firm's ability to manage resources could change very slowly, its relative position could change relatively more regularly because of the combined effects of other firms' efforts within an industry. In fact, we find that the average within-firm standard deviations of *MA_Score* and *MA_Rank* are 0.06 and 0.10,[16] respectively, which implies that there are non-trivial levels of variation in a firm's ability in the sample period.

As the measure of managerial efficiency developed by Demerjian *et al.* (2012) has been proved reliable and more manager specific, it has been widely used in recent studies (e.g. Baik *et al.*, 2011; Demerjian *et al.*, 2013; Francis *et al.*, 2013; Choi *et al.*, 2015). We use this as our measure of managerial ability.

3.2.2 The measure of value relevance

Value relevance is the association between accounting information and market values or equity returns (Francis and Schipper, 1999; Barth *et al.*, 2001). The three categories of value-relevance studies discussed in Holthausen and Watts (2001) are relative association studies, incremental association studies, and marginal information content studies. Relative

[15] The authors check the validity of their measure through multiple tests. First, they find a statistically and economically significant correlation between the measure and the managerial fixed effects. Second, their evidence shows that announcement returns to CEO turnover are negatively associated with the managerial ability score. Third, further tests show that firm performance tends to improve following the appointment of a CEO with higher managerial ability.

[16] Note that *MA_Score* represents the raw measure of ability and *MA_Rank* shows the industry-year decile ranking.

association studies test the association between stock market values and alternative measures of accounting. Usually in this type of study, we observe the differences in R^2 using different measures of bottom-line accounting numbers. Higher R^2 implies an accounting number is more value relevant.

Incremental association studies are concerned about how much explanatory power an accounting number has in the presence of other variables. The variable of interest is value relevant if the associated regression coefficient is significantly different from zero.

The studies of marginal information content test the informational contribution of a specified accounting number, usually by conducting event studies following the release of particular accounting information. An abnormal price reaction implies value relevance given the availability of other information.

For our study, we measure value relevance by observing the explanatory power of related information as indicated by adjusted R^2. Another way to measure value relevance is by testing the estimated coefficients on the variable of interest. Following a large number of studies, we rely on both adjusted R^2 and estimated coefficients in measuring value relevance. For example, in examining changes in value relevance over time, Collins *et al.* (1997) and Francis and Schipper (1999) use both adjusted R^2 and estimated coefficients on book values and earnings.

In our model specifications, we use both price value relevance and return value relevance models; these models are discussed in more detail below.

3.2.2.1 Price value relevance

We employ Ohlson's (1995) accounting-based valuation model to test the value relevance of managerial ability. The model's approach (that firm market value is a function of the book value of equity and earnings) has been used in a large number of previous studies (for example, see Burgstahler and Dichev, 1997; Barth *et al.*, 1998; Francis and Schipper, 1999; Al-Jifri and Citron, 2009). The basic form of the model is as follows:

$$P_{it} = \alpha_0 + \beta_1 BVPS_{it} + \beta_2 EPS_{it} + \varepsilon_{it,} \quad (1)$$

where P_{it} is the stock price three months after the end of fiscal year t for firm i, and *BVPS* is the book value per share calculated as the book value of equity (*CEQ*) divided by shares outstanding (*CSHO*) at the end of fiscal year t. *EPS* is earnings per share, calculated as income before extraordinary items (*IB*) divided by shares outstanding at the end of fiscal year t.

Following previous studies (e.g. Barth *et al.*, 1998; Balachandran and Mohanram, 2011), we modify equation (1), addressing three econometric problems that might affect the above model. First, cross-sectional differences might contaminate the effect of earnings and book values of equity on the stock price. For example, firms with fewer financial constraints

tend to have higher earnings multiples and lower multiples on book value (Barth *et al.*, 1998). Therefore, we control for financial soundness using size and leverage. Second, as the frequency of losses increases over time (Hayn 1995; Givoly and Hayn, 2000; Klein and Marquardt, 2006) and losses play a less informational role than profits, we predict that the increase in loss frequency reduces the explanatory power of value-relevance regressions. Therefore, following Core *et al.* (2003), we further control for losses in our regression model. Third, these regressions assume that the coefficients of accounting variables are similar for firms across industries. But in the presence of an increase in the heterogeneous effect of industry over time, as Balachandran and Mohanram (2011) argue, we experience lower value relevance, which has nothing to do with the explanatory power of accounting information. Thus, we also control for industry effects by including separate indicator variables for each industry defined by Fama and French's (1997) 48 industry classifications based on SIC codes. Finally, we also control for year effects.

Considering these problems, we use the following regression model for our empirical test of price value relevance:

$$\begin{aligned} P_{it} = {} & \alpha_0 + \beta_1 BVPS_{it} + \beta_2 EPS_{it} + \beta_3 Size_{it} + \beta_4 Leverage_{it} + \beta_5 Loss_{it} \\ & + \beta_6 Size_{it} * EPS_{it} + \beta_7 Leverage_{it} * EPS_{it} + \beta_8 Loss_{it} * EPS_{it} \\ & + Ind_{it} + Year_{it} + \varepsilon_{it,} \end{aligned} \quad (2)$$

where P_{it}, $BVPS_{it}$, and EPS_{it} are as defined earlier; $Size$ is natural logarithm of total assets (*AT*); *Leverage* is short-term debt (*DLC*) plus long-term debt (*DLTT*) divided by total assets; *Loss* is an indicator variable for firm-years with negative *EPS*; Ind is a dummy variable for each group in the Fama-French 48 industry classifications; and $Year$ is a dummy variable for each year.

To examine the value relevance of managerial ability, we add a managerial ability score provided by Demerjian *et al.* (2012) to the model:

$$\begin{aligned} P_{it} = {} & \alpha_0 + \beta_1 BVPS_{it} + \beta_2 EPS_{it} + \beta_3 MA_{it} + \beta_4 MA_{it} * EPS_{it} + \beta_5 Size_{it} \\ & + \beta_6 Leverage_{it} + \beta_7 Loss_{it} + \beta_8 Size_{it} * EPS_{it} + \beta_8 Leverage_{it} * EPS_{it} \\ & + \beta_9 Loss_{it} * EPS_{it} + Ind_{it} + Year_{it} + \varepsilon_{it,} \end{aligned} \quad (3)$$

where MA is the measure of managerial ability. We employ two variables based on the managerial ability score. First, *MA_Score* is the raw version of ability score; the industry-year decile rank of managerial ability following Demerjian *et al.* (2013) is *MA_Rank*. We interact each of these variables with earnings.

3.2.2.2 Return value relevance

Kothari and Zimmerman (1995) identify some econometric problems associated with price models, even though price models are less likely to produce biased coefficients than

return models. Easton (1999) also argues for the use of return problems after finding similar issues. We use the following model for return value relevance:

$$\begin{aligned} R_{it} = {} & \alpha_0 + \beta_1 EPS_{it} + \beta_2 \Delta EPS_{it} + \beta_3 MA_{it} + \beta_4 \Delta EPS_{it} * MA_{it} + \beta_5 Size_{it} \\ & + \beta_6 Leverage_{it} + \beta_7 Loss_{it} + \beta_8 Size_{it} * \Delta EPS_{it} \\ & + \beta_9 Leverage_{it} * \Delta EPS_{it} + \beta_{10} Loss_{it} * \Delta EPS_{it} \\ & + Ind_{it} + Year_{it} + \varepsilon_{it,} \end{aligned} \quad (4)$$

where R_{it} is the 12-month, compounded, market-adjusted monthly returns from the fourth month of the current fiscal year to the third month after the end of the fiscal year. *EPS* is earnings per shared deflated by the stock price at the beginning of the year. ΔEPS is the change in *EPS* deflated by the stock price at the beginning of the year. Other variables are as previously defined.

We examine both the estimated coefficients and adjusted R^2 of the above models while testing the value relevance of managerial ability.

IV. Main Results

4.1 Descriptive Statistics and Correlations

Table 1 reports the descriptive statistics for the entire sample, as well as for the subsamples based on ranking managerial ability. The "High Ability" subsample consists of observations within the upper half of the decile ranking of managerial ability. Similarly, the "Low Ability" subsample consists of observations for which managerial ability falls into the lower half of the decile ranking. We use the decile ranking provided by Demerjian *et al.* (2012) which constructs the ranking on the basis of a continuous measure of managerial ability for each industry for each year. A higher rank for a particular year implies superior management ability compared to industry peers. We first examine whether such differences are associated with different firm characteristics.

Table 1 Descriptive Statistics

This table reports descriptive statistics for the variables representing key firm characteristics and the measure of managerial ability for different subsamples. Columns (1) and (2) show values for the whole sample, columns (3) and (4) include the "High Ability" sample, and columns (5) and (6) include the "Low Ability" sample. *High Ability* represents observations for which the industry-year decile rank for the managerial ability score is more than five, whereas *Low Ability* represents observations for which the industry-year decile rank is less than or equal to five. *Price* is the stock price three months after the fiscal year end. *BVPS* is the book value per share, calculated as book value of equity (*CEQ*) divided by shares outstanding (*CSHO*) at the end of fiscal year *t*. *EPS* is earnings per share, calculated as income before extraordinary items (*IB*) divided by shares outstanding at the end of fiscal year *t*. *Total Assets* is the total assets (*AT*) in millions of dollars. *M/B* is the ratio of market value of equity to book value of equity, where market value of equity is the stock price at the end of the fiscal year multiplied by shares outstanding. *MV* is the market value of equity; *Leverage* is short-term debt (*DLC*) plus long-term debt (*DLTT*) divided by total assets; *Loss* is an indicator variable for firm-years with negative *EPS*; and *MA_Score* is the measure of managerial ability provided by Demerjian *et al.* (2012).

	Whole sample		High Ability		Low Ability		Differences
Variable	Mean	Median	Mean	Median	Mean	Median	(3)−(5)
	(1)	(2)	(3)	(4)	(5)	(6)	
Price	14.155	8.500	16.325	11.080	12.063	6.800	4.262***
BVPS	6.882	4.643	7.249	5.239	6.529	4.070	0.720***
EPS	0.429	0.225	0.734	0.504	0.135	0.032	0.600***
Total Assets	1067.850	104.226	1115.350	124.962	1022.040	90.123	93.310***
M/B	2.961	1.761	3.151	1.960	2.777	1.586	0.374
MV	1038.360	93.166	1270.320	126.003	814.641	74.174	455.679***
Leverage	0.328	0.202	0.363	0.181	0.295	0.223	0.069**
Loss	0.373	0.000	0.269	0.000	0.473	0.000	-0.204***
MA Score	-0.012	-0.019	0.098	0.070	-0.118	-0.101	0.216***
Obs	127,597		62,644		64,953		

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 1 shows that the stock prices of "High Ability" firms are on average higher than those of "Low Ability" firms. These firms with better management capabilities are also associated with higher mean and median book values per share, earnings per share, growth opportunities, and market capitalisation. Furthermore, they are larger and more leveraged. *Loss*, an indicator variable for negative earnings per share, shows that negative earnings are on average a more frequent event for firms with low managerial ability. Differences in the mean of all these variables between "High Ability" and "Low Ability" firms are statistically significant, except for *M/B* (market-to-book ratio).

Appendix Table 1 shows the correlations between the variables capturing key firm characteristics related to our value-relevance regressions. Our results from a Pearson correlation confirm that market price, book value per share, earnings per share, total assets, market capitalisation, and managerial ability score are positively correlated with one another. *Loss*, showing the frequency of firm-years experiencing negative earnings, is negatively correlated with all other variables except for *M/B* and *Leverage*. The managerial ability score is strongly and positively correlated with the stock price, BVPS, EPS, total assets, market capitalisation, and leverage, which reflects the characteristics of variables we observe in the "High Ability" and "Low Ability" subsamples in Table 1.

4.2 Price Value Relevance and Managerial Ability

In Table 2, we use different forms of models (1) and (2) to examine our hypothesis in the price value relevance framework. The dependent variable is stock price three months after fiscal year end. We control for *Size* as the natural logarithm of total assets, *Leverage* as total debt to total assets, and *Loss* as an indicator variable of firms with negative earnings in a year. Throughout the models, we find that negative earnings and leverage have a negative impact on equity value. Larger firms have higher market prices, as expected. These results are consistent with findings in prior studies (e.g. Collins *et al.*, 1997; Core *et al.*, 2003).

In Panel A, Column (1) shows the results using model (1) but not controlling for the

industry and year effects. We find that the coefficients of both *BVPS* and *EPS* are significantly and positively correlated with the market price. But after including both industry and year effects as control variables, as shown in Column (2), we observe that the coefficient of *BVPS* increases from 0.39 to 0.46 and the coefficient of *EPS* increases from 4.72 to 5.34. Also, the overall model fit in Column (1) increases by three percentage points in Column (2). This implies that after controlling for fixed effects associated with industry and time, we can better recognise the value relevance of accounting information.

As discussed, our main interest is to examine whether the association of accounting information, particularly earnings, with stock values improves with management ability. In Column (3), we include *MA_Score*, a measure of managerial ability, and an interaction term between managerial ability score and earnings. We find that the coefficient on the interaction term is 5.47, which is significant at the 1% level. Meanwhile, we find that *MA_Score* is positively associated with the market price, which is both economically and statistically significant. It confirms our prediction that earnings become more relevant information in the equity market when the reporting firms are led by better management teams.

MA_Score facilitates an ordinal ranking of management quality for a large sample of firms. Demerjian *et al.* (2013) construct a decile ranking of management ability, *MA_Rank*, for each industry for each year, which should mitigate concerns about the influence of extreme observations and make the analysis of scores more comparable across years and industries. We include *MA_Rank* and an interaction term between *MA_Rank* and earnings in Column (4) of Table 2. We find that the decile ranking of managerial ability is significantly associated with equity values. More importantly, we detect a significantly positive association between the interaction term and stock price, which implies higher-quality management helps increase the value relevance of earnings. In other words, for one decile increase of managerial ability, on average, the market price increases by (2.877+0.611*0.429) or $3.14, given $0.429 as the sample average of EPS. Given that the average number of shares held by the sample firms is 44.54 million, this results in an increase in market value of $139.82 million; 92% of this value addition, or $128 million ($2.877*44.54), occurs exclusively as a result of the increase in managerial ability. Furthermore, the results imply that for each decile increase in inability, EPS relevance increases by 13% (0.611/4.565).

Overall, our results in Panel A of Table 2 confirm our hypothesis that earnings are more value relevant in determining stock prices when managerial capacity is better. However, to obtain a better view of how managerial ability affects the value relevance of managerial ability, in Panel B, we group the sample into “High Ability” and “Low Ability” subsamples and test the price value relevance using Model (3) for each subsample.

Table 2 Price Value Relevance and Managerial Ability

Panel A reports the results from OLS regressions of stock price on accounting information and managerial ability. Panel B reports the results from OLS regressions of stock price on accounting information for the "Low Ability" and "High Ability" subsamples. Firms in the upper (lower) half of the decile rankings of managerial ability fall into the High (Low) Ability group; the decile rankings for each industry for each year are based on Demerjian *et al.*'s (2012) rankings of the continuous measure of managerial ability, *MA_Score*. The dependent variable is the stock price three months after fiscal-year end. *BVPS* is the book value per share, calculated as book value of equity (*CEQ*) divided by shares outstanding (*CSHO*) at the end of fiscal year *t*. *EPS* is earnings per share, calculated as income before extraordinary items (*IB*) divided by shares outstanding at the end of fiscal year *t*. *MA_Score* is the measure of managerial ability provided by Demerjian *et al.* (2012); *MA_Rank* is the decile rank of the measure of managerial ability by industry-year; *Size* is the natural logarithm of total assets (*AT*); *Leverage* is short-term debt (*DLC*) plus long-term debt (*DLTT*) divided by total assets; and *Loss* is an indicator variable for firm-years with negative *EPS*. Panel B controls for industry and year effects and other control variables. Industry and year effects are dummy variables for each industry defined by the Fama-French 48 industry classifications and for each year, respectively. Heteroskedasticity-robust standard errors are reported in parentheses.

Panel A: Full sample analysis				
	(1)	(2)	(3)	(4)
Intercept	-2.187***	-9.522***	-9.648***	-11.116***
	(0.072)	(0.229)	(0.228)	(0.235)
BVPS	0.394***	0.459***	0.474***	0.479***
	(0.008)	(0.008)	(0.008)	(0.008)
EPS	4.722***	5.343***	5.020***	4.565***
	(0.137)	(0.135)	(0.135)	(0.153)
MA_Score			5.467***	
			(0.191)	
*MA_Score*EPS*			0.521***	
			(0.207)	
MA_Rank				2.877***
				(0.0920
*MA_Rank*EPS*				0.611***
				(0.103)
Size	2.064***	2.068***	2.083***	2.085***
	(0.018)	(0.019)	(0.019)	(0.019)
Leverage	-0.035***	-0.031*	-0.031*	-0.029*
	(0.020)	(0.018)	(0.018)	(0.017)
Loss	-0.561***	-0.751***	-0.471***	-0.470***
	(0.069)	(0.068)	(0.068)	(0.068)
Size EPS*	0.194***	0.116***	0.135***	0.143***
	(0.016)	(0.016)	(0.016)	(0.016)
Leverage EPS*	-0.602***	-0.577***	-0.555***	-0.549***
	(0.229)	(0.225)	(0.220)	(0.215)
Loss EPS*	-5.163***	-5.519***	-5.340***	-5.213***
	(0.106)	(0.105)	(0.107)	(0.106)
Industry effects	No	Yes	Yes	Yes
Year effects	No	Yes	Yes	Yes
Obs.	127,597	127,597	127,597	127,597
Adjusted R^2	63%	66%	66%	66%

Panel B: Subsample analysis		
	High ability (1)	*Low ability* (2)
EPS	5.854***	4.244***
	(0.187)	(0.188)
Adjusted R^2	66%	65%
Obs.	62,644	64,953
p-value from the Chi-squared test of the equality of coefficients of *EPS* of High versus Low ability = 0.000		

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Using Model (2), we expect the sign of the coefficient β_2 to be positive for both subsamples, but we expect the magnitude of β_2 for the "High Ability" subsample to be significantly higher than that of the "Low Ability" subsample. We expect the adjusted R^2, which is the explanatory power of the model, and another measure of value relevance, to be higher for the "High Ability" group.

Panel B of Table 2 shows the results. We find that the β_2 of the "High Ability" group is 5.85, whereas the β_2 of the "Low Ability" group is 4.24. Furthermore, the differences in coefficients between the two groups are significant at the 1% level, as the *p*-value in the bottom row of the table indicates. Furthermore, the adjusted R^2 of the "High Ability" group is one percentage point higher than that of the "Low Ability" group. Overall, in the table, we can observe that the EPS relevance of the firms run by high-ability managers is, on average, 38% (5.854/4.244) higher than that of the firms run by low-ability managers.

The results confirm our prediction that accounting information is more relevant in valuing firms when managerial ability is higher.

4.3 Return Value Relevance

We further examine the value relevance of managerial ability in the models of return value relevance. Table 3 shows the results from regressions using a variant of Equation (4). In Column (1), we observe that *EPS*, as earnings per share deflated by the beginning-of-the-period price and change in *EPS*, is significantly and positively correlated with equity returns. In Column (2), we include both industry and year effects in the model and document a significantly positive association of *EPS* and Δ*EPS* with returns as well.

In Column (3), we include *MA_Score* as the managerial ability in the model and examine the associated value relevance. As *MA_Score* is positively and significantly associated with equity returns, we can argue that investors are likely to strongly recognise management quality. Also, the coefficient on the interaction term between *MA_Score* and Δ*EPS* suggests a very strong and positive relationship between management ability and the value relevance of earnings. In Column (4), we examine the effect of *MA_Rank*, the industry-year decile rank of managerial ability, on market returns. We find a positive association between managerial ability and equity returns. Overall, our results in Table 3

Table 3 Return Value Relevance and Managerial Ability

This table reports the results from industry and year effects OLS regressions of stock returns on accounting information and managerial ability. Returns are compounded monthly and market-adjusted returns from the fourth month of the current fiscal year to the third month after the end of the fiscal year. *EPS* is earnings per share deflated by price at the beginning of the period, whereas earnings per share is calculated as income before extraordinary items (*IB*) divided by shares outstanding (*CSHO*) at the end of fiscal year *t*. Δ*EPS* is calculated as $(EPS_t - EPS_{t-1}/P_{t-1})$; *MA_Score* is the measure of managerial ability provided by Demerjian *et al.* (2012); *MA_Rank* is the decile rank of the measure of managerial ability by industry and year; *Size* is the natural logarithm of total assets (*AT*); and *Leverage* is short-term debt (*DLC*) plus long-term debt (*DLTT*) divided by total assets. Heteroskedasticity-robust standard errors are reported in parentheses.

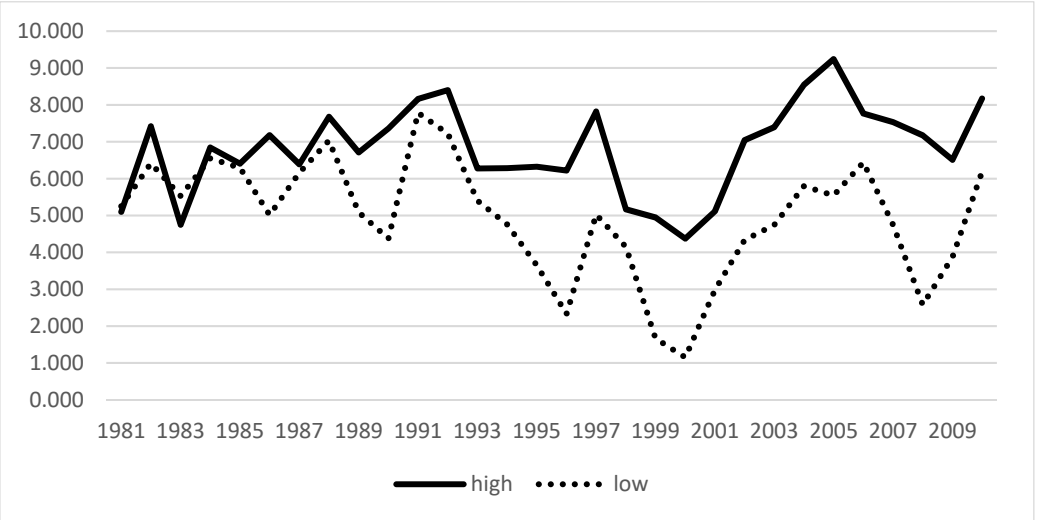
	(1)	(2)	(3)	(4)
Intercept	-0.017***	-0.007	-0.009	-0.026***
	(0.005)	(0.009)	(0.009)	(0.010)
EPS	0.141***	0.184***	0.177***	0.177***
	(0.015)	(0.014)	(0.015)	(0.015)
Δ*EPS*	0.776***	0.756***	0.764***	0.660***
	(0.033)	(0.032)	(0.032)	(0.039)
MA_Score			0.064***	
			(0.011)	
*MA_Score*ΔEPS*			0.289***	
			(0.077)	
MA_Rank				0.032***
				(0.005)
*MA_Rank*ΔEPS*				0.180***
				(0.039)
Size	0.012***	0.005***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
Leverage	-0.102***	-0.070***	-0.069***	-0.069***
	(0.013)	(0.010)	(0.009)	(0.009)
Loss	-0.133***	-0.154***	-0.149***	-0.149***
	(0.005)	(0.004)	(0.004)	(0.004)
Δ*EPS*Size*	0.004	0.000	0.001	0.002***
	(0.005)	(0.005)	(0.005)	(0.005)
Δ*EPS*Leverage*	-0.181***	-0.180***	-0.176***	-0.175***
	(0.037)	(0.034)	(0.034)	(0.033)
Δ*EPS*Loss*	-0.440***	-0.438***	-0.423***	-0.421***
	(0.025)	(0.025)	(0.025)	(0.025)
Industry effects	No	Yes	Yes	Yes
Year effects	No	Yes	Yes	Yes
Obs.	112,581	112,190	112,190	112,190
Adjusted R^2	8%	13%	13%	13%

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

using the model of return value relevance reconfirm the positive role of managerial ability in strengthening the value relevance of accounting information.

To check the robustness of our results suggesting that earnings information is more value relevant for firms led by better quality managers, we run annual cross-sectional regressions from 1981 to 2010 for each group. Figure 1 plots the earnings coefficients for "High Ability" and "Low Ability" firms for each year. We can readily identify that the coefficients on the former group are predominantly higher than the coefficients on the latter group, especially since the mid-1980s. The gap between the two groups tends to be consistently high, beginning in the 1990s. Even though both groups seem to move together, we see that the downward movement in the "Low Ability" group is both sharper and greater in magnitude. Overall, the graph shows that the value relevance of earnings tends to be consistently higher for firms with high-quality management.

Figure 1 Earnings Multiples of High-Ability Versus Low-Ability Management



V. Robustness Tests

5.1 The Concern of Earnings Attributes and Value Relevance

One potential concern regarding our findings is that earnings quality may drive the results. Prior research finds a positive association between managerial ability and earnings quality. For example, Aier *et al.* (2005) provide evidence of fewer restatements when CFOs are skilled in accounting practices. Recent evidence from Demerjian *et al.* (2013) suggests that managerial ability is strongly and positively associated with earnings quality. Thus, the results could suggest that our findings are not solely due to better managerial ability but also to higher earnings quality. In other words, it is possible that earnings quality is the first-order effect and value relevance is just a second-order effect of managerial ability. We argue that although one of the many positive effects of having a better management team is higher earnings quality, management ability has its own strength of affecting value relevance.

One way to see how robust our findings are is to examine the value relevance of earnings for firms with high and low management abilities against subsamples of high and low quality earnings. Earnings quality should be positively associated with value relevance, so we are interested in determining whether higher management ability is more associated with greater value relevance for high and low earnings quality. Otherwise, for example, if high management ability fails to show a strong association with higher value relevance when earnings quality is low, this would suggest that earnings quality dominates managerial ability in affecting the value relevance of accounting information.

First, for our empirical setting, we divide the sample into "High-Quality Earnings" and "Low-Quality Earnings" subsamples. Following Dechow and Dichev (2002), we measure

earnings quality on the basis of how cash flows reflect accruals. Because current levels of accruals forecast future cash flows and update themselves when cash from past accruals is received, the Dechow and Dichev (2002) model has accruals as a function of past, present, and future cash flows, highlighting their significant role in mapping the cash flows in earnings. Residuals from the accrual model show the errors in estimation due to limitations in managerial judgments or incentives. First, we estimate the following regression for each Fama and French (1997) industry for each year:

$$\Delta WC_t = \alpha_0 + \alpha_1 CFO_{t-1} + \alpha_2 CFO_t + \alpha_3 CFO_{t+1} + \alpha_4 \Delta REV_t + \alpha_5 PPE_t + \varepsilon_t, \quad (5)$$

where ΔWC is the change in working capital, CFO is the cash flow from operations (*OANCF*), ΔREV is the change in sales (*SALE*), and PPE is property, plant, and equipment (*PPENT*). All variables are normalised by average total assets between the current year and the previous year. WC or working capital is the sum of changes in accounts receivable (*RECCH*), inventory decrease (increase) (*INVCH*), changes in accounts payable and accrued liabilities (*APALCH*), changes in accrued income taxes (*TXACH*), and net changes in other current assets and liabilities (*AOLOCH*), and the sum is multiplied by -1. We include ΔREV and PPE following McNichols (2002). We require each industry-year to have at least 20 observations to run the regression. Higher absolute values of residuals imply the presence of higher estimation errors. The measure of earnings quality is the standard deviation of the residual over a rolling window of four years or the standard deviation of ε_{t+1}, ε_{t+2}, ε_{t+3}, and ε_{t+4}. Managerial failure in regard to precise recognition of accruals is represented by the higher standard deviation. We then create a decile ranking of earnings quality for each industry-year and define the firm-years belonging to the lower half of the decile as "High-Quality Earnings" and firm-years belonging to the upper half of the decile as "Low-Quality Earnings".

Panel A of Table 4 shows the results where we compare the value relevance of firms with high and low management ability separately with the subsamples of high and low quality earnings. Examining the "High-Quality Earnings" subsample, we find that the coefficient on earnings for the "High Ability" group is higher than that for the "Low Ability" group by 1.809, and the difference is significant at the 10% level. More importantly, for the "Low-Quality Earnings" subsample, we find that the coefficient on earnings for the "High Ability" group is significantly higher than that of the "Low Ability" group at the 5% level of significance. Also, the adjusted R^2 of the former is five percentage points higher than that of the latter. The results imply that regardless of earnings quality, the value relevance of accounting information increases with management ability. They also imply that the greater value relevance of superior management predominantly exists in the presence of firms disseminating low-quality earnings reports.

Prior literature further suggests that increasing the use of accounting conservatism in

financial reporting practices could decrease the value relevance of accounting information (e.g. Elliott and Jacobsen 1991; Jenkins, 1994).[17] To consider the plausible influence of accounting conservatism on our results, we first create an industry-year decile ranking of accounting conservatism, and we follow the methodology of Khan and Watts (2009) in calculating conservatism. In Panel B of Table 4, the subsample of "high" ("low") conservatism represent the firm-years in the upper (lower) half of the ranking. We find that for the subsample of high conservatism, the coefficient of *EPS* of high-ability firms is significantly higher than that of low-ability firms. We observe similar results for the subsample of firms with low conservatism. Thus, the results suggest that regardless of whether firms practise high or low conservatism, firms with high managerial ability tend to experience significantly higher earnings relevance than firms with low managerial ability.

Table 4 Earnings Characteristics and Value Relevance of Management Ability

The table reports the results of OLS regressions of subsamples based on different earnings characteristics and management ability. In Panel A, the "High-Quality Earnings" ("Low-Quality Earnings") subsample represents firm-years in the lower (upper) decile of industry-year rankings from the Dechow and Dichev (2002) measure of earnings quality, where Dechow and Dichev (2002) measure standard deviation (ε_{t+1}, ε_{t+2}, ε_{t+3}, and ε_{t+4}) using residuals from the following industry-year regression:

$$\Delta WC_t = \alpha_0 + \alpha_1 CFO_{t-1} + \alpha_2 CFO_t + \alpha_3 CFO_{t+1} + \alpha_4 \Delta REV_t + \alpha_5 PPE_t + \varepsilon_{t,}$$

where ΔWC is the change in working capital, CFO is the cash flow from operations (*OANCF*), ΔREV is the change in sales (*SALE*), and PPE is property, plant, and equipment (*PPENT*). All variables are normalised by average total assets between the current year and previous year. WC, or working capital, is the sum of changes in accounts receivable (*RECCH*), inventory decrease (increase) (*INVCH*), changes in accounts payable and accrued liabilities (*APALCH*), changes in accrued income taxes (*TXACH*), and net changes in other current assets and liabilities (*AOLOCH*). The sum is multiplied by -1. In Panel B, the "High Conservative" ("Low Conservative") subsample represents firm-years in the lower (upper) decile of the industry-year ranking of the measure of conditional conservatism following the methodology of Khan and Watts (2009). In measuring conservatism, the following annual cross-sectional model is estimated:

$$X_i = \beta_1 + \beta_2 D_i + R_i\left(\mu_1 + \mu_2 Size_i + \mu_3 M/B_i + \mu_4 Lev_i\right) + D_i R_i\left(\gamma_1 + \gamma_2 Size_i + \gamma_3 M/B_i + \gamma_4 Lev_i\right) + \left(\delta_1 Size_i + \delta_2 M/B_i + \delta_3 Lev_i + \delta_4 D_i Size_i + \delta_5 D_i M/B_i + \delta_6 D_i Lev_i\right) + \varepsilon_i,$$

where *i* represents the firm, X_i is the earnings (income before extraordinary items (*IB*) divided by 1-year lagged value of makret value of equity equity (price (*PRCC_F*) multiplied by shares outstanding (*CSHO*)) of firm *i*, *R* shows stock returns, *D* is indicator variable for a negative value of R, Size is the natural logarithm of toal assets (AT), *M/B* is market value of equity over book value of equity (*CEQ*), and *Lev* is leverage (short-term debt (*DLC*) plus long-term debt (*DLTT*) divided by total assets). The combined effect of the coefficients of R_i and $D_i R_i$ show the total effects of conservatism and is used as the measure of conditional conservatism. The dependent variable is the stock price three months after fiscal year end. *EPS* is earnings per share, calculated as income before extraordinary items (*IB*) divided by shares outstanding (*CSHO*) at the end of fiscal year *t*. Other variables included in each regression, but not reported in the table, are *BVPS*, which is book value per share calculated as book value of equity (CEQ) divided by shares outstanding at the end of fiscal year *t*; *Size*, which is the as natural logarithm of total assets (*AT*); *Leverage*, which is short-term debt (*DLC*) plus long-term debt (*DLTT*) divided by total assets; and *Loss*, which is an indicator variable for firm-years with negative *EPS*. Each regression model controls for both firm and year effects. Heteroskedasticity-robust standard errors are reported in parentheses.

[17] Contrary to the findings of previous studies, Balachandran and Mohanram (2011) find that increasing conservatism does not lead to a lower value relevance; rather, their evidence suggests that value relevance is most likely to decrease when there is not increase in conservatism.

Panel A: Discretionary accruals						
	High-quality earnings			Low-quality earnings		
	High Ability (1)	*Low Ability* (2)	*Differences* (1)−(2)	*High Ability* (3)	*Low Ability* (4)	*Differences* (3)−(4)
EPS	7.653***	5.844***	1.809*	6.460***	3.687***	2.773**
	(0.510)	(0.468)		(0.453)	(0.441)	
Adjusted R^2	66%	67%	-1%	66%	61%	5%
Obs	5,158	5,178		5,000	4,861	
Panel B: Accounting conservatism						
	High conservatism			Low conservatism		
	High Ability (1)	*Low Ability* (2)	*Differences* (1)−(2)	*High Ability* (3)	*Low Ability* (4)	*Differences* (3)−(4)
EPS	4.916***	3.890***	1.026***	5.589***	3.786***	1.803**
	(0.167)	(0.009)		(0.208)	(0.200)	
Adjusted R^2	69%	66%	3%	63%	65%	-2%
Obs	30,013	34,795		27,655	34,368	

*, **, and *** indicates statistical significance at the 10%, 5%, and 1% level, respectively. The statistical significance of differences in the coefficients is based on Chi-squared test.

5.2 Investment Efficiency

Since high-ability managers are good at executing operational activities, our results could be influenced by managerial practices of efficient investment. To address this concern, we test whether the higher value relevance of high managerial ability persists both in firms that adopt efficient investment practices and those that adopt inefficient investment practices. Following Biddle *et al.* (2009), we identify the firm-years in the middle two quartiles of the ranking of the measure of investment efficiency as the benchmark or efficient investment group. On the other hand, firm-years are placed in the inefficient investment group if they are in either the top or bottom quartile of the ranking. In Table 5, we observe that for efficient and inefficient investment firms, the earnings relevance of better-managed firms is significantly higher than that of firms run by low-ability managers.

Table 5 Investment Efficiency

The table reports the results of OLS regressions of subsamples based on the level of investment efficiency. "Efficient Investment" ("Inefficient Investment") comprises a subsample of firm-years that are in the middle two quartiles (either top or bottom quartile) of the quartile ranking of the measure of investment efficiency. In calculating investment efficiency, we first run the following regression model for each industry-year using the Fama-French 48-industry classification with at least 20 observations:

$$\boldsymbol{Investment}_{i,t+1} = \boldsymbol{\beta}_1 + \boldsymbol{\beta}_2 \boldsymbol{Sales\ \ Growth}_{i,t} + \boldsymbol{\varepsilon}_{i,t+1},$$

where $\boldsymbol{Investment}_{i,t+1}$ represents the investment of firm *i* in year *t+1*, $\boldsymbol{Sales\ \ Growth}_{i,t}$ is the growth in sales from t-1 to t, and $\boldsymbol{\varepsilon}_{i,t+1}$ is the residual of firm i. $\boldsymbol{Investment}$ is the sum of research and development expenditure (*XRD*), capital expenditure (*CAPX*), and acquisition expenditure (*AQC*) less cash receipts from property, plant, and equipment (*SPPE*) multiplied by 100 and then divided by lagged total assets (*AT*). The residuals obtained from above regression model are used as the measure of efficiency. Firms in the upper (lower) half of the decile rankings of managerial ability fall into the High (Low) Ability group, whereas decile rankings for each industry for each year are based on Demerjian *et al.*'s (2012) rankings of the continuous measure of managerial ability, *MA_Score*. Each regression model controls for both Fama-French 48 industry and year effects. Heteroskedasticity-robust standard errors are reported in parentheses.

	Efficient investment			Inefficient investment		
	High Ability (1)	*Low Ability* (2)	*Differences* (1)−(2)	*High Ability* (3)	*Low Ability* (4)	*Differences* (3)−(4)
EPS	6.440***	4.372***	2.068***	5.622***	4.130***	1.803**
	(0.184)	(0.165)		(0.189)	(0.172)	
Adjusted R^2	67%	67%	0%	65%	62%	2%
Obs	29,415	30,563		29,304	29,440	

*, **, and *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

5.3 Alternative Measures

To further test the robustness of our results, we use alternative measures of managerial ability in Appendix Table 2. Another measure that captures the quality of the management team is Chemmanur *et al.*'s (2019) *MQF*, which is based on a common factor analysis of seven proxies of the management quality of a firm. In Column (1) of Table 8, we find that the coefficient on the interaction term between *EPS* and *MQF* is positive and highly significant. Next, we focus on the media citations of CEOs. First, following prior literature (e.g. Baik *et al.*, 2011; Demerjian *et al.*, 2013), each year, we calculate the total number of times a CEO has been mentioned in the media in the last five years. Then, for each year and each industry, we create a decile ranking of that sum and define it as *CEO_CITE_RANK*. Similarly, we define the variable *CFO_CITE_RANK* using the media citations of the CFO. Assuming that a higher ranking of an executive's media citations implies higher managerial ability, in both columns (2) and (3), we observe that higher managerial ability registers significantly higher earnings relevance. Finally, we use a measure of ability based on historical market performance. Following Demerjian *et al.* (2013), and using CRSP monthly return data of the last five years, we calculate value-weighted industry-adjusted return for each year. Then, we create an industry-year decile ranking of that return and define it as *HISTORICAL_RET_RANK*. In Column (4), confirming our original results, we find that managerial ability, as revealed through a higher ranking of historical stock return, significantly increases the value relevance of earnings.

5.4 The Transition of Managerial Ability

Our evidence provides support for the argument that superior managerial ability makes earnings more meaningful to market participants in determining equity prices. One concern, which might question the validity of our results, is the possibility of an association between prior firm performance and management quality (e.g. McGuire *et al.*, 1990). Such an association could raise the issue of endogeneity by producing biased OLS coefficients. Nonetheless, it is largely the market perception that individual outsiders depend on to determine management quality.

Logically, past performance and inherent firm characteristics could help develop the perception of management quality, but such a concern should not affect our results since the

measure of managerial ability is the residual from the regression where firm characteristics are already controlled for. However, if high ability and low ability firms are systematically different from each other in terms of size and financial position, as we can observe in Table 1, we can run a separate regression for each group. If the members in each group are homogeneous, then the residuals containing unaccounted for systematic characteristics should be constant and should not be correlated with the explanatory variables. Given this assumption, we examine our results separately for the high and low ability groups of firms. Further, within each group, we separately observe the EPS coefficients for (1) the firms experiencing an increase in managerial ability score and (2) the firms experiencing a decrease in managerial ability score. For example, in Panel A of Table 6, Column (1) shows the results for the "High Ability" firms that experienced an increase in ability ranking from the previous period to the current period while being in the high-ability group in both periods. The results show that the difference in EPS coefficients between high-ability firms that experienced an "increase" in ranking and high-ability firms that experienced a "decrease" in ranking is -0.580, which is not significant.

Table 6 Transition of Managerial Ability

This table reports the results from OLS regressions of stock price on accounting information for subsamples of firms that experience transitions with respect to the two groups of managerial ability: high and low. Firms in the upper (lower) half of the decile rankings of managerial ability fall into the High (Low) Ability group; the decile rankings for each industry for each year are based on Demerjian *et al.*'s (2012) rankings of the continuous measure of managerial ability, *MA_Score*. "Transition within groups" consists of firms that experience an increase or decrease in their ability rankings within their corresponding ability group. "Transition between groups" consists of firms that switch from the High (Low) Ability group to the Low (High) Ability group. The dependent variable is the stock price three months after fiscal year end. *EPS* is earnings per share, calculated as income before extraordinary items (*IB*) divided by shares outstanding (*CSHO*) at the end of fiscal year *t*. Other variables included in each regression, but not reported in the table, are *BVPS*, which is book value per share, calculated as book value of equity (*CEQ*) divided by shares outstanding at the end of fiscal year *t*; *Size*, which is the natural logarithm of total assets (*AT*); *Leverage*, which is short-term debt (*DLC*) plus long-term debt (*DLTT*) divided by total assets; and *Loss*, which is an indicator variable for firm-years with negative *EPS*. Each regression model controls for both industry and year effects. Industries are defined following the Fama-French 48 industry classifications. Heteroskedasticity-robust standard errors are reported in parentheses.

Panel A: Transition within groups						
	High ability		Low ability		Differences	
	Increase (1)	*Decrease* (2)	*Increase* (3)	*Decrease* (4)	*(1)−(2)*	*(3)−(4)*
EPS	4.950***	5.530***	5.109***	3.734***	-0.580	1.374**
	(0.567)	(0.536)	(0.519)	(0.475)		
Adj. R^2	66%	65%	64%	63%	1%	1%
Panel B: Transition between groups						
	No transition		Transition		Differences	
	High ability (1)	*Low ability* (2)	*Low to high* (3)	*High to low* (4)	*(1)−(2)*	*(3)−(4)*
EPS	6.124***	4.241***	4.324***	4.276***	1.883***	0.048
	(0.207)	(0.212)	(0.438)	(0.392)		
Adj. R^2	66%	66%	66%	63%	0%	3%

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. The statistical significance of differences in the coefficients is based on Chi-squared test

On the other hand, within the "Low Ability" group, the EPS coefficient difference between "increase" and "decrease" is 1.374, which is statistically significant at the 1% level. Overall, the results in Panel A suggest that an increase in managerial ability predominantly affects the firms in the group of low-ability firms. Panel B shows that the difference in EPS coefficients between the firms consistently performing at a high ability level from the previous year to the current year and the firms consistently performing at a low ability level is 1.883, which is significant at the 1% level.

Next, we observe what happens to the firms that were in the highest ability group or at the top of the decile ranking in the previous period but which slide down to a lower rank in the current period. Using adjusted R^2 as another measure of value relevance, the horizontal axis of Figure 2 shows the current ability rank. For example, "<=4" means the firms were in the top rank in the previous period but go down to less than or equal to 4 in the current period. Similarly, "1" means that firms were in the top rank in both the previous period and the current period. The figure shows that the adjusted R^2 is as high as 61% for the firms ranked at the top both in the previous period and the current period. Further, we observe that the more a firm deviates from its previous-period top-rank position, the lower the adjusted R^2 becomes.

In Figure 3, we observe what happens to firms which were not in the top decile ranking in the previous period but move up to the top decile in the current period. The graph shows that the firms that were already in the high-ability group or the upper half of the decile group in the previous period and then move up to the top decile experience higher value relevance, as revealed by the adjusted R^2.

Figure 2 Transition from Highest Ability Rank to Lower Rank and Value Relevance

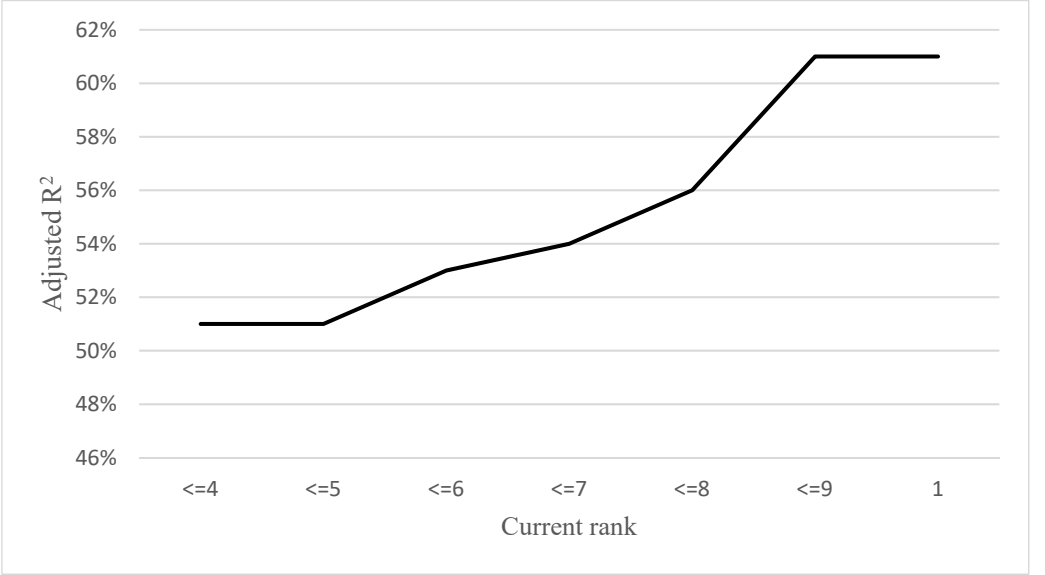
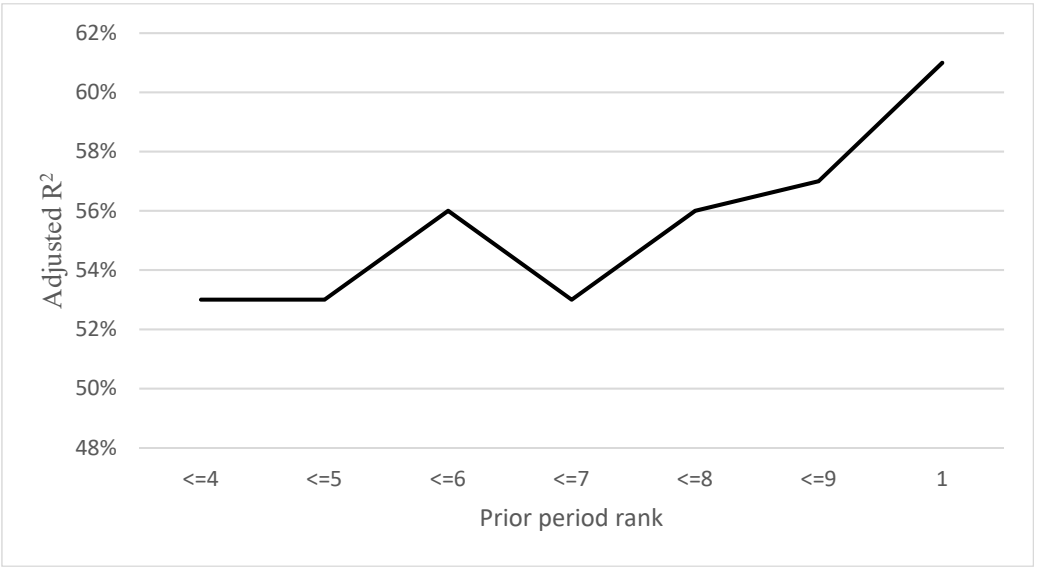


Figure 3 Transition from Lower Rank to Highest Ability Rank and Value Relevance



In Appendix Table 3, we check whether higher earnings relevance for higher managerial ability only occurs as the result of an update of market information about managerial quality or whether the earnings of firms that consistently perform better in management continue to be seen by the market as having greater relevance. In other words, if managerial ability is simply one-time information about the status of the current management team's efficiency, then we are likely to observe higher earnings relevance disappearing for the firms that have an efficient management team running for years. On the other hand, if managerial ability as an intangible capital has long-term value, then the market should value the earnings highly as long as a better management team runs the operations.

We create the variables *CONSISTENT_ABILITY5* and *CONSISTENT_ABILITY3* as dummy variables representing firm-years with a managerial ability score that is higher than the industry-year median for the last five years and three years, respectively. The results in Appendix Table 3 suggest that firms that consistently perform better in management than their peers also receive higher earnings relevance.

5.5 Replacement of CEOs

To deal with the concern that some unaccounted for firm characteristics might bias our results, we consider CEO replacements as an identification strategy. Essentially, we employ an empirical setting that focuses on CEO turnover and helps us examine how a new CEO's management ability compared to the hiring firm's ability could affect the value relevance of earnings information. Even though the measure of managerial ability we use captures the ability of the top management team, nonetheless, we cannot ignore the strong influence of

the CEO on the management team, which could make a significant contribution to determining a team's ability. In fact, Demerjian *et al.* (2012) find that, besides firm fixed effects, CEO fixed effects can significantly explain managerial ability. Thus, in the absence of a better suitable analytical framework, we conduct a CEO turnover analysis assuming that a CEO's ability can largely be developed and can also contribute to the current company's managerial ability score. Thus, we examine the differences in the managerial ability of the new CEO's old company and the ability of that CEO's current company and its impact on earnings relevance.

Table 7 CEO Turnover and Return Value Relevance

This table reports the results from industry and year effects OLS regressions of stock returns on accounting information and managerial ability. Returns are compounded monthly and market-adjusted returns from the fourth month of the current fiscal year to the third month after the end of the fiscal year. *EPS* is earnings per share deflated by price at the beginning of the period, whereas earnings per share is calculated as income before extraordinary items (*IB*) divided by shares outstanding (*CSHO*) at the end of fiscal year *t*. Δ*EPS* is calculated as $(EPS_t - EPS_{t-1}/P_{t-1})$. Δ*CEO_Score* is the difference between the new CEO's ability score prior to replacement and the replaced CEO's ability score before replacement; Δ*CEO_Rank* is the difference between the new CEO's ability score prior to replacement and the replaced CEO's ability score before replacement. *Size* is the natural logarithm of total assets (*AT*), and *Leverage* is short-term debt (*DLC*) plus long-term debt (*DLTT*) divided by total assets. Each model controls for industry fixed effects. Heteroskedasticity-robust and industry-year clustered standard errors are reported in parentheses.

	(1)	(2)
Intercept	0.560	0.529
	(0.381)	(0.385)
EPS	-0.570	-0.502
	(0.587)	(0.575)
Δ*EPS*	1.192	1.234
	(2.513)	(2.633)
Δ*MA_Score*	0.472*	
	(0.278)	
Δ*EPS*Δ*MA_Score*	4.109**	
	(1.838)	
Δ*MA_Rank*		0.208
		(0.148)
Δ*EPS*Δ*MA_Rank*		1.885**
		(0.924)
Size	-0.050	-0.050
	(0.041)	(0.041)
Leverage	0.051	0.129
	(0.345)	(0.349)
Loss	-0.444***	-0.433***
	(0.149)	(0.150)
Δ*EPS*Size*	-0.179	-0.206
	(0.201)	(0.210)
Δ*EPS*Leverage*	3.900***	3.756***
	(1.035)	(1.015)
Δ*EPS*Loss*	-0.867	-0.768
	(1.487)	(1.557)
Obs.	101	101
Adjusted R^2	0.231	0.201

*, **, and *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

For our empirical test, we first construct a sample of CEO turnovers from Execucomp and select the observations that have sufficient information. Furthermore, for each new and replaced CEO, we require the observations to have management scores for the most recent period prior to the turnover year. Finally, to remove the concern that a new CEO is hired on an interim or short-term basis, we only include new CEOs who stay for more than a year in their new firms. Our final sample consists of 101 observations from 91 unique firms, among which 81 firms replaced CEOs only once and 10 firms replaced CEOs twice in the sample period. We use a return value-relevance model, as shown in Equation (4), except that we replace MA_Score with ΔMA_Score, where ΔMA_Score is the difference between the most recent ability score associated with a new CEO prior to the turnover year and the ability score of the replaced CEO prior to the turnover year. We apply a similar procedure to calculate ΔMA_Rank.

Table 7 shows the results using the sample of CEO turnovers. We observe that the coefficient on the interaction term between ΔEPS and ΔMA_Score is 4.109, which is both economically and statistically significant. Similarly, the coefficient on ΔMA_Rank interacted with earnings change is positive and statistically significant. Our results imply that improvement in a firm's management ability after hiring a new CEO increases the value relevance of earnings, which strengthens our argument that accounting information becomes more relevant in equity valuations when firms are run by more able managers.

Table 8 Propensity Score Matching and 2-SLS

Panel A reports the results of regressions using the methodology of propensity score matching. Panel B shows the results of second stages from an instrumental based 2-SLS method, where average managerial ability score in the city in which a firm is headquartered is used as the instrument. Each model controls for industry fixed effects. Heteroskedasticity-robust and industry-year clustered standard errors are reported in parentheses.

	Panel A: Propensity score matching		
EPS	4.572***	4.168***	4.469***
	(0.137)	(0.153)	(0.141)
MA_SCORE	5.585***		
	(0.201)		
MA_RANK		2.705***	
		(0.097)	
HIGH_ABILITY			1.139***
			(0.051)
*EPS*MA_SCORE*	0.550***		
	(0.212)		
*EPS*MA_RANK*		0.702***	
		(0.103)	
*EPS*HIGH_ABILITY*			0.419***
			(0.055)
Adjusted R^2	0.663	0.663	0.662
Observations	125,288	125,288	125,288

	Panel B: Two-stage least squares		
EPS	4.622***	4.127***	4.272***
	(0.160)	(0.242)	(0.207)
Predicted (MA_SCORE)	6.286***		
	(0.387)		
*Predicted (EPS*MA_SCORE)*	1.354***		
	(0.436)		
Predicted (MA_RANK)		3.502***	
		(0.219)	
*Predicted (EPS*MA_RANK)*		0.705***	
		(0.250)	
Predicted (HIGH_ABILITY)			2.409***
			(0.153)
*Predicted (EPS*HIGH_ABILITY)*			0.477***
			(0.178)
Observations	94,594	94,594	94,594
Adjusted R-squared	0.670	0.671	0.669

*, **, and *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

5.6 Propensity Matching and Instrument Variable Regressions

Since high ability firms are, on average, larger and highly leveraged and overall tend to show better financial performance, as shown in Table 8, we cannot ignore the influence of systematic differences between high versus low ability firms on our results. Therefore, we employ a propensity score methodology to alleviate the endogeneity concern. In Panel A, using the key firm characteristics used as control variables in our preliminary regression table as the variables for matching criteria, we observe that the interaction between EPS and measures of managerial ability is positive and significant.

Further, in Panel B, we employ an instrumental variable approach to deal with the issue of endogeneity. We use the average ability score of the city where a firm is headquartered to identify the first-stage equation. More availability of high-ability managers in the area surrounding the headquarters is likely to be related to a firm's ability to hire and retain high-ability managers but would not necessarily be related to a firm's earnings relevance. Since the interaction variable could also be endogenous because one of the terms is the measure of managerial ability, we also instrument the interaction variables. As shown in Panel B, the results suggest that our results persist with the instrumental variable approach.

VI. Channels

6.1 Corporate Governance

In the absence of strong corporate governance, the management can play an important role in the decision-making process of a firm. Thus, in Table 9, we empirically test our

second hypothesis that managerial ability would affect the value relevance of earnings to a greater extent in the absence of strong corporate governance. In Panel A of Table 9, we create our initial subsamples on the basis of corporate board busyness. First, we define a busy board as the fraction of directors involved with three or more boards. Then, we make an industry-year decile ranking and define the firm-years in the upper (lower) half of the decile ranking as "High" ("Low") busy board. Supporting our hypothesis, we find that the earnings relevance associated with higher managerial ability is significantly higher for firms with a very busy board than for firms with a relatively less busy board. In Panel B and Panel C of Table 9, we further use institutional ownership and anti-takeover defence as alternative measures of corporate governance. Similarly, we find that firms with better managerial ability demonstrate higher earnings relevance when the fraction of institutional ownership is low and when the anti-takeover defence is high.

Table 9 Corporate Governance

In Panel A, busy board refers to fraction of directors involved in three or more boards. Firm-years in the upper (lower) half of the industry-year decile ranking of busy boards comprise the "High" ("Low") busy board subsample. In Panel B, the "High" ("Low") institutional ownership subsample represents firm-years in the upper (lower) half of industry-year decile ranking of ownership. In Panel C, Gompers, Ishii, and Metrick's (2003) metric of governance index is used for anti-takeover defence. Firm-years in the upper (lower) half of the industry-year decile ranking of the governance index comprise the "High" ("Low") anti-takeover subsample. Firms in the upper (lower) half of the decile rankings of managerial ability fall into the High (Low) Ability group, whereas decile rankings for each industry for each year are based on Demerjian *et al.*'s (2012) rankings of the continuous measure of managerial ability, *MA_Score*. The dependent variable is the stock price three months after fiscal year end. *EPS* is earnings per share, calculated as income before extraordinary items (*IB*) divided by shares outstanding (*CSHO*) at the end of fiscal year *t*. Other variables included in each regression, but not reported in the table, are *BVPS*, which is book value per share calculated as book value of equity (*CEQ*) divided by shares outstanding at the end of fiscal year *t*; *Size*, which is the as natural logarithm of total assets (*AT*); *Leverage*, which is short-term debt (*DLC*) plus long-term debt (*DLTT*) divided by total assets; and *Loss*, which is an indicator variable for firm-years with negative *EPS*. Each regression model controls for both Fama-French 48 industry and year effects. Heteroskedasticity-robust standard errors are reported in parentheses.

Panel A: Busy board						
	Low			High		
	High Ability (1)	*Low Ability* (2)	*Differences* (1)−(2)	*High Ability* (3)	*Low Ability* (4)	*Differences* (3)−(4)
EPS	8.309***	6.498***	1.811*	9.013***	4.398***	4.075***
	(0.505)	(0.427)		(0.590)	(0.557)	
Adjusted R^2	64%	64%	0%	65%	69%	-4%
Obs	6,186	6,321		4,968	4,757	
Panel B: Institutional ownership						
	High			Low		
	High Ability (1)	*Low Ability* (2)	*Differences* (1)−(2)	*High Ability* (3)	*Low Ability* (4)	*Differences* (3)−(4)
EPS	7.691***	6.480***	1.211**	5.132***	3.145***	1.987***
	(0.323)	(0.298)		(0.191)	(0.163)	
Adjusted R^2	53%	58%	-5%	65%	62%	3%
Obs	17,082	14,834		18,805	20,785	

Panel C: Anti-takeover defence						
	Low			High		
	High Ability (1)	*Low Ability* (2)	*Differences* (1)−(2)	*High Ability* (3)	*Low Ability* (4)	*Differences* (3)−(4)
EPS	9.037***	5.522***	3.515**	9.594***	5.279***	4.315***
	(0.677)	(0.573)		(0.763)	(0.706)	
Adjusted R^2	56%	63%	-7%	60%	67%	-7%
Obs	5,238	4,555		4,356	3,550	

*, **, and *** indicates statistical significance at the 10%, 5%, and 1% level, respectively. The statistical significance of differences in the coefficients are based on the Chi-squared test.

6.2 Product Market Power

Firms operating in competitive industries where managers have little discretion cannot create as much value from superior managerial practices as firms that operate in less competitive industries. In other words, in a competitive industry, managers have little control over market pricing and operate with a limited opportunity to increase profitability. On the other hand, managers in firms with greater market power can exercise a significant influence on the pricing and quality of products. In such a condition, managers with more flexibility in terms of operating environments can create more value given better management practices. Prior evidence suggests that firms with product market power can have higher and more stable profitability (e.g. Peress, 2010; Irvine and Pontiff, 2009). Moreover, market power allows firms to become involved in risky ventures (e.g. Hoberg *et al.*, 2014).

Therefore, we can argue that better managerial ability would be more useful for firms that have greater market power. To test this prediction, we use the methodology of Peress (2010) to measure the market power of each sample firm. This measure captures the price-cost margin, which is calculated as follows:

$$PCM_{jt} = \left[S_{jt} - COGS_{jt} - XSGA_{jt}\right)/S_{jt}] - \sum_{j=1}^{N} \frac{S_{jt}}{\sum_{j=1}^{N} S_{jt}} [(S_{jt} - COGS_{jt} - XSGA_{jt})/S_{jt}, \quad (6)$$

where $PCM_{jt}$is the price-cost margin of firm j in year t, S_{jt} is total sales, $COGS_{jt}$ denotes the cost of goods sold, and $XSGA_{jt}$ is selling, general, and administration expenses. In the above equation, the second term shows the sales-weighted industry average of the price-cost margin. A higher value of the price-cost margin of a firm implies that the firm has greater market power.

Table 10 shows the results. We find that for the case of the subsample of firms with high market power, the EPS coefficient of the firms with "High" management ability is considerably higher than the firms with "Low" management ability. The difference in EPS coefficients between "High" versus "Low" management ability is statistically significant at the 1% level. But, for the case of firms with low market power, we do not find any statistically

significant differences in the EPS coefficients between the two management capacity groups. The results imply that management capacity becomes crucial when firms have market power.

Table 10: Market Pricing Power

Following Peress (2010), market pricing power, as the price-cost margin, is calculated as follows:

$$\boldsymbol{PCM_{jt}} = [(\boldsymbol{S_{jt}} - \boldsymbol{COGS_{jt}} - \boldsymbol{XSGA_{jt}})/\boldsymbol{S_{jt}}] - \sum_{j=1}^{N} \frac{\boldsymbol{S_{jt}}}{\sum_{j=1}^{N} \boldsymbol{S_{jt}}} [(\boldsymbol{S_{jt}} - \boldsymbol{COGS_{jt}} - \boldsymbol{XSGA_{jt}})/\boldsymbol{S_{jt}},$$

where $\boldsymbol{S_{jt}}$ is firm *j*'s total sales in year *t*, $\boldsymbol{COGS_{jt}}$ is cost of goods sold, and $\boldsymbol{XSGA_{jt}}$ is selling, general, and administrative expenses. The second term of the above equation is the sales weighted average of the price-cost margin within a particular Fama-French 48 industry. The "High" ("Low") pricing power subsample represents firm-years in the upper (lower) half of the industry-year decile ranking of price-cost margin. Firms in the upper (lower) half of the decile rankings of managerial ability fall into the High (Low) Ability group; the decile rankings for each industry for each year are based on Demerjian *et al.*'s (2012) rankings of the continuous measure of managerial ability, *MA_Score.* The dependent variable is the stock price three months after fiscal year end. *EPS* is earnings per share, calculated as income before extraordinary items (*IB*) divided by shares outstanding (*CSHO*) at the end of fiscal year t. Other variables included in each regression, but not reported in the table, are *BVPS*, which is book value per share calculated as book value of equity (*CEQ*) divided by shares outstanding at the end of fiscal year t; *Size,* which is the natural logarithm of total assets (*AT*); *Leverage,* which is short-term debt (*DLC*) plus long-term debt (*DLTT*) divided by total assets; and *Loss,* which is an indicator variable for firm-years with negative *EPS*. Each regression model controls for both Fama-French 48 industry and year effects. Heteroskedasticity-robust standard errors are reported in parentheses.

	High Pricing Power			Low Pricing Power		
	High Ability (1)	*Low Ability* (2)	*Differences* (1)−(2)	*High Ability* (3)	*Low Ability* (4)	*Differences* (3)−(4)
EPS	6.905***	5.693***	1.212***	3.539***	2.990***	0.549
	(0.187)	(0.202)		(0.162)	(0.142)	
Adjusted R^2	61%	63%	-2%	69%	60%	9%
Obs	35,770	6,321		26,874	36,550	

*, **, and *** indicates statistical significance at the 10%, 5%, and 1% level, respectively. The statistical significance of differences in the coefficients is based on the Chi-squared test.

VII. Conclusion

In this paper, we examine the association between managerial ability and the value relevance of earnings. Prior research both theoretically and empirically argues that managerial ability is an intangible asset for the value creation process of a company. On the other hand, literature also suggests that better managers might use their knowledge and skill to exploit shareholders. Thus, how management quality might affect earnings relevance is an empirical question.

Using the measure of managerial ability developed by Demerjian *et al.* (2012), we find that earnings are more value relevant for firms run by high-ability managers. In further tests, we rule out the possibility that issues such as earnings quality, accounting conservatism, and investment efficiency drive our results. We attempt to mitigate concerns about endogeneity in our regression by using propensity score matching and the instrumental variable approach. We also employ an identification strategy by using a CEO turnover sample and examine

what happens to value relevance when firms hire more able CEOs. We find that replacing old CEOs with more talented CEOs significantly increases the value relevance of accounting information. We find that two important channels, weak corporate governance and strong product market power, can significantly increase the effect of the positive role of managerial ability on the value relevance of earnings. Overall, our results indicate that better management capacity plays an important role in improving the information environment by making accounting measures more informative. Our findings have important implications for investors and managerial labour markets.

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Appendix Table 1: Correlation Matrix

This table reports Pearson correlations for the variables representing key firm characteristics and the measure of managerial ability. *Price* is the stock price three months after fiscal year end. *BVPS* is the book value per share, calculated as book value of equity (*CEQ*) divided by shares outstanding (*CSHO*) at the end of fiscal year t. *EPS* is earnings per share, calculated as income before extraordinary items (*IB*) divided by shares outstanding at the end of fiscal year t. *Total Assets* is the total assets (*AT*) in millions of dollars. *M/B* is the ratio of market value of equity to book value of equity, whereas market value of equity is the stock price at the end of the fiscal year multiplied by total number of shares outstanding. *MV* is the market value of equity; *Leverage* is short-term debt (*DLC*) plus long-term debt (*DLTT*) divided by total assets; *Loss* is an indicator variable for firm-years with negative *EPS*; and *MA_Score* is the measure of managerial ability provided by Demerjian *et al.* (2012).

	Price	*BVPS*	*EPS*	*Total Assets*	*M/B*	*MV*	*Leverage*	*Loss*	*MA_Score*
Price	1								
BVPS	0.671***	1							
EPS	0.610***	0.575***	1						
Total Assets	0.362***	0.330***	0.241***	1					
M/B	0.007***	-0.011***	-0.001	0.000	1				
MV	0.474***	0.233***	0.271***	0.699***	0.007**	1			
Leverage	-0.019***	-0.019***	-0.012	-0.002	-0.001	-0.005*	1		
Loss	-0.419***	-0.390***	-0.652***	-0.128***	0.001	-0.158***	0.026***	1	
MA_Score	0.162***	0.066***	0.250***	0.021***	0.004	0.072***	0.011***	-0.261***	1

*, **, and *** indicate statistical significance at 10%, 5%, and 1% level, respectively.

Appendix Table 2: Alternative Measures of Managerial Ability

The table reports the results of OLS regressions in observing the effects of alternative measures of managerial ability on the earnings relevance of the sample firms. The dependent variable is the stock price three months after fiscal year end. *EPS* is earnings per share, calculated as income before extraordinary items (*IB*) divided by shares outstanding (*CSHO*) at the end of fiscal year t. *MQF* is the management quality factor, obtained from Chemmanur *et al.* (2019), as a measure of top management quality. *CEO_CITE_RANK* is the industry-year decile rank of CEO media citations from year *t* to *t-4*. Similarly, *CFO_CITE_RANK* is the industry-year decile rank of CFO media citations from year *t* to *t-4*. *HISTORICAL_RET_RANK* is the industry-year decile ranking of historical return, which is the five-year (*t-5* to *t-1*) value-weighted industry-adjusted return. Other variables included in each regression, but not reported in the table, are *BVPS,* which is book value per share calculated as book value of equity (*CEQ*) divided by shares outstanding at the end of fiscal year t; *Size,* which is the as natural logarithm of total assets (*AT*); *Leverage,* which is short-term debt (*DLC*) plus long-term debt (*DLTT*) divided by total assets; and *Loss,* which is an indicator variable for firm-years with negative *EPS.* Each regression model controls for both Fama-French 48 industry and year effects. Heteroskedasticity-robust standard errors are reported in parentheses.

	(1)	(2)	(3)	(4)
EPS	7.303***	10.689***	10.562***	3.626***
	(0.346)	(0.610)	(0.722)	(0.169)
MQF	0.044			
	(0.077)			
*EPS*MQF*	0.233***			
	(0.070)			
CEO_CITE_RANK		-0.141***		
		(0.053)		
*EPS*CEO_CITE_RANK*		0.071*		
		(0.037)		
CFO_CITE_RANK			-0.074	
			(0.059)	
*EPS*CFO_CITE_RANK*			0.085**	
			(0.043)	
HISTORICAL_RET_RANK				0.707***
				(0.013)
*EPS*HISTORICAL_RET_RANK*				0.160***
				(0.013)
Adjusted R^2	0.674	0.656	0.665	0.702
Obs	27,199	8,445	5,471	75,960

*, **, and *** indicates statistical significance at the 10%, 5%, and 1% level, respectively.

Appendix Table 3: Management Consistency

The table reports the results of OLS regressions in observing the effects of managerial ability on the earnings relevance of the sample firms. The dependent variable is the stock price three months after fiscal year end. *EPS* is earnings per share, calculated as income before extraordinary items (IB) divided by shares outstanding (CSHO) at the end of fiscal year t. *CONSISTENT_ABILITY5* and *CONSISTENT_ABILITY3* are dummy variables that equal one if a firm-year's *MA_Score* is greater than that of the industry-year median in each of last five and three years, respectively. *MA_Score* is the measure of managerial ability provided by Demerjian *et al.* (2012). Other variables included in each regression, but not reported in the table, are *BVPS,* which is book value per share calculated as book value of equity (CEQ) divided by shares outstanding at the end of fiscal year t; *Size,* which is the as natural logarithm of total assets (AT); *Leverage,* which is short-term debt (DLC) plus long-term debt (DLTT) divided by total assets; and *Loss,* which is an indicator variable for firm-years with negative *EPS.* Each regression model controls for both Fama-French 48 industry and year effects. Heteroskedasticity-robust standard errors are reported in parentheses.

	(1)	(3)
EPS	4.627***	4.702***
	(0.137)	(0.140)
CONSISTENT_ABILITY5	0.253***	
	(0.014)	
*EPS*CONSISTENT_ABILITY5*	0.216***	
	(0.014)	
CONSISTENT_ABILITY3		0.489***
		(0.020)
*EPS*CONSISTENT_ABILITY3*		0.226***
		(0.022)
Adjusted R^2	0.661	0.661
Obs	127,597	127,597

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.