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Managerial ability, investment efficiency and stock price crash risk

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ABSTRACT

We examine empirically the effect of managerial ability on firm-level investment efficiency and how this affects future stock price crash risk. Using a managerial ability measure developed by Demerjian et al. (2012), the paper documents consistent evidence that the more able managers over-invest compared to their not-so-able counterparts, even after controlling for the effects of financial reporting quality and other firm specific determinants of investment efficiency. This evidence is robust to alternative proxies for investment efficiency. The empirical evidence also suggests that crash risk increases for firms with more able managers, primarily through the investment inefficiency channel. Overall, the study contributes to a better understanding of the influence of managerial ability on investment decisions in the context of diverging opinions regarding manager-specific effects on organizational outcomes.

1. Introduction

We examine empirically the effect of managerial ability on firm-level investment efficiency and how this affects future stock price crash risk. Our study is motivated by the desire for a better assessment of the management's impact on investment decisions and on stock price crash risk: an outcome of direct economic consequence for investors. According to the optimal investment argument proposed in the neo-classical framework, managers should continue investing until the marginal benefit of capital investment equals marginal costs. This proposition, however, is based on the assumption of no friction in the capital markets, i.e. managers obtain financing for positive net present value projects (NPVs) at the prevailing economy-wide interest rate and return excess cash to investors (e.g., Abel 1983; Hayashi, 1982; Yoshikawa, 1980). However, the agency theory view suggests that managerial self-interest might produce sub-optimal investment decisions resulting in both over- or under-investment. For example, both moral hazard and adverse selection imperfections inherent in the information asymmetry between managers and outside suppliers of capital, can adversely affect investment efficiency.

Managers intending to maximize their personal welfares are sometimes inclined to make investments that are not in the best interests of shareholders (Berle and Means, 1932; Jensen and Meckling, 1976; Jensen, 1986). Since there is divergence of incentives between mangers and investors, models of moral hazard suggest that managers will invest in negative NPVs. Models of adverse selection, on the other hand, suggest that if managers are better informed than investors about a firm's prospects, they will try to time capital issuances to sell overpriced securities (i.e. a 'lemons' problem). If they are successful, they may over-invest these proceeds (e.g., Baker et al., 2003).

Since inefficient investment increases agency costs, it is important to understand the impact of various mechanisms for constraining such investments. We examine managerial ability as one such mechanism. Our interest in investigating managerial ability stems from ongoing debate as to whether top executives (CEOs in particular) matter. Proponents of the 'CEOs matter' hypothesis

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argue that top leaders, headed by the CEO, devise strategies that unites participants in an organization and decide on the organization's course of action, e.g., formulating and executing value-creating investment decisions in the face of rapid technological and environmental change (Mackey, 2008). Barney (1991) argue that a manager's ability to understand and effectively use firm resources is itself a valuable resource that 'has the potential for generating sustained competitive advantages' for a firm (Barney, 1991, p. 117). Bertrand and Schoar (2003) find that managers have an effect on firm choices, such as acquisitions or research and development expenditures. Dejong and Ling (2013) document that managerial expansion strategies, whether involving internal investment or external acquisitions, tend to have lower accounting accruals. Bamber et al. (2010) and Francis et al. (2008) provide evidence supporting the presence of manager-specific traits.

Opponents of this view, in contrast, argue that CEOs are so constrained by their environment that they have little ability to affect company performance. For instance, a company's culture, the structure of its industry, and its fixed assets are all constraining factors that reduce the CEOs ability to take actions that will have an impact on the company. Lieberson and O'Connor (1972) find that CEO ability explains only about 6.5% to 14.5% of the variation in firm performance: much lower than the variation explained by industry and firm factors.

Following Francis et al. (2008) we consider two mutually exclusive arguments for an association between managerial ability and investment efficiency. First, from an "efficient contracting" perspective, we would expect the more able managers to invest more efficiently compared to their less able counterparts. More able managers are better able to gauge the timing and economic returns from investment, as well as to synthesize information into reliable, forward-looking estimates of the risks and returns associated with corporate investment (Demerjian et al., 2013). Managers with high abilities may obtain more precise information on investment opportunities, thereby making better investment choices with a greater likelihood of successful project outcomes (Chemmanur et al., 2009). Trueman (1986) demonstrates analytically that more able managers are more likely to signal positively about the firm's value compared to their less able counterparts through forecast disclosures. Trueman (1986) argues that such disclosures will favorably impact investors' perceptions of his ability to predict future changes in the firm's economic environment and adjust the firm's production plan accordingly. In contrast, the "rent extraction" perspective argues that more able managers overemphasize their personal career enhancement and, in so doing, take actions that may worsen agency costs. For example, more able managers may be overconfident and, thus, overestimate the return payoffs from corporate investment. Empirical evidence reveals that managerial overconfidence can lead to distortions in corporate investment decisions (Huang et al., 2011; Lin et al., 2005; Malmendier and Tate, 2005), and result in value-destroying mergers (Malmendier and Tate, 2008).

We then examine the association between investment efficiency and future stock price crash risk conditional on managerial ability. Conceptually, crash risk is premised on the notion that managers have a tendency to withhold bad news for an extended period of time, allowing bad news to stockpile. When the accumulation of bad news passes a threshold, it is revealed to the market at once, leading to a large negative drop in price for the stock (Jin and Myers, 2006). Some of the determinants of crash risk include poor quality financial reporting (Hutton et al., 2009); auditor-provided tax services and associated earnings manipulation (Habib and Hasan, 2016); tax avoidance (Kim et al., 2011a); and CEO equity incentives (Kim et al., 2011b).

We expect that managerial incentives to overinvest or to keep bad projects alive motivate managers to withhold bad news: a catalyst for price crash. Bleck and Liu (2007) argue that accounting system for recording unprofitable projects at historical costs instead of fair values, allows managers to bypass the recording of loss from poor investments. By allowing managers to conceal poor performances of these bad projects, negative NPV investments increases price crash. However, whether this line of reasoning will be applicable for more able managers depend on the competing arguments of 'efficient contracting' versus 'rent extraction'. In the former case we expect the crash risk will be lower for firms with more able managers because of their incentives to invest in positive NPV projects. Rent extraction, on the other hand, increases crash risk because more able managers make poor investments, hide bad news for an extended period, which leads to price crash.

Using a managerial ability measure developed by Demerjian et al., 2012,[1] we document some interesting findings. First, we find consistent evidence that more able managers over-invest compared to their less-able counterparts, even after controlling for the effects of financial reporting quality and a set of control variables documented in prior literature as determinants of investment efficiency. Second, we document that crash risk increases for firms with more able managers, through the investment inefficiency channel, thus supporting the 'rent extraction' theory.

Our study contributes to the existing literature in a number of ways. First, by documenting an association between managerial ability and investment efficiency, we enrich the emerging literature on managerial ability. However, unlike other studies that examine managerial ability on financial reporting outcomes (Demerjian et al., 2013; Francis et al., 2008), we provide evidence of a real effect of managerial ability. Second, we extend the literature on the determinants of investment efficiency by incorporating a human side into the equation. Prior literature has primarily investigated firm-specific financial determinants, e.g. size, capital structure, *CAPEX*, cash holding and so on. This finding will be of interest to stakeholders who would like to evaluate the role of management skills: managerial ability in this case; as a potential determinant of firm-level investment efficiency. Finally, we contribute to the burgeoning literature on crash risk (Habib et al., 2017 forthcoming) by documenting an hitherto unexplored determinant of crash, investment efficiency and importantly, how managerial ability moderates the association between the two.

[1] We measure ability using the managerial ability score developed in Demerjian et al. (2012) which is publicly available at http://faculty.washington.edu/smcvay/abilitydata.html. Demerjian et al. (2012) employ data envelopment analysis (DEA] to measure managerial ability based on managers' efficiency, relative to their industry peers, in transforming resources to revenues. They consider a large array of revenue-generating resources and argue that more able managers better understand technology and industry demands and predict product demand, invest in value-creating projects, and manage their employees more efficiently compared to their less able counterparts. These attributes would enable more able managers to generate higher revenue for a given level of resources than less able managers.

2. Prior literature and development of hypotheses

Although managerial ability is central to the understanding of managerial contributions to firm performance and investment decisions, executive compensation, and corporate governance; there remains a divergence of opinion regarding manager-specific effects on different organizational outcomes. Where the impact of firm management is concerned, mainstream Economics and Finance research has largely followed the neoclassical paradigm, which leaves only limited role for manager idiosyncrasies (Berk and Stanton, 2007). The agency theory view, too, posits that individuals are more or less homogeneous and merely react rationally to the regulations and incentives that surround them. The management literature, on the other hand, has long emphasized the importance of managers for the outcomes achieved by the enterprise. One theoretical approach that has formalized reasons for the pervasiveness of management factors in driving success is summarized by Hambrick's (2007) and Hambrick and Mason's (1984) upper echelons theory. This theory predicts that the complexity of actual decision making situations necessitates an idiosyncratic importance of the top management team.

Early research on the CEO effect attributed firm performance to firm and industry factors rather than to CEO ability. For example, Lieberson and O'Connor (1972) find that CEO ability explains only about 6.5% to 14.5% of the variation in firm performance: much lower than the variation explained by industry and firm factors. However, Wasserman et al. (2010) find that CEOs have the most significant impact where opportunities are scarce or where CEOs have slack resources. Mackey (2008) provides robust evidence in support of the 'CEO matters' hypothesis by documenting a much stronger CEO impact at the corporate level.

Several prior studies measure managerial ability using DEA and examine consumer goods in the mature stage of the product life cycle (Murthi et al., 1996), the incidence of corporate bankruptcies (Barr and Siems, 1997; Leverty and Grace, 2012) as well as the effect of fund managers on mutual fund industries (Murthi et al., 1997). Other studies use broader, but potentially less precise, measures of ability. For example, Fee and Hadlock (2003) and Rajgopal et al. (2006) use prior industry-adjusted stock returns as a proxy for managerial ability and find that talented managers enjoy more employment opportunities. Milbourn (2003), too, uses prior industry-adjusted stock returns along with CEO tenure and prior media citations, and documents that more able managers have higher pay-for-performance sensitivities. Bertrand and Schoar (2003) find that managerial style affects the corporate policy decisions and is reflected in their compensation levels. Malmendier and Tate (2009) find significant underperformance in stock returns, higher executive compensation, and higher earnings management after CEOs are recognized as "superstars" by the media. Some studies consider managerial overconfidence as a plausible explanation for corporate outcomes. For example, Malmendier and Tate (2005, 2008) find that overconfident managers are more likely to overinvest because of overestimation of payoffs from investment projects.

Identifying a reliable proxy for managerial ability is complex simply because " *a CEO's reputational assessment is realistically multidimensional, encompassing perceived competence at the task, credibility, charisma, integrity, honesty, and vision, among other attributes that are typically difficult to quantify*" (Francis et al., 2008, p. 114). Prior literature has used media citations and industry-adjusted returns as indirect proxies for managerial ability. These indirect proxies have however been subjected to criticisms, as they may encompass information above and beyond management's control. Demerjian et al. (2012) attempt to develop a more direct proxy for managerial ability by using financial statement information and employing DEA to construct a firm efficiency measure. Since this measure consists of both manager-specific and other firm-specific characteristics, they purge out the firm-specific effect to construct a managerial ability score (the residual component). Recent studies used this managerial ability score to investigate the effect of ability on management earnings forecasts (Baik et al., 2011); on earnings quality proxied by accounting restatements, earnings persistence and accruals quality (Demerjian et al., 2013); and on corporate tax avoidance (Francis et al., 2013). Francis et al. (2013) argue that more able managers spend more effort in normal business operations than in tax avoidance activities, given the significant costs associated with tax avoidance.

In contrast to the aforementioned studies that examine managerial ability primarily on financial reporting outcomes, we investigate its effect on real economic decisions by exploring the association between managerial ability and investment efficiency. In so doing we first introduce the theoretical underpinnings for non-optimal investment and then use two mutually exclusive perspectives (i.e. efficient contracting and rent extraction) to predict the likely association between managerial ability and investment efficiency. According to the optimal investment argument proposed in the neo-classical framework, managers should continue investing until the marginal benefit of capital investment equals the marginal costs (e.g., Abel, 1983; Hayashi, 1982; Yoshikawa, 1980). However, the agency perspective (Jensen and Meckling, 1976) and the information asymmetry perspective (Myers and Majluf, 1984) provide arguments for investment distortion. For example, the agency view proposes that managers over-invest in order to reap private benefits such as "perks," large empires, and entrenchment. Whether able managers with superior skill in foreseeing future growth and product demand will be subject to investment distortions depends on the their incentives.

We consider two mutually exclusive theories to link managerial ability with investment efficiency. First, from an "efficient contracting" perspective we would expect more able managers to make more efficient investments compared to their less able counterparts. Talented managers are better able to gauge the timing and economic returns from investment, and better able to synthesize information into reliable forward-looking estimates regarding the risks and returns associated with corporate investment (Demerjian et al., 2012). In contrast, the "rent extraction" perspective argues that reputed CEOs overemphasize their personal career enhancement and, in so doing, take actions that may worsen agency costs. For example, very able managers may also be overconfident and, thus, overestimate the return payoffs from corporate investment. Empirical evidence reveals that managerial overconfidence can lead to distortions in corporate investment decisions (Huang et al., 2011; Lin et al., 2005; Malmendier and Tate, 2005), and result in value-destroying mergers (Malmendier and Tate, 2008). The following hypotheses are developed to test these competing arguments:

H1A. Under the ‘efficient contracting hypothesis’, more able managers will deviate less from the expected investment level than less able managers.

H1B. Under the ‘rent extraction hypothesis’, more able managers will deviate from the expected investment level more than less able managers.

Next we develop the set of hypotheses on how investment efficiency impacts crash risk and whether such an association is moderated by managerial ability. Crash risk occurs because managers have a tendency to withhold bad news for an extended period (Kothari et al., 2009), allowing bad news to stockpile. When the accumulation of bad news passes a threshold, it is revealed to the market at once, leading to a large negative drop in price for the stock (Jin and Myers, 2006). We argue that efficient (inefficient) investments reduce (increase) price crash. Recent studies investigate whether managerial tendency to overinvest or to keep bad projects alive for a long period increases price crash. Benmelech et al. (2010) show that although stock-based compensation schemes granted to executives encourage them to take risk, such schemes also induce them to conceal bad news emanating from sub-optimal investment policies to support the pretense of high growth. Thus, bad news emanating from and bad investments accumulate over time and subsequently lead to price crashes. Bleck and Liu (2007) argue that historical cost accounting enables managers to hide bad news about unprofitable projects. In case of fair value accounting, managers have to record losses from unprofitable projects as the market value of the bad investments are lower than their historical costs. The poor performances of these bad projects thus accumulate courtesy of historical cost accounting and consequently increase stock price crash risk. However, accounting conservatism, by accelerating the disclosure of bad news, curtails their tendencies to overinvest and to delay the termination of negative NPV projects. Kim and Zhang (2015) find support for this hypothesis.

If managerial ability is associated with efficient contracting then we should expect a negative association between ability and crash risk because of their incentives to invest in value-creating investments. Inefficient investments by more able managers will have a more adverse impact on their human capital compared to their not-so-able counterparts. Furthermore, considering prior evidence that value-enhancing investment projects reduces the cost of capital (Francis et al., 2005; Francis et al., 2004), inefficient investments by reputable CEOs will be penalized more severely in terms of a higher cost of equity capital, as markets will generally be expecting investments in positive NPV projects from talented CEOs. Taken together, from an efficient contracting perspective, investments in positive NPV projects and early disclosure of good news will reduce crash risk. On the other hand, the rent extraction hypothesis would suggest the opposite. This perspective argues that an emphasis on career enhancement and celebrity status motivates reputable CEOs to invest in risky projects. Since poor performance gives rise to accumulation of bad news, crash risk eventually accentuates when accumulated bad news is released all at once in the market. We therefore develop the following hypotheses:

H2A. Under the efficient contracting hypothesis, more able managers will undertake efficient investments which will decrease crash risk by dampening the incentives for bad news hoarding.

H2B. Under the rent extraction hypothesis, more able managers will make inefficient investments which will increase crash risk by accentuating the incentives for bad news hoarding.

3. Research design issues

3.1. *Investment efficiency*

Given our inability to observe firms’ investment opportunities and its decisions concerning investment opportunities directly, we define *normal* or *expected* investment levels operationally in order to determine the level of investment expected by the *normal* firm. Assuming that the average firm makes efficient investments in order to survive in a competitive environment, a firm could be viewed as investing inefficiently if its actual investment level deviates from that expected. We measure investment efficiency as the deviation from the expected investment level using the following model that predicts investment as a function of growth opportunities (Hubbard, 1998). Eq. (1) is estimated for each industry-year based on the Fama and French 48-industry classification for all available industries with at least 20 observations in a given year.

$$INV_{i,t} = \gamma_0 + \gamma_1 REVGROW_{i,t-1} + \varepsilon_{i,t} \tag{1}$$

Where *INV* is aggregate investment and *REVGROW* is the annual revenue growth rate for firm i in year t-1. We define *INV* as the sum of capital expenditure, acquisition expenditure, research and development expenditure less cash receipts from sale of property, plant, and equipment and scaled by lagged total assets. The residuals from the above model is our proxy for investment efficiency and we denote this as *INVEFF_1*. Firm-year observations with positive residuals from Eq. (1) are classified as over-investing (*OINV_1*), firm-year observations with negative residuals are classified as under-investing (*UINV_1*). We multiply *UINV_1* by minus −1 for the ease of interpretation.

We also use an expanded version of Eq. (1) whereby we estimate the following model incorporating the differential predictability for revenue increases and revenue decreases in order to determine the magnitude of over (under)-investment (Eberly, 1997; McNichols and Stubben, 2008; Chen et al., 2011).

$$INV_{i,t} = \gamma_0 + \gamma_1 NEG_{i,t-1} + \gamma_2 REVGROW_{i,t-1} + \gamma_3 NEG^{*}REVGROW_{i,t-1} + \varepsilon_{i,t} \tag{1a}$$

The indicator variable $NEG_{i,t-1}$ is coded 1 for negative revenue growth, and 0 otherwise. The residuals from the above model is denoted as *INVEFF_2*. Firm-year observations with positive residuals from Eq. (1a) are classified as over-investing (*OINV_2*), firm-year observations with negative residuals are classified as under-investing (*UINV_2*). Similar to *UINV_1* above, we multiply *UINV_2* by minus −1 for the ease of interpretation.

3.2. Managerial ability

Identifying a reliable proxy for managerial ability is complex as manager's reputational assessment is multidimensional. Prior literature has used media citations and industry-adjusted returns as indirect proxies for managerial ability (Milbourn, 2003; Rajgopal et al., 2006). These indirect proxies have, however, been subjected to criticisms as, e.g. prior abnormal stock returns, encompass information above and beyond management's control. Demerjian et al. (2012) used DEA to evaluate the relative efficiency of certain inputs (labor, capital, etc.) into outputs (revenue, income, etc). The following inputs into the revenue production process have been considered: Net PP & E; Net Operating Leases; Net R & D; Purchased Goodwill; Other Intangible Assets; Cost of Inventory; and SG & A Expenses. All these inputs contribute to the generation of revenue and are affected by managerial ability, as each of the inputs is subject to managerial discretion. Using an optimization procedure incorporating these variables, the authors calculated firm efficiency, and then regressed it on six firm characteristics that affect firm efficiency: firm size, firm market share, cash availability, life cycle, operational complexity, and foreign operations. The residual term derived from this regression is the component reflecting managerial ability.[2]

3.3. Stock price crash risk

In this study two measures of firm-specific crash risk are used, consistent with Chen et al. (2001). Both measures are based on the firm-specific weekly returns estimated as the residuals from the market model. This ensures that our crash risk measures reflect firm-specific factors rather than broad market movements. Specifically, we estimate the following expanded market model regression:

$$r_{j,\tau} = \alpha_j + \beta_{1,j}\ r_{m,\tau-2} + \beta_{2,j}\ r_{m,\tau-1} + \beta_{3,j}\ r_{m,\tau} + \beta_{4,j}\ r_{m,\tau+1} + \beta_{5,j}\ r_{m,\tau+2} + \varepsilon_{j,\tau} \tag{2}$$

where $r_{j,\tau}$ is the return of firm *j* in week τ, and $r_{m,\tau}$ is the return on CRSP value-weighted market return in week τ. The lead and lag terms for the market index return are included, to allow for non-synchronous trading (Dimson 1979). The firm-specific weekly return for firm *j* in week τ ($W_{j,\tau}$) is calculated as the natural logarithm of one, plus the residual return from Eq. (1) above. In estimating Eq. (1), each firm-year is required to have at least 26 weekly stock returns. Our first measure of crash risk is the negative conditional skewness of firm-specific weekly returns over the fiscal year (*NCSKEW*). *NCSKEW* is calculated by taking the negative of the third moment of firm-specific weekly returns for each year, and normalizing it by the standard deviation of firm-specific weekly returns raised to the third power. Specifically, for each firm *j* in year τ, *NCSKEW* is calculated as:

$$NCSKEW = -\left[n(n-1)^{3/2}\sum w^3{}_{j,\tau}\right] / \left[(n-1)(n-2)\left(\sum w^2{}_{j,r}\right)^{3/2}\right] \tag{3}$$

Our second measure of crash risk is the down-to-up volatility measure (*DUVOL*) of the crash likelihood. For each firm *j* over a fiscal-year period τ, firm-specific weekly returns are separated into two groups: "down" weeks when the returns are below the annual mean, and "up" weeks when the returns are above the annual mean. The standard deviation of firm-specific weekly returns is calculated separately for each of these two groups. *DUVOL* is the natural logarithm of the ratio of the standard deviation in the "down" weeks to the standard deviation in the "up" weeks:

$$DUVOL_{j,\tau} = \log\{(n_u - 1)\sum_{Down} w^2{}_{j,\tau}/(n_d - 1)\sum_{Up} w^2{}_{j,\tau}\} \tag{4}$$

A higher value of *DUVOL* indicates greater crash risk. As suggested in Chen et al. (2001), *DUVOL* does not involve third moments and, hence, is less likely to be overly influenced by extreme weekly returns.

3.4. Empirical model

We estimate the following regression equation to examine **H1:**

$$\begin{aligned} |INVEFF_{i,t}| &= \gamma_0 + \gamma_1 ABILITY_{t-1} + \gamma_2 EQ_{t-1} + \gamma_3 SIZE_{t-1} + \gamma_4 MTB_{t-1} + \gamma_5 KSTRUCTURE_{t-1} + \gamma_6 OPCYCLE_{t-1} \\ &+ \gamma_7 ZSCORE_{t-1} + \gamma_8 ROA_{t-1} + \gamma_9 DIV_{t-1} + \gamma_{10} CFOSALES_{t-1} + \gamma_{11} ATO_{t-1} + \gamma_{12} AGE_{t-1} + \\ &\gamma_{13} TANGIB_{t-1} + \gamma_{14} SLACK_{t-1} + \gamma_{15} LOSS_{t-1} + \varepsilon \end{aligned} \tag{5}$$

We estimate Eq. (5) for both the |*INVEFF_1*| and |*INVEFF_2*| measuresd as well as the respective *OINV* and *UINV* measures. *ABILITY* is managerial ability proxied by the Demerjian et al. (2012) measure; *EQ* is financial reporting quality proxied by abnormal accruals models. We estimate performance-matched discretionary accruals following the model developed by Kothari et al. (2005). Specifically, we estimate the following model for all firms in the same industry (two-digit SIC code) with at least ten observations in

[2] For a detailed exposition to the measurement of managerial talent using DEA, please refer to Demerjian et al. (2012, pp. 1235–1238).

an industry in a particular year.

$$ACC_t/TA_{t-1} = \gamma_0(1/TA_{t-1}) + \gamma_1[(\Delta SALES_t - \Delta RECEIVABLE_t)/TA_{t-1}] + \gamma_2(PPE_t/TA_{t-1}) + \gamma_3(ROA_{t-1}) + \varepsilon_t \quad (6)$$

where *ACC* is total accruals calculated as earnings before extraordinary items and discontinued operations minus operating cash flows; *TA* is total assets in year t-1; Δ*SALES* is change in sales from year t-1 to year t; *ΔRECEIVABLE* is change in accounts receivable from year t-1 to year t; *PPE* is gross property plant & equipment; *ROA* is the prior year's return-on-assets measured as earnings before extraordinary items and discontinued operations divided by total assets for the previous year. The coefficient estimates from Eq. (2) are used to estimate the non-discretionary component of total accruals (*NDAC*) for our sample firms. The discretionary accruals is then the residual from Eq. (6), i.e. *DAC* = *ACC-NDAC*. We take the absolute value of residual from the above regression as our earnings quality proxy. We multiply this by −1 so that higher values of *DAC* represent higher earnings quality. We denote this accruals quality measure as *EQ*.

SIZE is natural log of total assets; *MTB* is market-to-book ratio; *KSTRUCTURE* is firm-level capital structure computed as the ratio of long-term debt to the sum of long-term debt and the market value of equity; *OPCYCLE* is a measure of the operating cycle of the firm; Z-*SCORE* is a measure of distress computed following the methodology in Altman (1968); *ROA* is return on assets; *DIV* is an indicator variable that takes the value of one if the firm paid a dividend; *CFO_SALES* is the ratio of *CFO* to sales; *ATO* is asset turnover computed as sales divided total assets; *AGE* is the difference between the first year when the firm appears in CRSP and the current year; *TANGIB* is the ratio of *PPE* to total assets; *SLACK* is the ratio of cash to PPE; and *LOSS* is an indicator variable that takes the value of one if net income before extraordinary items is negative, zero otherwise.

If the efficient contracting (rent extraction) hypothesis holds then the coefficient on both over- and under-investment will be significantly negative (positive). We estimate the following regression specification to examine H2:

$$CRASH_{i,t} = \gamma_0 + \gamma_1 CRASH_{t-1} + \gamma_2 INV_{t-1} + \gamma_3 TURN_{t-1} + \gamma_4 RET_{t-1} + \gamma_5 SDRET_{t-1} + \gamma_6 SIZE_{t-1} + \gamma_7 MTB_{t-1} + \gamma_8 LEV_{t-1} + \gamma_9 ROA_{t-1} + \gamma_{10}|EQ_{t-1}|\varepsilon_{i,t} \quad (7)$$

CRASH risk is proxied by *NCSKEW* and *DUVOL* measures following Eqs. (3) and (4) above. The independent variables are calculated using data from the preceding year, consistent with the crash risk literature. We first control for the lag value of *CRASH* to account for the potential serial correlation of *NCSKEW* or *DUVOL* for the sample firms. Inclusion of the control variables follows prior literature on the determinants of crash risk. *TURN* is the average monthly share turnover for the current fiscal year minus the average monthly share turnover for the previous fiscal year, where monthly share turnover is calculated as the monthly trading volume divided by the total number of shares outstanding during the month. Chen et al. (2001) show that negative skewness is larger in stocks that have had positive stock returns over the prior 36 months. To control for this possibility, we include past one-year weekly returns (*RET*). *SDRET* is the standard deviation of firm-specific weekly returns over the fiscal year and is expected to be positively related to crash risk. Crash risk is higher for larger firms (*SIZE*); for firms with higher growth opportunities (*GROWTH*); higher profitability (ROA) but lower for firms with higher leverage (*LEV*) and better earnings quality (*EQ*).

4. Sample selection and descriptive statistics

As reported in Panel A of Table 1, we begin with an initial sample of 267,154 firm-year observations for the period 1987–2012. We start with 1987 as our first sample year because direct method cash flow statements became available in 1987. We need data on cash flows to estimate earnings quality proxies as well as *CFO/SALES* variable in the investment model. Our sample period ends in 2012 because of the availability of managerial ability data up to this period. After performing screening procedures to delete observations from regulated and financial industries and missing data, our final sample consisted of 76,249 firm-year observations for estimating H1. Our crash risk sample is smaller than the baseline sample because of missing observations for calculating the two proxies for estimating crash risk and the relavtn control variables fro estimating Eq. (7).

Table 1 Panel B presents the industry distribution of the sample. About 58% of the sample observations come from three industries namely, Chemical and allied products (28–30), Industrial Machinery & Equipment (35–39) and Business services (70–79). We include industry fixed effects in all our regression specifications to control for unobservable industry effects as documented in panel B, Table 1.

Panel C reports descriptive statistics of the variables included in the regression analysis. This panel shows that the mean (median) value of lagged management ability (*ABILITY*) is −0.01 (−0.03). Absolute investment efficiency measures estimated from *INVEFF_1* and *INVEFF_2* show a mean (median) of 0.17 (0.10) and 0.17 (0.09) respectively. By construction, the mean and median of *ABILITY* and residuals from investment efficiency models are close to 0. Furthermore, the mean (median) absolute value of *OINV_1* and *UINV_1* are 0.20 (0.09) and 0.15 (0.10) and those of *OINV_2* and *UINV_2* are 0.22 (0.09) and 0.15 (0.10), respectively. These values are very close to those reported in other investment efficiency studies (e.g. Biddle et al., 2009; Chen et al., 2012; Chen et al., 2011). The mean values of *NCSKEW* and *DUVOL* are −0.08 and −0.58 respectively. Overall, the estimates in Panel C of Table 1 are in the range of those reported in earlier studies.

Two sets of correlations among the variables are reported in Table 2. In Panel A, we report the correlations among the variables for the investment efficiency model. The correlation between *ABILITY* (raw score) and absolute values of the deviation between actual and predicted investments is positive and significant (correlation 0.04, $p < 0.01$ using the $|INV\_1|$ proxy) suggesting that more able managers make less efficient investments. The negative and significant correlation between earnings quality and

Table 1
A) Panel A: Sample selection procedure. B) Panel B: Industry distribution. C) Panel C: Descriptive statistics.

A)

Explanation	Observations
Initial sample for the period 1987–2010	267,154
Less: Observations in the regulated (#49) and financial institutions (#60–#69)	(61,513)
Less: missing financial reporting quality data proxied by Kothari et al. (2005)	(112,798)
Less: missing data on investment efficiency	(11,039)
Less: missing observations on the relevant control variables	(5555)
Final usable sample for managerial talent, investment efficiency, and financial reporting quality regression	76,249

B)

Code	Industry	Observations	% observations
1–14	Agriculture & mining	6393	0.08
15–17	Building construction	1200	0.02
20–21	Food & Kindred Products	2866	0.04
22–23	Textile Mill Products & apparels	1913	0.03
24–27	Lumber, furniture, paper, and printing	2454	0.03
28–30	Chemical, petroleum, and rubber & Allied Products	11,487	0.15
31–34	Metal	4460	0.06
35–39	Machinery, electrical, computer equipment	19,684	0.26
40–48	Railroad and other transportation & utilities	4463	0.06
70–79	Business services	16,186	0.21
80–99	Others	5143	0.07
	Total	76,249	1.00

C)

	Variables	N	Mean	SD	25%	50%	75%
Talent measure	$ABILITY_1$	76,249	−0.01	0.15	−0.11	−0.03	0.07
Investment efficiency measures	$\|INV\_1\|$	76,249	0.17	0.21	0.05	0.10	0.19
	$\|OINV\_1\|$	22,489	0.20	0.27	0.03	0.09	0.24
	$\|UINV\_1\|$	53,760	0.15	0.18	0.05	0.10	0.17
	$\|INV\_2\|$	76,249	0.17	0.28	0.04	0.09	0.18
	$\|OINV\_2\|$	23,826	0.22	0.39	0.03	0.09	0.23
	$\|UINV\_2\|$	52,419	0.15	0.19	0.05	0.10	0.17
EQ proxies	$\|EQ\|*-1$	76,249	−0.19	0.33	−0.20	−0.09	−0.04
Crash risk proxies	$NCSKEW_t$	61,325	−0.06	1.05	−0.70	−0.08	0.54
	$NCSKEW_{t-1}$	61,325	−0.07	1.03	−0.70	−0.09	0.52
	$DUVOL_t$	61,325	−0.54	0.88	−1.06	−0.49	0.04
	$DUVOL_{t-1}$	61,325	−0.54	0.86	−1.05	−0.49	0.03
Control variables	$SIZE_{t-1}$	76,249	4.97	2.36	3.31	4.86	6.55
	MKT_BK_{t-1}	76,249	2.85	5.66	1.02	1.90	3.49
	KSTRUCTURE	76,249	0.18	0.22	0.00	0.08	0.28
	OPCYCLE	76,249	4.73	0.80	4.31	4.78	5.20
	ROA_{t-1}	76,249	−0.10	0.54	−0.1	0.04	0.11
	DIV	76,249	0.28	0.45	0.00	0.00	1.00
	CFO_SALES	76,249	−0.42	3.08	−0.02	0.06	0.14
	ATO	76,249	1.08	0.76	0.56	0.95	1.41
	AGE_1	76,249	2.34	0.91	1.69	2.37	3.01
	TANGIB	76,249	0.27	0.23	0.09	0.20	0.39
	SLACK	76,249	0.19	0.22	0.03	0.10	0.28

(continued on next page)

Table 1 *(continued)*

C)							
	Variables	N	Mean	SD	25%	50%	75%
	LOSS	76,249	0.40	0.49	0.00	0.00	1.00
Control variables for crash risk	*TURN* $_{t-1}$	61,325	−0.0015	0.08	−0.02	−0.0006	0.02
	RET $_{t-1}$	61,325	0.0029	0.012	−0.0038	0.0027	0.009
	SDRET $_{t-1}$	61,325	0.08	0.05	0.05	0.07	0.10

Note: *ABILITY* is the managerial ability score constructed by Demerjian et al. (2012) using DEA. Using an optimization procedure incorporating an array of revenue-generating inputs Demerjian et al. (2012) calculated firm efficiency, and then regressed it on six firm characteristics that affect firm efficiency. The residual term derived from this regression is the component reflecting managerial ability. *INVEFF_1* is the residual from a regression of aggregate investment on revenue growth. Firm-year observations with positive residuals from equation are classified as over-investing (*OINV_1*), firm-year observations with negative residuals are classified as under-investing (*UINV_1*). We multiply *UINV_1* by minus −1 for the ease of interpretation. *INVEFF_2* is the residual from a regression of aggregate investment on revenue growth incorporating the differential predictability for revenue increases and revenue decreases. *OINV_2* and *UINV_2* are defined analogously. *EQ* is the absolute value of the performance-matched discretionary accruals following the model developed by Kothari et al. (2005) described in the text. We multiply |EQ| by −1 so that higher values imply better reporting quality. We report the descriptive statistic for this transformed variable in this table. *DUVOL* is down-to-up volatility measure calculated as the natural logarithm of the ratio of the standard deviation in the "down" weeks to the standard deviation in the "up" weeks [see text for the detailed formula). *SIZE* is the log of total assets; *MKT_BK* is the ratio of the market value of total assets to book value of total assets; *KSTRUCTURE* is the ratio of long-term debt to the sum of long-term debt to the market value of equity; *OPCYCLE* is the log of receivables to sales plus inventory to COGS multiplied by 360; *ROA* is net income before extraordinary items divided by lagged total assets; *DIV* is an indicator variable that takes the value of one if the firm paid a dividend, and zero otherwise; *CFO_SALES* is the ratio of CFO to sales; *ATO* is asset turnover calculated as the ratio of sales to total assets; *AGE* is the difference between the first year when the firm appears in CRSP and the current year; *TANGIB* is the ratio of PPE to total assets; *SLACK* is the ratio of cash to PPE; *LOSS* is an indicator variable that takes the value of one if net income before extraordinary items is negative, and zero otherwise; *TURN* is the average monthly share turnover over the current fiscal year minus the average monthly share turnover over the previous fiscal year, where monthly share turnover is calculated as the monthly trading volume divided by the total number of shares outstanding during the month; *RET* is weekly returns for the year; *SDRET* is the standard deviation of firm-specific weekly returns over the fiscal year.

investment suggests that better quality earnings reduce inefficient investments (correlation −0.11, $p < 0.01$). Panel B, reports correlations among the crash risk regression variables. We document a significantly positive correlation between *NCSKEW* and |*INV_1*| (correlation 0.02, $p < 0.01$) implying that inefficient investment increases carsh risk. We also find a significantly positive correlation between crash proxies and *ABILITY* measure (correlation of 0.05 and 0.11 for *NCSKEW* and *DUVOL* measures respectively both significant at $p < 0.01$).

5. Main test results

Panel A in Table 3 presents our primary regression result where we regress current investment efficiency measures (*INV_1*) on the lagged values of managerial ability (*ABILITY*), and a set of control variables that prior literature has identified as determinants of corporate investments. Columns 1 and 6 show that the coefficient on *ABILITY* (raw score) is 0.10 ($p < 0.01$) and 0.11 ($p < 0.01$) for the |*INV_1*| and |*INV_2*| measures, respectively. The positive and significant coefficients imply that firms with more able managers tend to invest more in less efficient investments thus supporting H1B. To gauge the economic significance of the coefficients, note that the interquartile range for the *ABILITY* measure is 0.18 and the mean of |*INV_1*| is 0.17. Thus moving *ABILITY* from the first to the third quartile increases |*INV_1*| by 10.59% (0.10*0.18/0.17). The corresponding increase for the |*INV_2*| is 14.24% (0.11*0.22/0.17). Given that the unconditional means for *OINV_1* and *OINV_2* are 17% respectively, the documented increase is economically significant as well. The coefficients on *ABILITY* for the two overinvestment proxies are positive and statistically highly significant, e.g., the coefficients on |*OINV_1*| and |*OINV_2*| are is 0.23 ($p < 0.01$) and 0.27 respectively in Columns (3) and (8). Our results remain robust to firm fixed effects regressions.

This positive association between ability and investment efficiency can also be construed as proxying for the effect of CEO overconfidence on investment efficiency. However, there is an important difference between managerial ability and CEO overconfidence. Managerial ability reflects the management team's efficiency in converting resources to outputs. This measure, therefore, is built on the DEA technique with the purpose of optimizing the input-output ratio. CEO overconfidence, on the other hand, is confined in measuring CEO net stock purchases (Malmandier and Tate, 2005). The coefficient on the *EQ* measure is significantly negative across all the investment specifications, implying that better quality financial reporting alleviates investment distortions.[3]

[3] Prior research has demonstrated that better quality financial reporting improves investment efficiency by mitigating adverse selection and moral hazard problems inherent in corporate investment decisions. Wang (2006) finds that firms with poor quality financial reporting over-invest in R & D and stock-financed mergers and acquisitions. Better quality financial reporting has been found to reduce investment-cash-flow sensitivities as well as deviation from expected investment levels (Biddle and Hilary 2006; Biddle et al., 2009). Bushman et al. (2011) find that more timely accounting recognition of economic losses constrains overinvestment by managers faced with declining investment opportunities. McNichols and Stubben (2008) find that firms investigated by the SEC for accounting irregularities over-invest substantially during the misreporting period. We argue that if the efficient contracting perspective dominates, then more able managers will improve financial reporting quality in order to mitigate the information asymmetry problem and to better align their interests with those of outsiders. On the other hand, the rent extraction theory would argue that the more able managers will manipulate financial reporting, using their more intimate knowledge of the firm-specific reporting process to obfuscate investments made with the intent of increasing personal gains.

Table 2
Correlation analysis. PANEL A: Correlations among variables in the investment model.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
|INV| (1)	1.00												
ABILITY(2)	**0.04**	1.00											
SIZE (3)	**−0.08**	**0.07**	1.00										
MTB (4)	**0.04**	**0.04**	−0.01	1.00									
KSTRUC(5)	**−0.03**	**−0.12**	**0.22**	**−0.18**	1.00								
OPCYCLE (6)	**−0.03**	**−0.05**	**−0.04**	**0.02**	**−0.08**	1.00							
ROA (7)	**−0.14**	**0.17**	**0.38**	**0.04**	**0.03**	**0.05**	1.00						
DIV (8)	**−0.12**	**0.12**	**0.49**	−0.01	**0.02**	0.01	**0.22**	1.00					
ATO (9)	**−0.11**	**0.16**	**0.18**	**−0.05**	**0.08**	**−0.13**	**0.34**	**0.11**	1.00				
AGE (10)	**−0.12**	**0.29**	**−0.21**	**−0.06**	**−0.04**	**−0.21**	0.01	**0.03**	**0.19**	1.00			
TANGIB (11)	**−0.10**	**0.05**	**0.28**	**−0.08**	**0.11**	**0.03**	**0.12**	**0.34**	**0.08**	**0.11**	1.00		
CASH(12)	**−0.03**	**−0.14**	**0.19**	**−0.07**	**0.29**	**−0.22**	**0.07**	**0.19**	**0.08**	**−0.17**	**0.07**	1.00	
LOSS (13)	**0.11**	**−0.02**	**−0.22**	**0.14**	**−0.39**	**−0.09**	**−0.12**	**−0.23**	**−0.25**	**−0.24**	**−0.23**	**−0.41**	1.00
|EQ|*−1 (14)	**−0.11**	**−0.27**	**−0.34**	0.00	**0.08**	**−0.02**	**−0.45**	**−0.36**	**−0.21**	**−0.12**	**−0.18**	**−0.07**	**0.17**
$NCSKEW_t$ (1)	1.00												
$DUVOL_t$ (2)	**0.77**	1.00											
$\|INV\_1\|_{t-1}$(3)	**0.02**	−0.01	1.00										
$TURN_{t-1}$(4)	**0.04**	**0.05**	**0.04**	1.00									
RET_{t-1}(5)	**0.08**	**0.12**	0.01	**0.22**	1.00								
$SDRET_{t-1}$(6)	**−0.11**	**−0.30**	**0.06**	**0.09**	**0.16**	1.00							
$SIZE_{t-1}$(7)	**0.16**	**0.38**	0.00	**0.07**	**0.09**	**−0.46**	1.00						
MTB_{t-1}(8)	**0.04**	**0.03**	**0.06**	**0.06**	**0.17**	**0.04**	**0.14**	1.00					
LEV_{t-1}(9)	0.01	**0.02**	**0.04**	0.01	**−0.05**	**−0.07**	**0.10**	**−0.09**	1.00				
ROA_{t-1}(10)	**0.06**	**0.22**	**−0.12**	**0.06**	**0.13**	**−0.43**	**0.29**	**−0.03**	−0.01	1.00			
$\|EQ_{t-1}\|$*−1 (11)	−0.01	**−0.02**	**0.23**	**0.03**	**0.05**	**0.14**	**0.02**	**0.08**	**−0.06**	**−0.15**	1.00		

Note: Bold and italics are significant at better than the 1% level. Variables are defined in the notes in Table 1.

Table 3
Managerial ability and investment efficiency. $INVEFF_{i,t}| = \gamma_0 + \gamma_1 ABILITY_{t-1} + \gamma_2 EQ_{t-1} + \gamma_3 SIZE_{t-1} + \gamma_4 MKTBK_{t-1} + \gamma_5 KSTRUCTURE_{t-1} + \gamma_6 OPCYCLE_{t-1} + \gamma_7 ZSCORE_{t-1} + \gamma_8 ROA_{t-1} + \gamma_9 DIV_{t-1} + \gamma_{10} CFOSALES_{t-1} + \gamma_{11} ATO_{t-1} + \gamma_{12} AGE_{t-1} + \gamma_{13} TANGIB_{t-1} + \gamma_{14} SLACK_{t-1} + \gamma_{15} LOSS_{t-1} + \varepsilon$ (5)

Variables	OLS (1) |INV_1|	FFE (2) |INV_1|	OLS (3) OINV_1	FFE (4) OINV_1	OLS (5) UINV_1	OLS (6) |INV_2|	FFE (7) |INV_2|	OLS (8) OINV_2	FFE (9) OINV_2	OLS (10) UINV_2
ABILITY $_{t-1}$	0.099***	0.117***	0.230***	0.303***	0.006	0.110***	0.140***	0.273***	0.357***	0.005
	[14.18]	[12.98]	[15.29]	[13.37]	[1.05]	[11.82]	[11.47]	[11.98]	[10.64]	[0.71]
SIZE $_{t-1}$	−0.004***	0.000	−0.006***	0.010**	−0.004***	−0.006***	−0.005**	−0.007***	0.016**	−0.006***
	[−7.26]	[0.27]	[−5.04]	[2.23]	[−8.95]	[−8.68]	[−2.29]	[−4.28]	[2.57]	[−11.13]
MKT_BK $_{t-1}$	0.000**	0.000*	0.001***	0.001	−0.000***	0.000*	0.000*	0.001***	0.001	−0.001***
	[2.22]	[1.69]	[2.88]	[1.54]	[−3.09]	[1.88]	[1.92]	[2.65]	[1.24]	[−3.10]
KSTRUCTURE $_{t-1}$	0.045***	0.055***	0.164***	0.163***	0.018***	0.054***	0.054***	0.204***	0.195***	0.016***
	[10.84]	[9.49]	[12.71]	[8.26]	[5.11]	[9.43]	[6.64]	[11.01]	[7.01]	[3.77]
OPCYCLE $_{t-1}$	−0.006***	0.008***	−0.011***	0.009	−0.005***	−0.006***	0.010***	−0.010**	0.013	−0.002
	[−3.81]	[3.31]	[−2.88]	[1.47]	[−3.41]	[−2.63]	[2.89]	[−1.99]	[1.59]	[−1.46]
ROA $_{t-1}$	−0.013***	−0.012***	−0.029***	−0.030***	0.000	−0.017***	−0.013***	−0.029***	−0.025**	−0.004
	[−4.77]	[−4.06]	[−5.27]	[−3.94]	[0.18]	[−4.07]	[−3.11]	[−3.19]	[−2.22]	[−1.56]
DIV $_{t-1}$	−0.012***	−0.003	−0.019***	0.008	−0.005**	−0.004	0.001	−0.011	0.018	0.001
	[−5.78]	[−1.08]	[−3.94]	[0.84]	[−2.56]	[−1.60]	[0.32]	[−1.61]	[1.44]	[0.52]
CFO_SALES $_{t-1}$	−0.002***	−0.001	−0.002**	−0.000	−0.000	−0.003***	−0.001	−0.002**	−0.000	−0.001***
	[−4.25]	[−1.28]	[−2.31]	[−0.34]	[−1.24]	[−4.48]	[−1.51]	[−2.01]	[−0.16]	[−2.74]
ATO $_{t-1}$	−0.028***	−0.038***	−0.079***	−0.086***	−0.005***	−0.034***	−0.052***	−0.100***	−0.106***	−0.003*
	[−15.48]	[−14.53]	[−14.62]	[−10.31]	[−3.20]	[−14.31]	[−14.13]	[−13.39]	[−9.40]	[−1.77]
AGE $_{t-1}$	−0.009***	−0.025***	−0.026***	−0.073***	0.004***	−0.008***	−0.030***	−0.032***	−0.078***	0.006***
	[−8.42]	[−8.61]	[−11.08]	[−9.48]	[4.72]	[−6.25]	[−7.18]	[−9.15]	[−7.58]	[6.15]
TANGIB $_{t-1}$	−0.058***	−0.073***	−0.119***	−0.155***	−0.066***	−0.056***	−0.081***	−0.152***	−0.174***	−0.055***
	[−10.11]	[−6.45]	[−7.84]	[−4.84]	[−12.93]	[−7.37]	[−5.02]	[−7.16]	[−3.70]	[−9.03]
SLACK $_{t-1}$	−0.044***	−0.056***	−0.112***	−0.139***	−0.022***	−0.047***	−0.061***	−0.159***	−0.163***	−0.015**
	[−7.64]	[−6.71]	[−7.86]	[−6.26]	[−4.53]	[−6.06]	[−5.16]	[−7.90]	[−5.15]	[−2.42]
LOSS $_{t-1}$	0.013***	0.005**	0.026***	0.010*	0.009***	0.024***	0.013***	0.028***	0.011	0.017***
	[6.86]	[2.28]	[5.43]	[1.82]	[5.24]	[8.52]	[4.38]	[4.18]	[1.47]	[7.81]
|*EQ*|*−1* $_{t-1}$	−0.123***	−0.106***	−0.194***	−0.183***	−0.053***	−0.159***	−0.140***	−0.315***	−0.294***	−0.047***
	[−25.25]	[−23.95]	[−26.54]	[−19.20]	[−13.46]	[−20.97]	[−20.78]	[−20.94]	[−17.36]	[−10.46]
Constant	0.234***	0.186***	0.434***	0.299***	0.154***	0.245***	0.220***	0.487***	0.275***	0.139***
	[15.85]	[10.11]	[11.87]	[6.10]	[12.65]	[12.38]	[8.59]	[8.94]	[3.79]	[9.78]
FFE	NO	YES	NO	YES	NO	NO	YES	NO	YES	NO
Industry FE	Yes	NO	Yes	NO	Yes	Yes	NO	Yes	NO	Yes
Year FE	Yes	YES	Yes	YES	Yes	Yes	YES	Yes	YES	Yes
Adjusted R^2	0.21	0.26	0.24	0.38	0.28	0.15	0.24	0.22	0.36	0.17
Observations	76,249	76,249	22,489	22,489	53,760	76,249	76,249	23,830	23,830	52,419

Note: ***, **, and * represent statistical significance at the 1%, 5%, and 10% level respectively (two-tailed test). Variable definitions are in Table 1

Table 4
Managerial ability and stock price crash risk: Investment efficiency channel. $$CRASH_{i,t} = \gamma_0 + \gamma_1 CRASH_{t-1} + \gamma_2 INV_{t-1} + \gamma_3 TURN_{t-1} + \gamma_4 RET_{t-1} + \gamma_5 SDRET_{t-1} + \gamma_6 SIZE_{t-1} + \gamma_7 MTB_{t-1} + \gamma_8 LEV_{t-1} + \gamma_9 ROA_{t-1} + \gamma_{10}|EQ_{t-1}|\varepsilon_{i,t} \quad (7)$$

							TALENT ≧ Median		TALENT < Median	
	OLS SKEW (1)	OLS DUVOL (2)	OLS SKEW (3)	OLS DUVOL (4)	OLS SKEW (3)	OLS DUVOL (4)	SKEW	DUVOL	SKEW	DUVOL
$CRASH_{t-1}$	0.062***	0.059***	0.066***	0.060***	0.060***	0.057***	0.072***	0.062***	0.052***	0.055***
	[10.95]	[11.50]	[6.52]	[6.87]	[8.73]	[9.21]	[8.88]	[8.80]	[6.49]	[7.45]
$\|INV\_1\|$	0.108***	0.051***	–	–	–	–	0.114***	0.066***	0.042	0.026
	[4.44]	[2.86]					[3.34]	[2.76]	[1.64]	[0.98]
$\|OINV\_1\|$	–	–	0.150***	0.072***	–	–		–	–	–
			[4.31]	[2.83]						
$\|UINV\_1\|$	–	–	–	–	0.045	0.019		–	–	–
					[1.22]	[0.72]				
TURN $_{t-1}$	0.213***	0.148***	0.285***	0.168***	0.166***	0.131***	0.277***	0.175***	0.173**	0.128**
	[4.31]	[4.07]	[3.35]	[2.78]	[2.67]	[2.80]	[4.01]	[3.54]	[2.43]	[2.39]
RET $_{t-1}$	9.506***	10.149***	10.826***	10.595***	8.921***	9.945***	10.645***	9.532***	8.364***	10.386***
	[17.96]	[29.07]	[11.71]	[17.70]	[13.79]	[22.86]	[13.07]	[17.99]	[11.78]	[22.03]
SDRET $_{t-1}$	−1.198***	−3.414***	−1.369***	−3.479***	−1.212***	−3.413***	−1.384***	−3.467***	−0.988***	−3.298***
	[−8.30]	[−27.94]	[−4.98]	[−15.53]	[−7.25]	[−23.75]	[−6.12]	[−18.92]	[−5.20]	[−20.33]
SIZE $_{t-1}$	0.063***	0.094***	0.069***	0.096***	0.059***	0.093***	0.059***	0.091***	0.067***	0.096***
	[23.43]	[41.95]	[13.74]	[24.37]	[19.20]	[35.43]	[15.64]	[30.44]	[17.51]	[29.35]
MTB $_{t-1}$	0.001*	−0.003***	−0.000	−0.004***	0.002*	−0.002**	0.001	−0.003***	0.002*	−0.003***
	[1.70]	[−3.88]	[−0.34]	[−3.67]	[1.83]	[−2.47]	[0.48]	[−2.92]	[1.77]	[−2.65]
LEV $_{t-1}$	0.005	−0.010	0.004	−0.004	−0.003	−0.016	−0.002	−0.018	0.017	0.005
	[0.18]	[−0.52]	[0.09]	[−0.10]	[−0.08]	[−0.68]	[−0.06]	[−0.65]	[0.50]	[0.17]
ROA $_{t-1}$	−0.024	0.114***	0.008	0.124***	−0.048***	0.109***	−0.004	0.124***	−0.039**	0.102***
	[−1.62]	[9.12]	[0.31]	[6.26]	[−2.71]	[6.59]	[−0.12]	[4.95]	[−2.12]	[6.82]
|EQ| $_{t-1}$	−0.024	0.034**	0.017	0.055**	−0.044*	0.025	−0.008	0.050***	−0.043*	0.024
	[−1.34]	[2.47]	[0.59]	[2.44]	[−1.93]	[1.43]	[−0.29]	[2.70]	[−1.70]	[1.19]
Constant	−0.572***	−0.891***	−0.538***	−0.813***	−0.562***	−0.913***	−0.539***	−0.872***	−0.588***	−0.897***
	[−8.57]	[−16.59]	[−4.26]	[−8.40]	[−7.31]	[−14.36]	[−5.62]	[−11.40]	[−6.53]	[−12.09]
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adjusted R^2	0.05	0.21	0.06	0.21	0.04	0.21	0.04	0.19	0.05	0.21
Observations	61,325	61,325	18,393	18,393	42,932	42,932	31,097	31,097	30,228	30,228
Difference in mean coefficients							3.30 ($p < 0.10$)	Chi2 3.92 ($p < 0.05$)		

Note: Firm-year observations with positive residuals from equation are classified as over-investing (*OINV*). *EQ* is the absolute value of the performance-matched discretionary accruals following the model developed by Kothari et al. (2005) described in the text. We multiply *EQ* by negative 1 so that higher the value the better the earnings quality.
***, **, and * represent statistical significance at the 1%, 5%, and 10% level respectively (two-tailed test).

Control variables generally have the predicted sign and significance. For example, larger firms make more efficient investment, whilst growth firms over-invest. Availability of cash reduces over-investment as is evident from the coefficient on cash divided by assets.

The finding that managerial ability is associated with over-investment positively is counterintuitive in relation to the efficient contracting hypothesis. Since prior literature on investment efficiency has generally concluded that over-investment increases agency costs, our evidence points towards rent extraction as a plausible explanation for the findings.

Table 4 reports regression results of crash risk on investment efficiency proxies in Columns (1) to (6). We fiond that the coefficient on *ABILITY* is significant positive for both the crash proxies [0.108 ($p < 0.01$) for *NCSKEW* and 0.05 ($p < 0.01$ for *DUVOL* measures). This is consistent with investment inefficiency motivating managers to withhold bad news for an extended period, thus increasing future crash risk. To gauges the economic significance of the reported coefficient, recall that the interquartile range for $|INV\_1|$ is 0.14. Thus moving $|INV_1|$from the first to the third quartile increases *NCSKEW* by 25.2% [0.108*0.14/(−0.06)]. The corresponding increase for *DUVOL* is only 1.32% [(0.051*0.14)/−0.54] due probably to a large average *DUVOL* value. Columns (3) and (4) reveal that crash risk increases when firms overinvest (coefficients 0.15 and 0.072 for *NCSKEW* and *DUVOL* measures respectively, both significant at $p < 0.01$). Moving $|OINV\_1|$ from the first to the third quartile increases crash risk by 15.75% (7.56%) for *NCSKEW* (*DUVOL*) measures respectively. This again is consistent with the proposition that managers need to conceal negative information emanating from overinvestment in negative NPV projects, thus increasing crash risk when the bad news is revealed to the market. Column (5) and (6) find no empirical evidence that underinvestment increases crash risk. Among the control variables, the coefficient on average returns is positive and that on return volatility is negative. This suggests that firms with better stock performance and lower volatility are more likely to experience crashes, indicating that crashes are unlikely to be a manifestation of declining business conditions, continuation of poor stock performance (i.e., negative stock momentum), and/or high stock volatility. This is consistent with the notion that crashes occur after a period of illusionary high prices and stability (Hamm et al., 2014). Larger firms and high M/B firms are more prone to crashes but firm leverage reduces crash risk.

In order to investigate whether managerial ability moderates the association between investments and crash risk, we partition the sample into two groups: more able managers (*ABILITY* ≧ median) and less able managers (*ABILITY* < median). We expect the association between inefficient investment and crash risk to be more pronounced for the more able groups because of their poor investments in negative NPV projects. We find evidence consistent with this prediction. The coefficients on $|INV\_1|$ is significantly positive for the more able group (coefficients 0.114 and 0.066 for the *NCSKEW* and *DUVOL* measures, both significant at $p < 0.01$). However, no significant evidence is found for the below ability group. Taken together this finding supports 'rent extraction' instead of 'efficient contracting' hypotheses (H2B, is therefore, supported.)

Taken together, our empirical findings lend support to the rent extraction as opposed to the efficient contracting hypothesis as an explanation for the association among managerial ability, investment efficiency and future stock price crash risk. More able managers may overemphasize their personal career enhancement and, in so doing, take actions that may worsen agency costs.

6. Conclusion

Despite the pivotal nature of managerial contributions to firm performance, investment decisions, and financial reporting quality, there remains a divergence of opinion regarding manager-specific effects on various organizational outcomes. Early research on the CEO effect attributed firm performance to firm and industry effects rather than to the CEO effect. However, subsequent research appears to document robust evidence of manager-specific effects. This paper extends research on managerial effects by investigating the effect of managerial ability on investment decisions and future crash risk.

We use managerial ability score of Demerjian et al. (2012) which is based on observable financial statement information at the firm level. We use a number of investment efficiency proxies, and document a significantly positive effect of managerial ability on firms' propensity to overinvest. We attribute this finding to the 'rent extraction' as opposed to the 'efficient contracting' perspective. We also document that inefficient investments increase crash risk which is more pronounced for more able managers sub-sample.

Our study contributes to the existing literature in a number of ways. First, by documenting an association between managerial ability and investment efficiency, we enrich the emerging literature on managerial ability. Second, we extend the literature on the determinants of investment efficiency by incorporating a human side into the equation. Finally, our study extends the crash risk literature by documenting an association between investment efficiency and crash risk conditional on managerial ability.

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