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Overconfident CEOs and the corporate investment cycle

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Abstract

This study adds to the literature that establishes a link between CEO overconfidence and corporate investment based on a model of managerial optimism, which says that overconfident CEOs over- and under-invest conditional on cash flow. When cash flow is abundant, overconfident CEOs overinvest because they over-estimate the expected returns from investment projects. When cash flow is scarce, overconfident CEOs underinvest; they are reluctant to issue new equity to fund investment because they believe investors under-value their stock. Using founder-CEO status as a proxy for overconfidence, our study does not support the key prediction of the model of managerial optimism; ASX-listed founder-run companies do not exhibit higher investment-cash flow sensitivities than other companies for our sample period of 2007 to 2020. Our main robustness check, which exploits the global financial crisis as a natural experiment, also fails to provide evidence of a link between CEO overconfidence and investment-cash flow sensitivities.

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Introduction

This study examines the link between managerial optimism and corporate investment based on a sample of ASX-listed companies with a founder-CEO from 2007 to 2020. Drawing on the social psychology literature on overconfidence and a model that establishes a relationship between CEO optimism and corporate investment Heaton (2002), we test whether firms run by founder-CEOs over-invest when there is a high level of free cash flow available and under-invest when the firm has low free cash flow. According to Heaton (2002), overconfident CEOs are reluctant to issue new equity to fund positive NPV projects when there is a shortage of free cash flow because they believe that capital markets under-value their shares. Under the model, optimistic CEOs are assumed to over-estimate the expected returns from the firm's opportunity set of investment projects (Heaton 2002). The pattern of over- and under-investment is expected to be more pronounced for firms that face financing constraints, notably equity dependent firms (Malmendier & Tate 2005, 2015). Our study adds to the empirical research which finds support for the hypothesis that large, listed firms in the United States run by overconfident CEOs have higher investment-cash flow sensitivities, where media reports and the propensity for some CEOs to remain over-exposed to company stock are used as measures of overconfidence (Malmendier & Tate 2005, 2008, 2015).

In the spirit of Malmendier and Tate (2005), we develop a novel proxy for overconfidence that is based on CEO under-diversification; founder-CEO status. Founder-CEOs are typically under-diversified; they have a larger ownership stake in the business they founded than professionally hired CEOs (Anderson & Reeb 2003; Fahlenbrach 2009).[2] Further, given the high failure rates among start-up businesses, many entrepreneurs over-estimate their chances of success and are shown to

[2] As at 30 June 2020, the mean and median ownership stakes of founder-CEOs of firms in the All Ordinaries index was 12.66% and 5.66% respectively, both significantly higher than the ownership stakes of other CEOs.

exhibit overconfidence (Bitler, Moskowitz & Vissing-Jørgensen 2005; Moskowitz & Vissing-Jorgensen 2002).

Our study of ASX listed companies from 2007 to 2020 does not support the key prediction of the model of managerial optimism that firms run by overconfident CEOs have higher investment to cash flow sensitivities than firms run by professionally hired CEOs.

We borrow from the framework developed by Malmendier and Taylor (2015) and address endogeneity of firms' financing constraints by exploiting the global financial crisis as a natural experiment, which represents an exogenous shock that reduced firm cash flows and increased financing constraints. Our findings are consistent with our results over the entire period of analysis; there is no difference in investment to cash flow sensitivities between founder-CEO and professionally hired-CEO firms in the financial crisis.

In additional robustness checks, we find that firms run by overconfident CEOs hold more cash and have higher dividend payout rates than other firms, which does not appear to be consistent with the view that over-confident CEOs use available resources to pursue growth strategies. It is reasonable to expect that firms run by an overconfident CEO – who over-estimates the profitability of projects she undertakes as depicted in Malmendier and Tate (2005) and Malmendier and Tate (2015) - would have a lower dividend payout rate (Deshmukh, Goel & Howe 2013) and hold less cash than other CEOs.

Our findings are preliminary only as we have not yet addressed the issue of the self-selection bias of founder-CEOs nor fully addressed the omitted variable problem. Given that we do not find evidence of a link between founder-CEO status and corporate investment, we expect our findings to be robust to endogeneity around founder-CEO status. Moreover, studies have shown that the departure of a

founder-CEO does not coincide or lag a period of poor performance (Adams, R, Almeida & Ferreira 2009; Wasserman 2003). Like many studies that seek to examine the link between managerial attributes and corporate outcomes involving panel data, our findings could reflect sources of unobserved heterogeneity – including age, education and other differences between founder-CEOs and professionally hired CEOs. We are currently compiling a hand-collected dataset on various characteristics designed to capture additional time invariant CEO characteristics.

Our study makes four contributions. We offer a methodological contribution by using founder-CEO status as a novel proxy for CEO overconfidence. Founder-CEOs have been commonly used as a proxy for managerial power, discretion and/or entrenchment (Adams, RB, Almeida & Ferreira 2005; Graham, Kim & Leary 2020; Morck, Shleifer & Vishny 1988). Founder-CEOs are shown to issue more optimistic earnings forecasts and the tone of their statements are more optimistic than other CEOs (Lee, Hwang & Chen 2017). Company founders who continue to run their company represent plausible candidates for representing under-diversified CEOs because their financial and human capital are closely linked to their company's prospects. They typically have higher ownership stakes than professionally hired CEOs and some derive non-pecuniary benefits thanks to their founder-status (Fahlenbrach 2009; Villalonga & Amit 2006). The use of founder-CEO status as a measure for overconfidence has an added benefit because such firms are typically small and young, attributes that are used to proxy for financing constraints (Malmendier & Tate 2005, 2015). We believe that the use of founder-CEO status as a measure of overconfidence should be viewed as complementary to the widely used proxy of option exercise deferral, in which CEOs who defer the exercise of deep ITM options on company own stock forgo valuable diversification benefits.

Relatedly, the value of developing complementary measures of CEO overconfidence could increase because of the risk that insider selling becomes less prevalent due to greater negative media and investor attention. CEOs need to balance the diversification benefits of insider selling with

reputational risk associated with signalling. Insider selling is less profitable and not as commonly used in companies that are conscious about corporate social responsibility (CSR) (Dai, Parwada & Zhang 2015; Gao, Lisic & Zhang 2014). The widespread adoption of CSR practices could therefore lead to systematic deferral of option exercise by CEOs thanks to heightened reputational risks.[3]

Second, our analysis is based on a hand collected survivorship bias free data set of ASX-listed company founders over the past fourteen years, to our knowledge the first of its kind that has been developed for the Australian market. The legal environment and culture between Australia and the United States are similar, both countries share the same language and investors in both jurisdictions enjoy strong legal protection. Nonetheless there are significant differences in the size of the two markets and sector compositions, with the Australian stock market tilted towards mining companies. Australia represents a valuable out of sample test of studies which find support on balance for the hypothesis that investment to cash flow sensitivities are higher among firms run by overconfident CEOs in the United States. Australia also offers a robustness check on the attributes of founder firms at a time of rapid growth in the market capitalisation of founder-led firms in the United States, particularly in the technology sector. Out of sample tests represent a valuable method for testing the robustness of findings and help to address concerns that data snooping and related biases contribute to the publication of false positives in financial economics (Harvey 2017).[4]

Third, the use of founder-CEO status as a proxy for overconfidence helps to address the problem of endogenous selection of CEOs with desirable attributes by corporate boards, (Daniel & Maristella 2002). Busy and entrenched boards are shown to be more likely to promote internally when the pool

[3] In 2019, Business Roundtable – a consortium of over 150 CEOs from America's largest companies – formally adopted a stakeholder approach to the purpose of the corporation, enunciating a commitment to customers, employees, suppliers and communities, as well as shareholders (Business-Roundtable 2019). In Australia, Telstra CEO, Mr Andy Penn, has questioned the primacy of shareholder value (Fernyhough 2020).

[4] Harvey (2017) also suggests increasing the significance levels for hypothesis testing to reflect the low marginal costs associated with testing hypotheses in financial economics. See also Harvey, Liu and Zhu (2016).

of senior executives are overconfident and conditional on promoting from within the company, they are more likely to select a candidate with a higher level of confidence (Banerjee et al. 2020). Founder-CEO firms have been used as a novel way to address the endogenous matching that can arise from CEOs' attitudes towards uncertainty and acquisitive behaviour on the basis that a founder-CEO is not selected by the board of directors (Pan, Siegel & Yue Wang 2020).

Fourth, our study adds to the growing literature on behavioural CEOs (for a comprehensive overview, see Malmendier and Taylor (2015)), which draws on the insight that CEO personal preferences and attributes can have implications for corporate outcomes. The findings of our study suggests that more work can be done in developing alternative and robust measures of CEO overconfidence and in understanding how models of behavioural CEOs can draw on the insights of the misalignment of interests that represents the foundation of agency theory (Jensen & Meckling 1976). Founder-CEO status – which is commonly used in the literature as a proxy for CEO power to highlight the prevalence of conflicts of interest (Morck, Shleifer & Vishny 1988) represents a promising area of research in terms of scope for cross fertilisation between agency theory and behavioural corporate finance.

The rest of the paper is organised as follows. A literature review and hypothesis development is contained in Section 2 while a discussion of the methodology used is contained in Section 3. Section 4 is devoted to an explanation of the data used and key findings, while Section 5 has brief concluding remarks.

Section 2 - Literature review and hypothesis development

The efficient markets hypothesis assumes that individuals are rational: they have unlimited processing power, are able to assess and rank the risk and return attributes of all asset alternatives instantaneously and do not exhibit psychological biases (Malkiel & Fama 1970). This assumption has been brought into question through the emergence of behaviour finance, which represents an interdisciplinary approach that draws on social psychology and finance research (Fama, EF 1998; Thaler 1980).

Drawing on the social psychology literature, individuals are seen to have a dual processing system, devoted to undertaking cognitive intensive tasks and effortless tasks (Kahneman 2003). This dichotomy is designed to economise on the use of limited cognitive resources, but in some cases the dual processing system can lead to systematic biases in decision making and errors of judgement, including, but not limited to, over-confidence and optimism (Kahneman 2003; Kahneman, Slovic & Tversky 1982). De Bondt and Thaler (1995) suggests that over-confidence represents a robust finding in the psychology of judgement and decision making.

The subject of this study is to examine the implications of managerial overconfidence on patterns in corporate investment. Traditional models of corporate investment predict that controlling for other factors, investment is positively related to expected cash flows and negatively related to discount rates. In valuation theory or the dividend discount model, expected growth in a firm's book equity is positively related to expected return on equity and negatively related to the stock's expected returns, patterns that are consistent with the data (Fama, EF & French 2006). Closely related to valuation theory is the q-theory model of investment, which says that capital accumulation accelerates in states when the ratio of the market value of assets to their replacement cost (otherwise denoted as q) is greater than 1 (Brainard & Tobin 1968). According to these models, a

firm's top managers seek to maximise the value of the firm by investing in projects with a positive net present value.

The traditional models of corporate investment do not incorporate the role of financing frictions, such as the lack of available internal cash flow to fund investment and/or the inability or unwillingness to raise external funds, notably debt and equity. Further, they assume that a firm's top managers are rational in the sense that they have unlimited capacity to process information and therefore do not rely on heuristics or mental short-cuts to preserve valuable and scare cognitive resources (Kahneman 2003).

We draw on upper echelons theory, which develops a link between the values, personality traits and backgrounds of senior executives and organisational outcomes (Hambrick & Mason 1984). Personal characteristics such as age, career experience, education and socioeconomic status are expected to affect corporate performance through various strategic decisions relating to product innovation, diversification ,capital intensity and financial leverage (Hambrick & Mason 1984). Upper echelons theory has empirical support from a range of studies, which map a relationship between for instance, a CEO's age, risk preferences, employment background in the military and founder-CEO status on various measures of corporate performance, including balance sheet leverage, corporate investment acquisitive behaviour, operating or accounting performance and stock returns (Benmelech & Frydman 2015; Fahlenbrach 2009; Malmendier & Tate 2015).

Studies in empirical corporate finance which examine the implications of CEO overconfidence draw on the social psychology literature which documents that overconfidence or optimism is a widespread phenomenon and identifies various dimensions of overconfidence.[5] First, subjects are

[5] In the spirit of Malmendier and Tate (2005), we use the term overconfidence as an overarching concept which encompasses optimism.

shown to exhibit the better-than-average effect, where they over-estimate their competencies and capabilities (Larwood & Whittaker 1977; Svenson 1981). Second, subjects suffer from the self-attribution bias, where they attribute favourable outcomes to their own skill and judgement and unfavourable outcomes to bad luck or factors beyond their control (Kahneman, Slovic & Tversky 1982). Third, subjects are prone to engaging in over-precision; the propensity to over-estimate the precision of one's own private signals or have too narrow confidence intervals around their central expectations, thus under-estimating uncertainty (Kahneman, Slovic & Tversky 1982; Moore & Schatz 2017). Fourth, subjects are shown to suffer from an illusion of control (Langer 1975).

These dimensions of over-confidence manifest in various behaviours and settings. Overconfident individuals tend to trade stocks excessively (Odean 1999), male portfolio managers trade more frequently than their female counterparts which is attributed to overconfidence and is associated with inferior portfolio performance (Barber & Odean 2001), and consumers tend to over-estimate their usage of certain products and services and therefore over-pay for services such as gym memberships (Grubb 2015).

Another setting in which over-confidence or optimism is documented is among entrepreneurs. Given the high failure rates among start-up businesses, many entrepreneurs over-estimate their chances of success and are shown to exhibit the various dimensions of overconfidence (Arabsheibani et al. 2000; Åstebro 2003; Åstebro et al. 2014; Bernardo & Welch 2001; Bitler, Moskowitz & Vissing-Jørgensen 2005; Busenitz & Barney 1997; Cooper, Woo & Dunkelberg 1988; Forbes 2005; Meza & Southey 1996; Moskowitz & Vissing-Jorgensen 2002; Salamouris 2013).

In a survey sample of 3,000 entrepreneurs, around 80% believed that their chances of success were at least 70% which represents an optimistic expectation because 75% of start-up businesses do not survive beyond five years (Cooper, Woo & Dunkelberg 1988), while over-estimates of survival can

help to explain the persistence of entrepreneurship despite the fact that the returns to private equity are no higher than public equity (Moskowitz & Vissing-Jorgensen 2002). When asked for their assessment on real world questions (e.g., whether road accidents or cancer is the leading cause of death) entrepreneurs are found to have comparable accuracy as managers, but with significantly higher confidence (Busenitz & Barney 1997). The persistence of seemingly irrational over-confident entrepreneurs is the subject of Bernardo and Welch (2001), which draws on the insight that over-confidence contributes to entrepreneurs not imitating their peers. By not engaging in herding behaviour, entrepreneurs offer valuable information to their social group and other agents about their own private information signals (Bernardo & Welch 2001).

In the managerial setting, studies document a relationship between CEO overconfidence and corporate outcomes. Firms run by over-confident or optimistic CEOs have higher investment-cash flow sensitivities (Malmendier & Tate 2005, 2015), adopt less conservative accounting practices (Ahmed & Duellman 2013), are more likely to issue rate increasing performance sensitive debt (Adam et al. 2019), engage in more innovation in innovative and competitive industries (Galasso & Simcoe 2011; Hirshleifer, Low & Teoh 2012), have higher leverage ratios (Ben-David, Graham & Harvey 2013), tend to use short-term debt in preference to long-term debt (Landier & Thesmar 2009), are more likely to engage in earnings smoothing (Bouwman 2014), issue less accurate earnings guidance (Chen, G, Crossland & Luo 2015), have lower dividend payout ratios (Deshmukh, Goel & Howe 2013), are more acquisitive (Malmendier & Tate 2008) and issue more earnings misstatements (Schrand & Zechman 2012).[6]

Measures of CEO overconfidence in empirical corporate finance studies rely on variants of several proxies developed by Malmendier and Tate (2005): press-based and under-diversification measures.

[6] See Table A1 in Appendix A, which contains a list of the relevant papers in the field of financial economics which use and develop various measures of overconfidence.

Press-based measures are based on text search analysis of newspaper and business magazine articles which contain the name of the CEO in question and terms such as 'optimistic', 'optimism', 'confident' and 'confidence.'

Second, managerial under-diversification is used as a proxy for over-confidence because the human capital of the CEO is already closely tied to the growth prospects of the company they run. A rational CEO would not further expose himself to the company's fortunes by continuing to accumulate company stock through net buying. Moreover, a rational CEO would immediately exercise deep in the money executive call options as soon as those options vest to reduce his exposure to company specific risk. To continue to hold the options for any period post vesting – particularly until expiry – without exercising further exposes the CEO to idiosyncratic risk.

Our study uses founder-CEO status as a novel measure of CEO overconfidence, which to our knowledge, has not been utilised for this purpose and complements late executive option exercise proxies because it is also based on the principle that under-diversification equates to over-confidence. Founder-CEOs are shown to issue more optimistic earnings forecasts and the tone of their statements are more optimistic than other CEOs (Lee, Hwang & Chen 2017). If the assumption that CEO under-diversification as a measure of over-confidence is correct, founder-CEO status offers an alternative proxy for managerial under-diversification because a founder's financial and non-financial wealth are closely tied to the company's fortunes. Specifically, they are exposed via their pay, ownership stake and any emotional or psychological attachment they have to the firm. Our use of founder-status as a proxy for CEO overconfidence also draws on the social psychology literature cited above which suggests that entrepreneurs exhibit overconfidence.

Heaton (2002) develops a model of managerial optimism which generates a pattern of under- and over-investment. First, optimistic managers are reluctant to raise external finance because they

believe that capital markets under-value their debt and equity securities. They are thus willing to forgo positive-NPV projects which leads to lower than optimal investment (i.e., under-investment). Second, optimistic managers over-estimate the expected returns from the firm's projects and thus are willing to invest in projects which the market believes have negative NPVs when there is an abundance of free cash flow. This leads to higher than optimal investment (i.e., over-investment).

Malmendier and Tate (2005) offer evidence that is consistent with the pattern of under- and over-investment predicted by the model developed in Heaton (2002). Specifically, they find that firms run by over-confident CEOs – those who are over-exposed to company stock by various measures or associated with words such as 'optimistic' and 'confident' in press articles - have higher investment-cash flow sensitivities than firms run by rational CEOs. The key finding that overconfident CEOs have higher investment-cash flow sensitivities is subject to the use of lagged measures of free cash flow; the relationship is not robust when contemporaneous free cash flow is used (Malmendier & Tate 2015).

Closely related to Malmendier and Tate (2005) and based on our novel measure of CEO optimism, the following hypothesis represents a test of the model of managerial optimism and corporate investment developed by Heaton (2002).

H1. *ASX-listed firms run by over-confident CEOs – as proxied by founder-CEOs - have higher investment to cash flow sensitivities than firms run by professionally hired CEOs.*

We address endogeneity of firms' financing constraints by exploiting the global financial crisis as a natural experiment, which represents an exogenous shock that reduced firm cash flows and increased financing constraints. Our findings are consistent with our results over the entire period of

analysis; there is no difference in investment to cash flow sensitivities between founder-CEO and professionally hired-CEO firms in the financial crisis. This leads to our second hypothesis.

H2. *During the global financial crisis when confronted with an exogenous increase in financing constraints and reduction in cash flow, ASX-listed firms run by over-confident CEOs reduced their investment by more than firms run by professionally hired CEOs.*

In additional robustness checks, we hypothesise that firms run by overconfident CEOs hold less cash and have lower dividend payout rates than other firms, which appears to be consistent with the view that over-confident CEOs use resources that are available to pursue growth strategies. It is reasonable to expect that firms run by an overconfident CEO – who over-estimates the profitability of projects she undertakes as depicted in Malmendier and Tate (2005) and Malmendier and Tate (2015) - would have a lower dividend payout rate and hold less cash than other CEOs. Consistent with this view, firms run by over-confident CEOs are shown to have lower dividend payout ratios than firms run by under-confident CEOs (Deshmukh, Goel & Howe 2013).[7] This leads to our final two hypotheses.

H3a. *ASX-listed firms run by overconfident CEOs have lower dividend payout rates than other firms.*

H3b. *ASX-listed firms run by overconfident CEOs have lower cash balances than other firms.*

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[7] Contrary to our intuition, over-confident CEO firms are found to have higher than average cash holdings (Chen, Y-R, Ho & Yeh 2020).

Section 3 - Methodology

We test H1 which states the sensitivity of investment to cash flow is higher for founder-CEOs using the following general regression specification:

(1) $$\boldsymbol{Ii(t) = \beta 0 + \beta 1\, CFi(t-1) + \beta 2 \ln(\text{Assets}) i(t-1) + \beta 3 Qi(t-1) + \beta 4 DFCEOi(t) + \beta 5\, [CFi(t-1) * FCEOi(t)] + \varepsilon i(t)}$$

where I is investment, CF is cash flow, Q is the ratio of the market value of equity over the book value of equity and $DFCEO$ is the overconfidence measure, a dummy variable corresponding to a value of 1 for founder-CEO firms and 0 otherwise. Investment is the net addition to property, plant and equipment while cash flow is earnings before extraordinary items plus depreciation & amortisation. Both variables are scaled by the value of total assets lagged by one year. The coefficient of interest is $\beta 5$, the interaction term between the cash flow variable and founder-CEO dummy. The null hypothesis is that null hypothesis is that $\beta 5 = 0$, while the alternative hypothesis is that it is greater than zero.

We estimate the regression equation (1) through OLS and adjust for year fixed effects through the inclusion of year dummies, adjust standard errors for firm cluster effects and include industry dummy variables. We report standard errors by clustering the observations within each firm, which effectively addresses problems associated with serial correlation of the error term and heteroskedasticity common to panel data sets (Peterson 2007).

For the financial crisis, we estimate the following regression – corresponding to H2 - where the dependent variable corresponds to the annual change in investment for the i^{th} company between 2009 and 2010, scaled by the value of assets for 2009. The cash flow variable is also expressed in

terms of delta. The coefficient of interest $\beta 5$, is on the interaction term between the delta cash flow variable and founder-CEO dummy variable.

$$(2)\quad \boldsymbol{\Delta Ii(2010) = \beta 0 + \beta 1\, \Delta CFi(2009) + \beta 2\, \ln(\text{Assets})i(2009) + \beta 3Qi(2009) + \beta 4DFCEOi(2009) + \beta 5\, [\Delta CFi(2009) * FCEOi(2009)] + \varepsilon i(t)}$$

For H3a and H3b, we estimate the following regressions.

$$(3a)\quad \boldsymbol{DIVi(t) = \beta 0 + \beta 1\, \ln(\text{Assets})i(t) + \beta 2Qi(t) + \beta 3ROAi(t) + \beta 4DFCEOi(t) + \varepsilon i(t)}$$

$$(3b)\quad \boldsymbol{CASHi(t) = \beta 0 + \beta 1\, \ln(\text{Assets})i(t) + \beta 2Qi(t) + \beta 3ROAi(t) + \beta 4DFCEOi(t) + \varepsilon i(t)}$$

DIV denotes dividends paid and CASH denotes cash and equivalents on the balance sheet. Both the dependent variables are scaled by the value of total assets lagged by one year. The coefficient of interest, $\beta 4$, in both regressions is on the dummy founder-CEO variable. In (3a), the hypothesis tested is that $\beta 4 < 0$ and in (3b) the hypothesis tested for is also that $\beta 4 < 0$, consistent with the view that firms run by overconfident CEOs have lower dividend payout rates and maintain lower cash balances than other firms. As per the regression equation for H1, we estimate the regressions (3a) and (3b) through OLS and adjust for year fixed effects through the inclusion of year dummies, adjust standard errors for firm cluster effects and include industry dummy variables.

Section 4 – Data Description and Results

The dataset on company founders is hand collated from 2007 to 2020. The universe selected is the real time constituents of the All Ordinaries Index, which represents a benchmark in the Australian market, composed of up to the largest five hundred ASX listed stocks by market capitalisation.[8] Given the large number of non-survivors over this fourteen year period, we undertook our search on 1,257 companies.

For each of these companies, various sources are used to identify the year in which the company was founded and/or incorporated, who the founder(s) was, what title the founder had with the company at listing, and whether the role has changed. For each founder company we identify – where the founder has had some active involvement with the company since 2007 – we track how his title has changed through to 2020. If the company founder resigns from the CEO role and departs the company or migrates to a director role on the board, he is no longer coded as a founder-CEO. Sources include Morningstar DatAnalysis, annual reports, ASX releases, prospectuses and various web sources.

Company founders are selected based on their active involvement in the company as a senior executive and/or board director. At this stage, we have hand-collected ownership data for company founders only for a portion of the period 2007 to 2020 and therefore are not in a position at this point to include ownership data in our analysis.

[8] Unlike other commonly used benchmarks in Australia, notably the ASX/S&P 200 and ASX/S&P 300 indices, inclusion into (and exclusion from) the All Ordinaries is conditional on non-free float adjusted market capitalisation.

Table B1 in Appendix B contains a list of the financial variables used in the analysis and their descriptions.

The total number of stocks in the All Ordinaries has varied from a minimum of 485 (2007) to a maximum of 500 (2013 and 2020) – see Table B2. The number of founder-CEO stocks as a percentage of the number of constituents of the All Ordinaries ranges from a minimum of 7.9% (2011) to a maximum of 12.9% (2018). This representation of founder-CEO companies is broadly consistent with the evidence in the S&P500 in the United States (Fahlenbrach 2009). The number of founder-CEO stocks as a percentage of the constituents in the All Ordinaries is depicted loosely as a U-shape during our period of analysis.

There are three sectors in which the representation of founder-CEOs is higher than 20% of all stocks that belong to the sector and are listed in the All Ordinaries: technology, travel & leisure and telecommunications (see Table B3). All ICB Supersectors, except for three, have some founder-CEO representation. The three are banks, chemicals and utilities. We account for industry effects by including industry dummies in our regression analyses.

Summary statistics based on averages and two sample t-tests with unequal variances show that ASX-listed founder-CEO firms are significantly smaller than firms with professionally hired CEOs, have a higher Q ratio, higher return on assets, are less capital intensive, exhibit higher dividend payout rates and hold more cash on their balance sheets (see Table B4). There is no significant difference in the cash flow to assets ratio between the two categories of firms.[9]

[9] It is noteworthy that in an appraisal of his long-time collaborator's approach, Kenneth French says of Eugene Fama…'He rarely uses a formal model to motivate his empirical work and when he turns to the data he says, "If you can't see it in the averages, it's probably not there."' (Fama, EFa, Cochrane & Moskowitz 2017).

While the focus of our study is the estimation of investment to cash flow sensitivities for firms run by overconfident CEOs, we report the time series of the mean ratio of capex to assets and cash flow to assets ratio since 2007. After remaining in double digits for most of the six year period to 2012, since then the mean capex to assets ratio across the constituents of the All Ordinaries has shifted lower to range from as low as 6% in 2016 to a high of 8.5% in 2018 (see Table B5). The mean cash flow to asset ratio across the constituents of the All Ordinaries has not exhibited the same downward trend, remaining within the range of 5% to 6% for most of the eleven years to 2017 and increasing to over 6% for each of the three years since 2018 (see Table B6).

Table B7 contains the key OLS results from regression (1) in which we estimate investment to cash flow sensitivities. Controlling for size and Q, the coefficient on the cash flow variable is positive and significant at the 1% level of significance. The coefficients on the size and Q variables are also significant at the 1% significance level. The signs of the coefficients indicate that larger firms those with a high Q exhibit lower capital intensity. In the second column, we add the variables of interest, our measure of CEO overconfidence. Both the founder-CEO dummy variable and the interaction term of the cash flow variable and founder-CEO dummy are not statistically significant. This result does not support the hypothesis that firms run by overconfident CEOs are associated with heightened investment to cash flow sensitivities.

Table B8 contains the OLS results from regression (2), which focuses on estimating the investment to cash flow sensitivity during the global financial crisis. Firm cluster effects are not adjusted for in the first column and they are in the second column. The coefficients on the interaction variable – which is the variable of interest – yield the correct sign but are not statistically significant. When faced with

an exogenous shock to financing constraints and cash flows in the financial crisis, firms run by overconfident CEOs did not appear to under-invest.

In the final set of regressions estimated, we report that firms run by overconfident CEOs pay out significantly more dividends as a share of assets and hold significantly more cash than firms run by professionally hired CEOs. The coefficients on the dummy founder-CEO variable are positive and significant at the 1% and 5% levels respectively (see Table B9). It is also noteworthy that firms with the following characteristics have higher dividend payout rates and are each significant at the 1% level: low assets, high Q and high ROA.

Section 5 – Concluding remarks

Our findings for the Australian market offer little evidence in support of a link between CEO overconfidence and corporate investment; founder-run firms – our proxy for CEO overconfidence - are not associated with heightened investment to cash flow sensitivities over the period 2007 to 2020. In various robustness checks, our use of the global financial crisis as a natural experiment shows that when confronted with an exogenous increase in financing costs, overconfident CEOs in Australia did not reduce their company's capital expenditures conditional on cash flows any more than rational CEOs. Further, ASX-listed firms run by overconfident CEOs tend to hold more cash and pay out higher dividends, which is not consistent with conventional wisdom that overconfident CEOs use resources available to them to execute growth strategies, stemming from their propensity to over-estimate the returns from projects they undertake.

Founder-CEO status is commonly used as a proxy for CEO power and managerial discretion (Adams, RB, Almeida & Ferreira 2005), including with respect to entrenchment (Morck, Shleifer & Vishny 1988). Our study suggests that not just agency theory, but behavioural corporate finance can draw on insights gleaned from the corporate behaviour and performance of firms run by founder-CEOs. Further, our novel use of founder-CEO status as a measure of overconfidence delivers two key benefits. It helps to address concerns around endogenous matching that arises from boards selecting CEOs with personality traits and attributes that are seen to be desirable. Second, it complements the widely used measure of deferral of option-exercise which is also based on the principle of CEO under-diversification. The development of additional measures of CEO overconfidence such as founder-CEO status could become more important if CEOs choose to more carefully manage their reputational risk around the signalling associated with insider selling, particularly in light of widespread adoption of CSR practices.

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Appendix A

Table A1: Empirical papers on CEO overconfidence and corporate outcomes

Author(s) & Year	Period of analysis	Universe of stocks	Dependent variable(s)	Independent variable(s) – Measure of overconfidence	Endogeneity addressed?	Key findings
Adam, Burg, Scheinert, Streitz (2019)	2002-2010.	ExecuComp (2,434 firms).	Performance sensitive debt.	Malmendier & Tate Longholder measure.	No	Firms with overconfident CEOs are more likely to issue rate increasing performance sensitive debt than regular debt.
Aghazadeh, Sun, Wang, Yang (2018)	1996-2012	na	Cost of equity capital	Principal component estimated from the Melmendier&Tate executive option based measures.	Yes (firm fixed effects).	The key finding is a non-linear relationship between CEO overconfidence and a firm's cost of equity capital; CEO's with a moderate level of CEO overconfidence are associated with the lowest cost of equity capital.
Ahmed, Duellman (2013)	1993-2009	S&P 1500 firms. Financial services firms and insurance firms are removed, leaving a final sample of circa 700 firms.	Financial reporting behaviour	Malmendier & Tate executive option based measure (67% ITM options) and net buying of company stock by CEO. Two additional measures include: capex above the industry median and excess asset growth (relative to sales growth).	Yes (first differences estimation).	Overconfident CEOs engage in less conservative accounting, consistent with overconfident managers over-estimating the returns from their firms' projects. Proxies for the strength of board monitoring do not ameliorate this effect.
Banergee, Humphrey-Jenner, Nanda	1992-2011	ExecuComp (circa 2,000 firms).	Firm value, CAPEX, beta, return volatility, cash holdings, and R&D.	Executive option and press-based measures.	Yes (firm fixed effects).	Following the enactment of SOX (2002), overconfident CEOs reduce overinvestment and risk taking, enhance firm value, improve operating performance and lift dividend payout. The findings are interpreted as being consistent with greater board independence (mandated by SOX) being associated with better outcomes for firms with overconfident CEOs.
Ben- David, Graham, Harvey (2013)	2001-2011	Duke University Survey (quarterly) of CFOs. Final sample of 757 firms.	Corporate policies, including investment and debt financing.	Measures of over-precision based on CFO one year and ten-year forward market wide stock return responses, and IRR estimates for own-firm projects.	No	Firms with CFOs exhibiting the greatest level of overprecision or miscalibration, and optimism with respect to long range market wide tend to pursue more aggressive corporate policies, reflected in higher investment intensities and leverage ratios.

Bouwman (2014)	1980-1994	477 largest publicly traded U.S. firms. A firm must appear no less than four times in the Forbes 500 from 1980 to 1994. Final sample contains 210 firms.	Various proxies for the level of earnings smoothing and earnings surprises.	Malmendier & Tate's executive stock options measures.	Yes	The author develops a model in which optimistic managers over-estimate future earnings and are therefore more willing to borrow from those earnings to boost current earnings, if necessary, than a rational manager. Consistent with the model, optimistic CEOs are more likely to engage in earnings smoothing, and their earnings surprises are smaller (although just as likely for optimistic and rational CEOs). The author uses the term (over)optimism in preference to overconfidence.
Campbell, Gallmeyer, Johnson, Rutherford, Stanley (2011)	1992-2005	ExecuComp (over 2,000 firms).	Forced CEO turnover.	Stock option exercise-based measures and net stock buying measure.	Yes	Over-optimistic CEOs and under-optimistic CEOs are more likely to be subject to forced turnover than moderately optimistic CEOs, in firms which are well governed. The findings are interpreted as supporting the thesis that vigilant boards are more likely to remove over and under-optimistic CEOs because they have a propensity to over and under-invest respectively.
Chen, Crossland, Luo (2015)	1994-2008	ExecuComp (578 firms)	Change in management forecast errors (scaled by share price).	Press based measure, option-based measure (non-exercise of 100% ITM executive options) and a separate index based on three measures: recent firm performance, media praise and CEO relative compensation.	No	Overconfident CEOs who issue voluntary earnings forecasts are more likely to be wrong for longer than rational CEOs, which the authors interpret as being consistent with overconfident CEOs suffering from self-attribution biases. Overconfident CEOs attribute past forecast errors to bad luck or external, one-off factors and are therefore less responsive to learning from past forecast errors when updating future earnings forecasts.
Deshumkh, Goel, Howe (2013)	1980-1994	477 largest publicly traded U.S. firms. A firm must appear no less than four times in the Forbes 500 from 1980 to 1994. From this original sample, financial and utilities are filtered out resulting in a final sample of 244 firms.	Dividend yield (ratio of total dividends paid to market value of equity). Dividend yield and dividend payout are used interchangeably by the authors.	Malmendier & Tate's executive stock options and press based measures.	Yes	The level of dividend payout is lower in firms that are led by overconfident CEOs. This finding is interpreted as overconfident CEOs – who are seen to be particularly averse to raising external finance – building up financial resources to fund future internal and external investment projects. The dividend payout is around 15% lower for overconfident CEOs than for rational CEOs, and the link between CEO overconfidence and lower dividend payouts is stronger for firms with low growth opportunities and lower cash flow.
Galasso, Simcoe (2011)	1980-1994	450 largest publicly traded U.S. firms. A firm must appear no less than four times in the Forbes 500 from 1980 to 1994. After filtering out financial, insurance and real estate sectors, the final sample is 290 firms.	Innovation (citation-weighted patent counts).	Executive stock options exercise (based on Malmendier & Tate's measures).	Yes (fixed effects model).	Firms with overconfident CEOs engage in more innovation, particularly in competitive industries; those characterised by strong product market competition. The findings are interpreted as overconfident CEOs having greater scope to influence their firm's strategic direction than rational CEOs.

Graham, Harvey, Puri (2013)	2005/2006.	785 firms (based on survey respondents).	M&A activity and capital structure decisions.	Psychometric tests administered to CEOs.	Yes	CEOs tend to be more risk tolerant and optimistic than other members of the population in the United States. Risk tolerant CEOs tend to engage in more acquisitive behaviour while optimistic CEOs tend to pursue more aggressive capital structures, particularly in the use of short-term debt.
Hilary, Hsu (2011)	1994-2007	FirstCall database (5,768 management forecasts).	Management forecast error.	Management earnings forecast accuracy over four quarters	Yes	A model of endogenous CEO overconfidence is developed, in which overconfidence arises from earnings forecast accuracy. CEOs with strong accuracy over a four-quarter period subsequently tend to issue less accurate earnings forecasts. Analysts and investors discount the forecasts from overconfident CEOs more than CEOs with a poor recent forecasting history.
Hirshleifer, Low, Teoh (2012)	1993-2003	1,771 firms (ExecuComp). This represents the final sample after excluding financial firms and utilities.	Return volatility, innovation, patents & patent citations, efficacy of R&D investment.	Executive stock options exercise and press-based proxies of overconfidence.	Yes	Firms with overconfidence CEOs are more innovative (proxied by R&D scaled by assets), exhibit higher return volatility, have higher patents and patent citations, and more effective R&D spending. The finding of a positive link between CEO overconfidence and innovation holds only in innovative industries. The authors suggest that their findings might explain why growth firms tend to select overconfident CEOs; because they are more effective innovators than other CEOs. Therefore, for some firms it might be optimal or efficient to choose an overconfident CEO.
Hribar, Yang (2016)	2001-2010	ExecuComp (2,179 firms).	Management earnings forecasts.	Executive options- and press-based measures.	Yes	Overconfident CEOs are more likely to issue voluntary earnings forecasts and those forecasts are less accurate than those made by rational CEOs.
Kolanski, Li (2013)	1986-2006	Various samples used.	Acquisition behaviour and announcement returns.	CEO insider purchases of own company stock (which are followed by negative abnormal returns within the next two calendar years).	Yes	Overconfident CEOs engage in more acquisitive behaviour, including undertaking diversifying acquisitions. The announcement effect of acquisitions undertaken by overconfident CEOs is more negative than the average acquisition. Independent boards tend to constrain the acquisitive behaviour of overconfident CEOs and are effective in reducing the extent of value destructive acquisitions.
Lee, Lu, Wang (2019)	2005-2014	Financial firms and utilities are excluded (less than 1,000 firms).	Stock price crash risk (Negatively skewed returns)	Executive options-based measure.	Yes (Generalised method of moments estimation).	Stock returns of firms with overconfident CEOs are subject to greater crash price risk than other firms, reflected in greater negative skewness. The positive relationship between CEO overconfidence and stock price crash risk is moderated for overconfident CEOs who preside over firms that rate poorly on Corporate Social Responsibility. The authors suggest that investors are less surprised by negative news from overconfident CEOs with poor CSR ratings.
Malmendier; Tate (2005)	1980-1994	477 largest publicly traded U.S. firms. A firm must appear no less than four times in the Forbes 500 from 1980 to 1994. Fortune 500 contains detailed information on CEO stock and options holdings. After excluding financial firms and utilities, the final sample is 337 firms.	Investment-cash flow sensitivity	Late exercise of company stock options post-vesting period and net buying of company stock.	Yes (control for industry and firm effects).	Overconfident CEOs over-estimate the returns they can generate from internal projects and are reluctant to issue new equity because they believe outside investors under-value their company. Investment to cash flow sensitivity is greater for overconfident CEOs, particularly in equity dependent firms.

Malmendier; Tate (2008)	1980-1994	394 largest publicly traded U.S. firms. A firm must appear no less than four times in the Forbes 500 from 1984 to 1994. Financial firms are included.	M&A activity and associated announcement returns.	Late exercise of company stock options, net buying of company stock and media coverage of 'confident' or 'optimistic' CEOs.	Yes	Overconfident CEOs are more likely to engage in acquisitive behaviour paid for from internal funds. The announcement effect is lower for these acquisitions.
Malmendier; Tate (2009)	1975-2002	S&P 500, MidCap 400, and SmallCap 600 firms. Final sample is 264 firms.	Stock performance, operating performance, CEO compensation, earnings management.	Award winning CEOs.	No	Superstar CEOs – those who have won prestigious awards and enjoy large press coverage – are associated with underperformance of stock returns and operating performance, have higher compensation and have a greater propensity to engage in earnings management than non-award-winning CEOs.
Malmendier; Tate (2011)	1980-1994	477 largest publicly traded U.S. firms. A firm must appear no less than four times in the Forbes 500 from 1980 to 1994. Financial firms and utilities are excluded. Final sample is 263 firms.	Level of equity financing; market leverage ratio.	Longholder measure: CEOs who hold options over company stock to expiry even though the option is at least 40% in the money. Press based measure of overconfidence.	Yes (fixed effects estimation strategy).	Overconfident CEOs are averse to issuing seasoned equity; conditional on tapping external investors, they raise less equity than their peers. They also tend to have higher leverage ratios. Other CEO traits and their relationship to firms' financing decisions are examined. Depression baby CEOs are debt averse and rely more heavily on internal sources of funding while CEOs who have served in the military are more aggressive in their financing decisions, reflected in higher leverage ratios.
Malmendier; Tate (2015)	1997-2012	ExecuComp (2,341 firms).	Investment-cash flow sensitivity	Longholder measure: CEOs who hold options over company stock to expiry.	Yes (exogenous shock to the pricing and availability of capital during the financial crisis; fall of 2007).	Long-holder measure is positively related to investment-cash flow sensitivity. Investment of overconfident CEOs is more sensitive to the rise in external funding costs during the financial costs than other CEOs.
Otto (2014)	1996-2005	Less than 1,000 firms.	CEO compensation.	CEO option exercise decisions and management earnings forecast errors.	No	Optimistic CEOs receive smaller stock option grants, fewer bonus payments and lower total compensation than other CEOs. The authors believe this finding reflects the fact that boards offer optimistic CEOs compensation with smaller high-powered incentives because they over-estimate the value of those incentives.
Phua, Tham, Wei (2018)	1993-2011	ExecuComp (final sample of 1,921 firms after financials and utilities are removed).	Various measures of employee and supplier commitment, including employee	Executive stock option-based measure, press based measure and unprofitable insider purchases of company own stock.	Yes	Overconfident CEOs offer strong leadership, reflected in greater engagement with and from employees and suppliers. The greater commitment is evident from suppliers tending to make larger relationship specific investments while employees exhibit lower turnover and have greater ownership.

			turnover and ownership.			
Schrand, Zechman (2012)	1990-2010	49 firms subject to SEC Accounting and Auditing Enforcement Releases (firms who issued earnings misstatements).	Earnings misstatements.	Executive stock option-based measure and an index based on four industry adjusted excess investment, industry adjusted acquisitions, industry adjusted debt to equity ratio and firms that issue convertible debt and/or preference shares. Dividend yield is also used separately.	No	Overconfident CEOs are more likely to issue intentional earnings misstatements.

Appendix B

Table B1: Variable descriptions

Cash flow to assets ratio (%)	$\frac{(Earnings\ before\ extraordinary\ items + D\&A)_t}{Total\ assets\ _{t-1}}$
Cash to assets ratio (%)	$\frac{Cash\ \&\ equivalents_t}{Total\ assets\ _t}$
Dividend payout rate (%)	$\frac{Dividends\ paid_t}{Total\ assets\ _{t-1}}$
Investment to assets ratio (%)	$\frac{(Net\ addition\ to\ property, plant\ \&\ equipment)_t}{Total\ assets\ _{t-1}}$
Return on assets, ROA (%)	$\frac{(Earnings\ before\ interest, tax\ and\ D\&A)_t}{Total\ assets\ _{t-1}}$
Size	ln (Assets)
Tobin's q or Q	$\frac{Stock\ market\ capitalisaion\ _t}{Book\ value\ of\ shareholders' equity\ _{t-1}}$

All financial variables are sourced from Datastream (Refinitiv). The variables are sourced annually as at 30 June each year for the period 2007-2020. This date is chosen because the financial year end for most ASX-listed companies is 30 June. Because most of the variables are scaled by the value of assets lagged by one year, total assets for all stocks are obtained for 2006 in order to calculate the variables from 2007.

Table B2: Frequency of founder-CEO firms vs professionally hired CEO firms

year_xao	ceofounder&xao 0	1	Total
2007	424	61	485
2008	439	56	495
2009	444	49	493
2010	451	47	498
2011	452	39	491
2012	450	40	490
2013	458	42	500
2014	449	47	496
2015	438	54	492
2016	437	58	495
2017	432	61	493
2018	431	64	495
2019	439	57	496
2020	436	64	500
Total	6,180	739	6,919

For each year in our sample at 30 June, we report the number of founder-CEO stocks that are constituents of the All Ordinaries (in the column entitled '1') and the number of stocks with professionally hired CEOs that are contained in the All Ordinaries (in the column entitled '0'). In our sample period, the total number of stocks in the All Ordinaries has varied from a minimum of 485 (2007) to a maximum of 500 (2013 and 2020), contained in the final column. The number of founder-CEO stocks as a percentage of the number of constituents of the All Ordinaries ranges from a minimum of 7.9% (2011) to a maximum of 12.9% (2018). While not graphically shown here, the number of founder-CEO stocks as a percentage of the constituents in the All Ordinaries is depicted loosely as a U-shape during our sample period of 2007 – 2020.

Table B3: Founder-CEO representation across sectors

ICB SUPRSECTOR NAME	ICB SUPRSECTOR CODE	Number of founder-CEO stocks (% All Ordinaries stocks)
Technology	1010	27.49
Travel and Leisure	4050	24.84
Telecommunications	1510	23.43
Retailers	4040	16.50
Consumer Products and Services	4020	13.99
Financial Services	3020	13.98
Health Care	2010	12.40
Automobiles and Parts	4010	11.31
Real Estate	3510	11.23
Insurance	3030	9.92
Media	4030	8.15
Energy	6010	7.75
Basic Resources	5510	6.73
Industrial Goods and Services	5020	6.20
Construction and Materials	5010	6.07
Personal Care, Drug and Grocery Stores	4520	3.57
Food, Beverage and Tobacco	4510	3.43
Banks	3010	0.00
Chemicals	5520	0.00
Utilities	6510	0.00

For each ICB Supersector, we calculate the number of founder-CEO stocks for each year in our sample and divide this by the total number of stocks in the All Ordinaries that belong to the same ICB Supersector. The number reported in this table represents the mean across all the years in our sample, 2007 – 2020.

Table B4: Summary statistics for Founder-CEO and Professional-hire CEO stocks

	Founder-CEO	Professional hire CEO	Founder-CEO	Professional hire CEO	Difference: Mean	Difference: Standard error
	Observations		Mean		Founder minus Professional hire	
Assets (million AUD)	729	6000	890	2591	-1701***	91.9
Tobin's q	725	5837	4.39	2.69	1.70***	0.16
ROA (%)	708	5772	6.43	1.34	5.09***	0.83
Investment (%)	705	5662	8.13	9.50	-1.36***	0.53
Cash flow (%)	663	5508	6.24	5.73	0.51	0.32
Dividends (%)	707	5768	6.09	3.41	2.68***	0.24
Cash & equivalents (%)	592	4810	48.75	43.62	5.13***	1.33

For our sample period, 2007-2020, for the two categories, Founder-CEO and Professional-Hire CEO stocks, the table reports key summary statistics across seven financial variables. All seven financial variables are winsorized at the 2.5th and 97.5th percentiles. The final four financial variables are expressed as % because they are scaled by total assets lagged by one year. Thus, Investment for example, corresponds to the ratio of investment to lagged assets. Across the two CEO categories, the summary statistics reported are the number of observations and means. The final two columns report the differences in means and standard errors, where the difference is expressed as Founder-CEO minus Professional Hire-CEO. *** denotes significance at the 1% level, ** at the 5% level and * at the 10% level based on a two sample t-test with unequal variances.

Table B5: Time series of investment to lagged assets ratio

year_xao	Summary of capex%assets Mean	Std. Dev.	Freq.
2007	13.299116	22.304255	453
2008	14.466286	20.875428	453
2009	9.0468348	12.651897	460
2010	10.660687	19.626116	469
2011	11.321896	15.997477	458
2012	12.332115	17.784291	461
2013	9.8638571	14.511987	467
2014	7.2115991	9.8589372	459
2015	6.7246667	8.8103006	465
2016	6.0451502	8.7271904	466
2017	7.1425289	11.395688	467
2018	8.4828541	15.154067	466
2019	7.2465821	9.98619	469
2020	6.510565	8.5975029	354
Total	9.3391205	15.01854	6,367

The table reports summary statistics for the investment rate for the stocks in the All Ordinaries each year in the period of analysis, 2007-2020. The investment rate is calculated for each stock as the annual net addition to property, plant & equipment, scaled by the value of assets lagged by one year. The number of constituents of the All Ordinaries where it was possible to calculate this variable is contained in the final column entitled 'Freq'. The number is lower than the total number of constituents due to the relevant data being unavailable for some stocks. The number for 2020 (354) is materially lower than prior years because not all constituents of the All Ordinaries have reported their full year results as at the time of writing or for some which have, their financial data are yet to be updated in Datastream (Refinitiv).

Table B6: Time series of cash flow to lagged assets ratio

year_xao	Summary of cashflow%assets Mean	Std. Dev.	Freq.
2007	5.6991289	7.4276942	444
2008	5.7602995	6.8625122	448
2009	5.399921	6.8165631	460
2010	4.7922581	7.7286981	472
2011	5.4768044	6.6209884	459
2012	5.6868706	7.1369023	465
2013	5.9838337	7.0209665	474
2014	5.6306601	6.5835118	453
2015	5.5698346	6.1185249	453
2016	5.3553508	7.5169402	455
2017	5.8654541	7.1442092	453
2018	6.1116013	6.8209178	452
2019	6.7268222	6.9414933	456
2020	8.2002327	10.058916	227
Total	5.7868107	7.1507173	6,171

The table reports summary statistics for the ratio cash flow to assets for the stocks in the All Ordinaries each year in the period of analysis, 2007-2020. The variable is calculated for each stock as annual earnings before extraordinary items plus depreciation & amortisation, scaled by the value of assets lagged by one year. The number of constituents of the All Ordinaries where it was possible to calculate this variable is contained in the final column entitled 'Freq'. The number is lower than the total number of constituents due to the relevant data being unavailable for some stocks. The number for 2020 (227) is materially lower than prior years because not all constituents of the All Ordinaries have reported their full year results as at the time of writing or for some which have, their financial data are yet to be updated in Datastream (Refinitiv).

Table B7: OLS Results – Dependent Variable: Investment to lagged assets ratio

Independent variables	(1)	(2)
Cash Flow, CF (t-1)	0.111***	0.115***
	(0.039)	(0.042)
Size (t-1)	-0.713***	-0.711***
	(0.184)	(0.107)
Q (t-1)	0.230**	0.225**
	(0.106)	(0.107)
Dummy_Founder-CEO		0.324
		(1.120)
Dummy_Founder-CEO*CF (t-1)		-0.028
		(0.096)
constant	18.053***	18.0101***
	(2.904)	(2.933)
Year fixed effects?	yes	yes
Industry dummies?	yes	yes
Firm cluster effects?	yes	yes
Observations	3,023	3,023
R squared	0.2735	0.2736

The table reports the key results from a regression of investment as the dependent variable. Investment is measured as net additions to property, plant & equipment scaled by the lagged value of total assets. The Cash Flow (CF) variable is measured as Earnings before extraordinary items plus depreciation & amortisation scaled by the lagged value of total assets. Size is the natural logarithm of total assets and Q is the ratio of price to book value. CF, Size and Q are each lagged by one year. The founder-CEO dummy variable attains a value of 1 if the CEO is the company founder as at 30 June of the year in question; and a value of 0 otherwise. We account for year fixed effects through the inclusion of year dummy variables and report standard errors that adjust for firm cluster effects. Industry dummy variables are included. The entire sample period is 2007-2020. The first year of the sample is effectively dropped because of the use of lagged values for the independent variables, CF, Size and Q. Thus, the two regressions reported are estimated for the period 2008-2020. Because the independent variables – with the exception of the founder-CEO dummy variable – are lagged by one year, the inclusion of the year 2020 in the period of analysis does not reflect the impact that COVID-19 has had on corporate investment. In our specification, we need to wait for the 2021 year to estimate the impact of the lagged independent variables on investment.

Table B8: OLS Results in the Financial Crisis –
Dependent Variable: Delta of investment to lagged assets ratio

Independent variables	(1)	(2)
Cash Flow Delta, (t-1)	0.01	0.01
	(0.086)	(0.098)
Size (t-1)	-0.018	-0.018
	(0.261)	(0.237)
Q (t-1)	0.074	0.074
	(0.15)	(0.146)
Dummy_Founder-CEO (t-1)	0.229	0.229
	(1.19)	(1.170)
Dummy_Founder-CEO*Cash Flow Delta (t-1)	0.153	0.153
	(0.250)	(0.286)
constant	-0.909	-0.909
	(3.901)	(3.531)
Year fixed effects?	no	no
Industry dummies?	yes	yes
Firm cluster effects?	no	yes
Observations	275	275
R squared	0.035	0.035

The table reports the OLS results from two cross-sectional regressions during the financial crisis; the first specification doesn't adjust for firm cluster effects and the second specification does. The dependent variable is the annual difference in corporate investment between 2009 and 2010 scaled by the value of total assets lagged by one year, notably in 2008. We label this variable the delta of investment to lagged assets ratio. The delta cash flow variable is measured in the same way, except the numerator is the annual difference between 2008 and 2009 of earnings before extraordinary items plus depreciation & amortisation. Year fixed effects are unnecessary because this does not represent a panel data set.

Table B9: OLS Results – Dependent variables: Dividends and cash balances

Independent variables	(1): DV: Dividend to assets ratio	(2): DV: Cash to assets ratio
Size	-0.491***	-2.438***
	(0.094)	(0.952)
Q	0.458***	1.141***
	(0.601)	(0.387)
ROA	0.119***	-0.062
	(0.01)	(0.059)
Dummy_Founder-CEO	1.36***	9.438**
	(0.456)	(4.721)
constant	8.692	55.465***
	(1.342)	(12.763)
Year fixed effects?	yes	yes
Industry dummies?	yes	yes
Firm cluster effects?	yes	yes
Observations	3615	2895
R squared	0.425	0.265

The table reports the OLS results from two regressions estimated over our sample period, 2007-2020. In specification (1), the dependent variable is the dividend payout rate, which is computed as the ratio of annual dividends paid scaled by the value of total assets lagged by one year. In specification (2), the dependent variable is the level of cash & equivalents reported on the balance sheet scaled by the contemporaneous value of total assets. The four regressors include size, which is measured as the natural logarithm of lagged total assets, Q ratio, ROA and the founder-CEO dummy variable, which attains a value of 1 if the CEO is the company founder as at 30 June of the year in question. Year fixed effects and firm cluster effects are adjusted for and industry dummies are included.