Market for Corporate Control, Takeover Defense & Corporate Investment Efficiency

Shu Yin

Accounting, Auditing and Control

Erasmus School of Economics

Supervisor: Jihun Bae

Co-reader: Rob van der Wal

Abstract: This study analyzes the relationship between market for corporate control and investment efficiency. I find firm with more anti-takeover provisions, suggesting a weaker market for corporate control, are more likely to over-invest in non-capital investments. Besides, this research studies the joint effect of product competition and market for corporate control on firm's investment. I find in a competitive industry, market for corporate control has a stronger power of reducing the likelihood of investment inefficiency. These results provide evidence on managerial wealth theory that anti-takeover provisions exaggerate investment inefficiency. Product competition and market for corporate control and have a synergic effect in reducing free cash flow for inefficient investment.

Keywords: market for corporate control, anti-takeover provision, E Index, investment efficiency

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1 Introduction

This paper investigates how market for corporate control, measured by anti-takeover provisions, affects a firm's investment efficiency. Prior research finds market for corporate control increase the probability of incumbent management being taken over, and market admires such a governance mechanism with positive returns (Hirshleifer & Titman, 1990). Mitchell & Lehn (1990) find that management makes bad acquisitions are more likely to be taken over later. Giroud & Mueller (2011) find supporting evidence that firms with weak internal governance are more likely to be targeted, especially in non-competitive industry, indicating that market for corporate control helps supervise and mitigate inefficient management.

Antitakeover devices increase the cost of managerial displacement through hostile takeover and diminish market for corporate control (Dodd & Warner, 1983). Therefore, anti-takeover provisions (hereafter APTs) would intensify shareholder-management conflicts. However, DeAngelo & Rice (1983) suggest that ATPs may have either a positive or negative effect on a firm's profitability and shareholders' benefits. Brickley, Coles, & Terry (1994) find a positive relation between poison pills and stock return if outsiders have a dominant power in the boards, whereas Sundaramurthy, Mahoney, & Mahoney (1997) find that the stock market reacts negatively to firm's ATP implement. Therefore, previous research could be grouped into two parts: the ***managerial welfare hypothesis***, arguing that ATPs will diminish a firm's profitability as well as shareholders' interests, and the ***shareholder welfare hypothesis***, that ATPs will remit agency conflicts, as managers protected by ATPs will feel less pressure of being takeover due to their near-term performance and have more incentive to work for the interest of shareholders.

Zhao et al. (2012) find that managers protected by more antitakeover devices are less pressured and enjoy a "quiet life", being less aggressive in booming short-term performance, as they find a negative relationship between takeover defense and real earnings management. Their

conclusion bases on the assumption that short-term oriented managers cut off free cash flow for real activities, for instance, long-term investment. However, their research fails to touch the root. That is, whether managers efficiently use cash flow in profitable investments. Hence, by investigating the relationship between ATPs and real earnings management, Zhao et al. (2012) provide insufficient evidence on whether the consequence of ATPs on mitigating managerial myopia (and pursuing long-term orientation) is beneficial to shareholders or not.

Bebchuk et al. (2008) propose an "Entrenchment Index" (E Index) as a managerial power measurement and find a negative correlation between managerial entrenchment power and a firm's long-term performance. Gompers et al. (2003) suggest that more protected managers destroy long-term stock return through inefficient investment. Biddle et al. (2009) use takeover defense as a control variable while investigating the relationship between financial reporting quality and investment efficiency but do not find a significant result. Masulis, Wang, & Xi (2007) find managers protected by more ATPs indulge more value-destroying acquisitions, indicating an opportunistic behavior in non-capital investment.

I choose U.S. listed firms from the year 1999 to 2016 as my sample. My final sample consists of 13,634 observations of 1,693 U.S. listed firms in 34 industries. In line with previous literature (e.g., Biddle, Hilary, & Verdi, 2009; Richardson, 2006), I define investment efficiency as it undertakes positive NPV investments under the scenario of no market frictions. In other words, firms neither reject positive NPV projects (under-investing) or undertake negative NPV projects (over-investing). The level of over-/under- investment is the difference between a firm's real investment and expected investment, which is calculated by growth opportunity. I find a positive relationship between ATPs and the likelihood of a firm being over-investing in non-capital investment. Results are robust cross-sectionally. This result is

consistent with previous research (Masulis et al., 2007) that ATPs destroy shareholder's interest via over-investment, supporting the managerial wealth hypothesis.

Besides market for corporate control, product competition also serves as an exogenous governance mechanism. Previous literature proposes an either complementary or substitutes relation between product competition and inside governance mechanism. Cremers et al. (2008), Hay & Liu (1997), Holmström (1999), and Nickell (1996) find that takeover defense increases with the increase of market competition, suggesting a substitute relationship between market for corporate control and product competition as governance devices. Although Cremers et al. (2008) do not test whether the effect of those two mechanisms would be synergetic or interchangeable on firm's performance in, for example, a long-term investment side, their findings suggest the overall effect of ATPs on firm's investment efficiency would differ in the industry that a firm belongs to.

Therefore, I use the Herfindahl Index as a measurement of product competition and find it reduce the positive relationship between ATPs and (capital) over/under- investment. These results suggest that product competition help mitigate opportunistic managerial behavior. This paper also finds that more protected managers are more likely to pass up valuable non-capital projects (under-invest) in competitive industries.

This study contributes to current research in 2 aspects. Firstly, using the most recent data, I find a correlation between ATPs and investment inefficiency, directly giving evidence on managerial wealth hypothesis through investment channel. It answers the question that how the implementation of ATPs influence manager's behavior of distributing free cash flow. Besides, this study also shed light on relationship between two external governance mechanism: product competition and market for corporate control. However, the main limitation of this

study is that half of my total sample (from the year 2007 to 2016) have constant ATPs. It brings potential bias to my empirical results.

This paper proceeds as follows. The next section shows how I generate my research question and hypothesis from prior literature. Section 3 is variables definition and data description. In Section 4 I elaborate on my regression model and main results. In Section 5, I introduce an additional test to support my main research. Section 6 is the conclusion and limitation of this research. Appendix shows variables definition and additional tests.

2 Literature Review and Hypothesis Development

2.1 Corporate Governance, Market for Corporate Control and Anti-takeover Provisions (ATPs)

Previous research distinguishes corporate governance into internal governance mechanism (such as board of directors and block-holders) and external governance mechanism (such as market for corporate control and product competition and block-holders) (Brown, Beekes, & Verhoeven, 2011; Cremers & Nair, 2005). External governance mechanism is an essential role in monitoring and correcting opportunistic managerial behavior, no matter a complement theory or substitute theory holds. According to Cremers & Nair (2005), internal and external governance mechanism work together as a governance system in a firm. For instance, the presence of large active block-holders has a positive impact on a firm's long-run return if a firm has a strong market for corporate control (measured by takeover vulnerability), and vice versa. External governance mechanism, beyond the control of shareholders and board of directors, according to substitute theory, can efficiently monitor managers if the firm is under the risk of non-effective internal governance mechanism, for instance, that the board is doubted being controlled by the management.

The mechanism of market of corporate control can be taken as a competition of incumbent management for managing corporate resources. Under the managerial competition model, board of directors and institutional shareholders have no loyalty to incumbent managers and behave for the most interest of shareholders (Jensen & Ruback, 1983). Therefore, an ordinary shareholder's voting for management replacement or a hostile takeover may happen if the replacement cost is relatively low. Prior research finds market for corporate control increase the probability of incumbent management being taken over, and market admires such a governance mechanism with positive returns (Hirshleifer & Titman, 1990). Mitchell & Lehn (1990) find that management makes terrible acquisitions are more likely to be taken over later. Giroud & Mueller (2011) find supporting evidence that firms with weak internal governance are more likely to be targeted, especially in non-competitive industry, indicating that market for corporate control help supervises and mitigate inefficient management.

Anti-takeover devices increase the cost of managerial displacement through hostile takeover and diminish market for corporate control (Dodd & Warner, 1983). Therefore, anti-takeover provisions (hereafter APTs) would intensify shareholder-management conflicts. However, DeAngelo & Rice (1983) suggest that ATPs may have either a positive or negative effect on a firm's profitability and shareholders' benefits. Brickley, Coles, & Terry (1994) find a positive relation between poison pills and stock return if outsiders have a dominant power in the boards, whereas Sundaramurthy, Mahoney, & Mahoney (1997) find that the stock market reacts negatively to firm's ATP implement. Therefore, previous research could be grouped into two parts: the managerial welfare hypothesis, arguing that ATPs will diminish a firm's profitability as well as shareholders' interests, and the shareholder welfare hypothesis, that ATPs will remit agency conflicts, as managers protected by ATPs will feel less pressure of being takeover due to their near-term performance and have more incentive to work for the interest of shareholders.

2.2 The Managerial Welfare Hypothesis

Firms with a higher level of governance mechanism would mitigate agency cost by constraining opportunistic managerial behavior (Eisenhardt, 1989). Previous research suggests that market for corporate control plays a vital role in enhancing the firm's value and therefore, guarantee shareholders' interests (Gompers et al., 2003). On the contrary, managers are more likely to act in favor of their benefits when they are free from corporate governance or have a strong power over shareholders (Dodd & Warner, 1983). As ATPs increase the cost for replacing incumbent management, under managerial welfare hypothesis, feeling more secured and locked in current position, managers propose ATPs as a tactic of their self-security on current position and discretion, even at the expense of shareholders' benefits (Bebchuk et al., 2008). Stulz (1988) investigates the relation between ownership structure (shareholders' voting rights) and firm's financing decision as well as firm value and find supporting evidence that the higher fraction of managerial control over shareholder's voting rights, the harder a hostile takeover proceeds through proxy content, even the management predict that such a takeover act would be beneficial to shareholders.

In the highly cited study of Gompers et al. (2003), using a "Governance Index" (G - Index) to measure the magnitude of shareholders rights (or on the other hand, managerial entrenchment power), researchers test the effect of ATPs on firm's performance. Gompers et al. (2003) suggest that managers feel less disciplined if they are protected by more anti-takeover provision devices, and they are becoming more likely to make value-destroying decisions. They also find that firms with more ATPs yield lower abnormal returns and make more acquisitions. Correspondingly, Masulis et al. (2007) further explore managerial behavior in merger and acquisition from the bidder side. Their findings suggest that acquirers with more anti-takeover provisions are less subject to the disciplinary power of the market for corporate

control and are more likely to indulge in value-destroying acquisitions. These findings are in line with prior literature by Morck, Shleifer, & Vishny (1990) that acquirers make value-destroying acquisitions if managerial quality at the bidder firm is relatively low before the acquisition announcement, while managers extract substantial benefits from such empire-building acquisitions (Jensen, 1986; Masulis et al., 2007; Morck et al., 1990). Bebchuk et al. (2008) propose an "Entrenchment Index" (E - Index) as a managerial power measurement and find a negative correlation between managerial entrenchment power and firm's long-term performance, while portfolios with lower entrenchment receive a higher stock return. Masulis et al. (2007) process interaction research and find firms which undertake equity to acquire a public target suffer the lowest stock return during the announcement period.

2.3 The Shareholder Welfare Hypothesis

Mahoney, Sundaramurthy, & Mahoney (1997) find firms cut long-term investment on a larger scale after an unsuccessful takeover. Similarly, Jain (2012) find a significant decrease in free cash flow and cash holding rate in a firm after the adoption of anti-takeover laws, indicating that firm are likely to put their cash holdings into investments. These findings correspond to arguments of Stein (1989) that takeover pressures are likely to make less-protected managers boost their short-term earnings by manipulating real activities, mainly, cutting off cash flow for long-term investments. Dechow & Sloan (1991) and Graham & Harvey (2005) proceed with a survey study and report that managers sacrifice discretionary expenditures or capital investments to beat an earnings target. McNichols & Stubben (2008) find a negative relationship between real earnings management and subsequently fixed assets investment, supporting the argument that higher real earnings management will diminish the firm's long-term investment. Similarly, Bushee (1998) finds an adverse relation between short-term earnings and R&D expenses. In recent research, Flammer & Bansal (2017) find that more long-term investment, indicating a higher level of long-term orientation has a positive effect

on firm's operating performance as well as a positive abnormal stock return when a new R&D spending is announced. To conclude, there is a substitute relation between real earnings management and long-term investment, as real earnings management sacrifices long-term free cash flow and thus, delays the timing of long-term investment (Zhao & Chen, 2008; Zhao et al., 2012).

Following previous literature, Zhao et al. (2012) take a study on the effect of corporate governance, particularly, market for corporate control on firm's decision-making. They find that ATPs would have constraining effects on real earnings management. Zhao et al. (2012) explain their findings with myopia theory that managers are more prevented from being turned over and feel less pressure of being blamed for unsuccessful short-term performance and, as a consequence, having less incentive to manage earnings by reducing long-term investments. Takeover defense, as a countermeasure of managerial myopia, allows managers operating in a long-term, undertaking the most valuable projects according to the shareholders' benefits, rather than preventing themselves from takeover threats or hostile takeovers and behaving in a shortsighted view (Stein, 1989; Zhao et al., 2012).

All of these findings are logically consistent with shareholder welfare hypothesis, only holding the view that real-earnings management will result in lower future performance. However, the impact of real-activity earnings management on firm performance could be two-sided. Roychowdhury (2006) and Gunny (2010) argue that only real earnings management surpass earnings benchmark could harm sub-performance. Real earnings management for meeting benchmark will result in a further superior performance, as it enhances the firm's credibility, which is in favor of shareholders' benefits. In their further research, Zhao et al. (2012) also find consensus evidence. Hence, by investigating the relationship between ATPs and real

earnings management, Zhao et al. (2012) provide insufficient evidence on whether mitigating managerial myopia (and pursuing long-term orientation) be beneficial to shareholders or not.

Bebchuk et al. (2008) and Gompers et al. (2003) point it out that ATPs have an impact on a firm's long-term performance through investment decisions. Under the shareholder welfare hypothesis, however, Zhao et al. (2012) leave a query that whether expenditure changes in long-term investment represent that managers act for maximizing shareholders' benefits, that is, investment efficiency (Mahoney et al., 1997). Researching on interaction effect of variables, Jensen (1986) find that managers are more likely to pursue an empire-building investment if a firm has abundant free cash flow even though they have no investment opportunities that create positive NPV. Richardson (2006) find that firm with the high level of free cash flow is more likely to over-invest in a long-run, suggesting that firm with the highest level of free cash flow may not invest efficiently. Jensen (1986) and Szewczyk, Tsetsekos, & Zantout (1996) propose an agency cost of free cash flow theory that managers use abundant free cash flow in low-return investment which conflicts with shareholders' benefits. It would be interesting to see whether managers disgorge free cash flow into profitable investment opportunities or they just make a waste of it, under the protection of high-level ATPs.

Therefore, I generate my research question as below,

How does Market for Corporate Control (as measured by ATPs) affect a firm's investment efficiency?

2.4 Market for corporate control and firm investment

According to the findings of Zhao et al. (2012), ATPs reduce managerial myopia and make a manager more long-term oriented. It can be further explained by the free cash flow theory (Jensen, 1986), that the management is more likely to reuse excess cash flow in investment. In robustness check, Richardson (2006) take governance mechanism into account when analyzing

investment-free cash flow theory and find firms lacking market for corporate control (represented by the presence of staggered boards and/or poison pills) generate higher over-investment of free cash flow.

Consistent with the research above, Gompers et al. (2003) find that firms with stronger shareholder power have relatively lower capital expenditure. They predict that the increasing level of take-over defensive devices will damage firm value through inefficient investment. Masulis et al. (2007) investigate bidders' merger and acquisition (M&A) activities and find managers protected by a higher level of ATPs are less disciplined and make more value-destroying acquisitions for an empire-building, suggesting an increased likelihood of over-investment. Opler, Pinkowitz, & Williamson (1999) provide some evidence in an accounting view. They investigate firms with excess cash flow from balance sheet cash information and find those firms have higher capital expenditures even investment environment is relatively poor.

In recent research, Bhojraj, Sengupta, & Zhang (2017) investigate how the amendment of anti-takeover laws affect firm's long-term value creation activities and find a significantly adverse effect on bad real earnings management if a firm is innovative and adopt an above-average level of ATPs. Their findings indicate that firms with a higher level of ATPs are more likely to put their additional free cash flow into innovation investment instead of real earnings management. Brown et al. (2011) and Chemmanur & Jiao (2012) that managers in innovative industries have more incentive to process long-term (innovative) projects instead of short-term ones.

However, the effect of increasing R&D investment can also be 2-sided. Lichtenberg & Siegel (1991), Sundaramurthy et al. (1997), and Szewczyk et al. (1996) find a positive market reaction to the firm's increasing R&D announcement. Bhojraj et al. (2017) find a positive short-term

stock return around the date of ATPs amendment adoption, for both non-innovative and innovative firms. However, Hubbard (1990) explores the role of agency problem played in a cash-investment relationship and finds firms increasing their investment by spending discretionary cash flow receive lower abnormal returns. Therefore, it is uncertain whether ATPs benefit shareholders through R&D investment channel.

Based on previous literature, I raise my first hypothesis as follows,

H1: Firm with a higher level of ATPs (suggesting a weaker market for corporate control) are more likely to invest inefficiently via over-investment.

2.5 Market for corporate control, product competition, and firm investment

Market (Product) competition plays an important role as an exogenous governance mechanism. Previous research finds a positive relationship between market competition and firm performance. Hay & Liu (1997), Inderst & Laux (2005) and Nickell (1996) find managers in a more competitive market have more incentive (or feel more pressured) to increase productivity, generate more profitable investment opportunities and behave more efficiently. One explanation is that market competition would mitigate agency cost, holding the substitute theory (Cremers et al., 2008). Tender firms regularly require their potential suppliers providing information in financial and other aspects, thereby reducing the costs of internal governance, especially when bidder competition is high among these suppliers. Cremers et al. (2008), Hay & Liu (1997), Holmström (1999), and Nickell (1996) find that takeover defense increases with the increase of market competition, suggesting a substitute relationship between market for corporate control and product competition as governance devices. They also find that both of these two devices increase if a firm has a stable relationship with its customers. Although Cremers et al. (2008) do not test whether the effect of those two mechanisms would be synergetic or interchangeable on the firm's performance in, for example, long-term investment

side, their findings suggest that the overall effect of ATPs on firm's investment efficiency would differ in the industry that a firm belongs to.

Giroud & Mueller (2011) investigate the role of product competition and weak governance. They find that managers in weak governance firms make value-destroying acquisitions and result in worse operating performance, lower firm value and lower equity returns, but only in non-competitive industries. Liao & Lin (2017) find the positive wealth effect of R&D spending is mainly driven by good-governance firms in non-competitive industries rather than competitive markets. These findings document that product competition and other governance mechanism has a synergic effect on promoting investment efficiency.

Therefore, I generate my second hypothesis as below,

H2: Relation between ATPs and investment inefficiency will be attenuated when product market competition is high.

3 Methodology

3.1 Variables Definition

Dependent Variable

I exam whether more ATPs adoptions would intensify the likelihood that firms deviate from their expected investments. Following previous literature (Biddle et al., 2009; Chen, Xie, & Zhang, 2017), I use the magnitude of over-/under- investment to measure investment efficiency. The firm-specific level of over-/under investment is measured by the difference between real investment and expected investment($Inv_{i,t}$), which is the residual of a regression below.

$$\text{Expected\_Inv}_{i,t} = \beta_0 + \beta_1 TQ_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

$\text{Expected\_Inv}_{i,t}$ is the expected average investment of all firms in each industry-year group. It is generated from growth opportunity, TQ[1] , which is the average change in each industry-year group Tobin's Q (Biddle et al. 2009, Hubbard 1998). For each firm, Tobin's Q is the market value of total assets, which is the book value of assets (Compustat item #6) minus book value of common equity (#60) plus the market value of common equity (#25 * #24), scaled by book value of total assets (#6), scaled by book value of firm's total assets (#6). The model is estimated cross-sectionally for each industry with at least 8 observations per year based on 2-digit SIC code (Cohen, Dey, & Lys, 2008).

For each firm, the total investment (TI) is calculated by the sum of capital expenditure (#128), R&D expenditure (#46), acquisitions (#129) minus sales of PPE (#107), scaled by lagged total assets (#6). Furthermore, I divide overall investment into capital investment (capital expenditure (#128) minus sale PPE (#107)) scaled by lagged PPE(#7), and non-capital investment (sum of R&D expenditure (#46) and acquisitions (#129)) scaled by lagged total assets (#6) (Biddle & Hilary, 2006; Biddle et al., 2009; Chen et al., 2017).

Abnormal investment (or unexpected investment), is the difference (error) between a firm's investment and expected average investment. It equals to the residual of regression which predicts expected investment in Eq.(1) (Biddle & Hilary, 2006; Chen et al., 2017).

Independent Variable

[1] Biddle et al. (2009) find similar results when using both Sales growth and Tobin's Q to represent the firm's growth opportunity. In unreported results, I use sales growth as an alternative test to calculate abnormal investment (investment inefficiency). Aligned with Biddle et al. (2009), I find similar results in my regressions when using Sales growth instead of Tobin's Q.

The IRRC release 24 antitakeover provisions (ATPs) in the years 1990, 1993,1998, 2000, 2002, and 2006. A higher level of ATPs enhances managerial entrenchment power and weakens market for corporate control. I use "Entrenchment Index" (E Index), as mentioned in the research of Bebchuk et al. (2008), to measure the level of takeover defense. E Index consists six out of 24 ATPs with high magnitude of entrenchment: staggered boards, limits to amend bylaws, limits to amend charter, supermajority to approve mergers, poison pills, and golden parachutes (Bebchuk et al., 2008). In unreported research, I further use Governance Index (G Index) introduced by Gompers et al. (2003) as a proxy of ATPs, consisting 24 anti-takeover provisions introduced by Investor Responsibility Research Center Institute (IRRC). A higher G Index indicates a lower power of market for corporate control.

Control Variables

Prior research (e.g. Biddle et al., 2009; Mahoney et al., 1997; Zhao & Chen, 2008) control firm characteristics such as firm size (Size) - the natural logarithm of total assets (#6) item to measure firm size, Tobin's Q (TQ), firm leverage (Lev), which is total liabilities (#9 plus #34) divided by total assets (#6), and market to book ratio (MtB), calculated by firm's outstanding common shares (#25) multiplying stock price (#24) at the end of fiscal year and then scaled by book value of equity (#60) (Chen et al., 2017). As I use Tobin's Q to calculate abnormal investment, I omit firm size and market to book ratio in my OLS regression on investment efficiency to avoid multicollinearity[2].

In his highly cited research, Richardson (2006) find a strong relationship between a firm's free cash flow and investment decisions. Firms with abundant cash balances are more likely to have agency problems and over-invest (Michael C. Jensen, 1986; Opler et al., 1999). Therefore,

[2] I use them as a robust test, replacing Tobin's q in my OLS regression of predicting firm's investment.

I control operating cash flow (Oancf), which is operating cash flow (#308) scaled by total assets (#6) in my regression[3](Biddle et al., 2009).

Financial analysts work as watchdogs to reduce information asymmetry between insiders and outsiders, and as a result, mitigating opportunistic management behavior and certifying managerial quality (Yu, 2008). Kelly & Ljungqvist (2012) find information asymmetry is reduced with more analysts taking part in financial forecasting. To et al. (2018) find supporting evidence that financial analysts coverage improves a firm's external financing behavior to fund productive investments, especially in firms which have a higher level of information asymmetry. Chen et al. (2017) exam the effect of financial analyzing quality on firm investment decisions and find more anticipating analysts effectively amend inefficient investments. This finding is consistent with previous research by Chen & Steiner (2000) that analyst coverage enhances firm valuation. Analyst Coverage (AC), is calculated as the total number of analysts that follow the firm in past 12-months prior annual earnings announcement (fiscal year end), as provided by I/B/E/S) (Biddle et al., 2009; Chen et al., 2017). I then use a natural logarithm of analyst coverage (LnAC) in my regression model.

Prior research suggests that internal and external governance mechanisms interact to affect a firm's decision making and performance (e.g., Cremers & Nair, 2005). Sundaramurthy et al. (1997) find evidence that the effect of ATPs on stock return varies with different board structures. Market reacts to ATPs become more severe in firms with more outsiders on board. Outsiders are less likely to be influenced by managers and help monitor opportunistic managerial behavior. This negative effect of ATPs on equity return is reduced if CEO also serves as chairman of the board.

[3] I build my hypothesis on the theory that ATPs release manager's pressure of boosting short-term earnings by sacrificing cash flow for long-term investment. I control for operating cash flow rather than the total amount of cash flow to avoid the bias of investing activities (non-operating cash flow).

Shleifer & Vishny (1986) document that institutional investors work jointly for monitoring management, holding findings that poor management without large shareholders is less probable to be taken over even ATPs in such firms are also relatively low. Bushee (1998) find institutional investors play a monitoring role in managerial myopia as firms with sizeable institutional ownership are less likely to cut their long-term investment proxied by R&D, but only if they are less pressured by takeover threats. Correspondingly, Wahal & McConnell (2000) find a positive relationship between the weight of institutional ownership and firm's expenditures on PPE and R&D.

Therefore, I control the effect of board size (logarithm of the number of board members), board independence (percentage of outsiders on a board), CEO duality (1 if CEO is also serving as board chairman, 0 otherwise), and institutional ownership. Institutional ownership is the percentage of outstanding shares held by institutional investors provided by Thomson Reuters about Institutional (13f) Holdings information generated by SEC (Bushee, 1998; Wahal & McConnell, 2000).

Deangelo (1981) find large audit firms are more conservative and provide higher audit quality and lower audit failure. On the other hand, Becker, Defond, Jiambalvo, & Subramanyam (1998) find higher audit quality will mitigate managerial myopia. In line with Becker et al. (1998), I use a dummy variable Big4 (whether big audit firms audit the firm) to represent audit quality (1 for high audit quality, 0 otherwise).

In hypothesis two, I will further take a product competition into account to test whether the effect of market for corporate control on managers investment behavior differs in different competitiveness product market. I use the Herfindahl-Hirschman Index (Herfindahl Index) to process an analysis between high competition group and low competition group. Herfindahl Index is a statistical measure of industry concentration (Cremers et al., 2008). Herfindahl Index

is the sum of squared market shares(in percentage) in a 2-digit SIC industry. Following DeFond & Park (1999), I assign the Herfindahl Index value to each firm-year sample equals its industry average Herfindahl Index over the five years before the reporting year in order to remove potential year-to-year variation. A lower Herfindahl Index suggests a lower industry concentration, and thus, a higher product competition. Here I use one minus the Herfindahl Index (HHI) to represent the level of competition. Thus, in my regression, larger HHI means higher market competition in an industry.

3.2 Data collection and cleaning

I obtain managerial entrenchment measurements (E Index) from data provided by Bebchuk et al. (2008). These data are also available in IRRC in RiskMetrics. Entrenchment measurements are only available in year 1990, 1993, 1995, 1998, 2000, 2002 & 2006. Previous research assumes that the ATP data remains constant from the last available year to the next (Bebchuk et al., 2008; Gompers et al., 2003; Masulis et al., 2007; Stráska & Waller, 2010). Therefore, I select US-listed firms from 1990 – 2016 as my whole sample and replace G-Index and E-Index with the previous year if they are missing. Firm-level financial data and HHI index are generated from Compustat - North America in Wharton Research Data Services. I get other governance mechanisms in Directors Legacy and Compustat Executive Compensation. These variables are only available from the year 1996. Institutional stock ownership data are obtained from the Thomson Reuters Institutional database (13f). I generate Analyst coverage from I/B/E/S.

I deduct sample of financial institutions as most of the variables are missing due to a different financial reporting method. I exclude sample with negative value in total assets, liabilities and common equity. I also exclude sample with negative investments. I drop observations if they are missing values in all these three variables: total investment, capital investment, and non-capital investment. Main financial variables are winsorized at the 1% and 99% percentiles if

Table 1 Description Statistics

	N	min	p25	mean	p50	p75	max	sd
TI	7206	-0.10	0.06	0.15	0.11	0.18	3.86	0.18
Caexp	10867	-0.78	0.06	0.15	0.10	0.16	75.27	0.93
NCaexp	9453	0.00	0.01	0.10	0.06	0.13	3.82	0.17
Inv	6151	-0.71	-0.06	0.00	-0.02	0.02	3.24	0.16
CaInv	9057	-20.61	-0.05	0.00	-0.01	0.03	55.99	0.69
NCaInv	8072	-0.49	-0.06	0.00	-0.01	0.01	3.25	0.15
Total assets	13634	17	647	7568	1775	5457	138876	18565
G index	11569	1.00	7.00	9.06	9.00	11.00	18.00	2.66
E index	11569	0.00	1.00	2.43	3.00	3.00	6.00	1.28
Lev	13585	0.00	0.04	0.21	0.19	0.32	0.92	0.17
LnAC	13634	0.00	4.06	4.56	4.66	5.20	6.51	0.86
%Institutional	13597	0.00	0.65	0.76	0.79	0.90	7.60	0.22
Ln_boardsize	13634	0.00	1.95	2.12	2.08	2.30	3.53	0.29
%Independent	13634	0.00	0.69	0.76	0.80	0.88	1.00	0.15
Ln_Boardtenure	13634	-0.34	2.01	2.24	2.26	2.48	3.50	0.38
HHI	10422	-0.53	-0.19	-0.15	-0.12	-0.07	-0.04	0.10

Table 2 Correlation Matrix

	TI	Caexp	NCaexp	Inv	CaInv	NCaInv	G Index	E Index	Lev	TQ	oancf	BIG4	LnAC	%Institu-tional	Ln_board-size	%Independ-ent	CEO duality	Ln_Board-tenure	HHI	EHI	GHI
TI	1																				
Caexp	0.273***	1																			
NCaexp	0.976***	0.175***	1.00																		
Inv	0.908***	0.175***	0.888***	1.00																	
CaInv	0.181***	0.837***	0.107***	0.196***	1.00																
NCaInv	0.915***	0.113***	0.923***	0.975***	0.118***	1.00															
G Index	-0.051**	-0.114***	-0.035*	-0.011	-0.048**	-0.006	1														
E Index	-0.020	-0.100***	-0.012	0.013	-0.024	0.014	0.665***	1													
Lev	0.091***	-0.088***	0.105***	0.125***	0.009	0.136***	0.127***	0.065***	1												
TQ	0.118***	0.257***	0.084***	-0.053***	-0.041**	-0.043**	-0.081***	-0.120***	-0.176***	1											
oancf	-0.038*	0.049**	-0.034*	-0.050**	0.015	-0.051**	-0.070***	-0.242***	0.132***	0.041**	1										
BIG4	0.011	0.028	0.013	-0.009	-0.002	-0.001	0.066***	0.012	0.104***	0.078***	0.073***	1									
LnAC	0.01	0.170***	-0.016	-0.025	0.0689***	-0.023	-0.053***	-0.184***	0.152***	0.217***	0.389***	0.212***	1								
%Institutional	0.038*	0.127***	0.023	0.029	0.102***	0.016	-0.047**	0.116***	-0.027	-0.004	-0.244***	0.041**	0.047**	1							
Ln_boardsize	-0.089***	-0.117***	-0.082***	-0.036*	-0.045**	-0.030	0.247***	0.153***	0.322***	-0.101***	0.315***	0.158***	0.299***	-0.174***	1						
%Independent	-0.055***	-0.072***	-0.021	-0.050**	-0.029	-0.038*	0.129***	0.118***	0.180***	-0.068***	0.086***	0.111***	0.110***	0.136***	0.219***	1					
CEO duality	-0.052***	-0.039*	-0.058***	-0.051**	-0.004	-0.046**	0.118***	0.082***	0.063***	-0.053***	0.016	0.019	0.053***	-0.060***	0.072***	0.005	1				
Ln_Boardtenure	-0.034*	-0.017	-0.044**	-0.036*	-0.028	-0.050**	0.079***	0.029	-0.096***	0.061***	-0.056***	-0.053***	-0.072***	-0.070***	-0.049**	-0.243***	0.070***	1			
HHI	0.101***	-0.035*	0.153***	0.001	-0.004	0.021	0.023	0.072***	-0.016	0.057***	-0.050**	0.031*	-0.052***	-0.04**	-0.049**	0.050**	0.029	0.023	1		
EHI	0.086***	0.033*	0.119***	-0.011	-0.002	0.005	-0.420***	-0.594***	-0.058***	0.106***	0.131***	0.016	0.079***	-0.093***	-0.129***	-0.054***	-0.042**	-0.009	0.653***	1	
GHI	0.109***	0.011	0.147***	0.002	0.005	0.018	-0.401***	-0.234***	-0.068***	0.073***	-0.001	-0.006	-0.016	-0.022	-0.146***	-0.011	-0.029	-0.023	0.870***	0.838***	1

* p<0.05, ** p<0.01, *** p<0.001

they have extreme values. My final sample consists of 1,693 US-listed firms from the year 1999 to 2016 with 13,634 observations in 34 industries.

Table 1 presents descriptive statistics for the variables described above. The mean (median) of total investment (TI), capital investment (Caexp) and non-capital investment (NCaexp) across all firm-years equal 15% (11%), 15% (10%) and 10% (6%) of prior years' assets, respectively, consistent with previous research (Biddle et al., 2009; Chen et al., 2017). Abnormal investments are 0 or 1% (2%) lower than the expected one. The median of E Index and G Index are 3 and 9 respectively, similar to previous research of Masulis et al. (2007).

Table 2 presents correlations among my main variables. Opposed my hypothesis, both E Index and G Index are negatively associated with firm's investment, indicating that ATPs may lead to an under-investing behavior. The absolute amount of correlations among variables are less than 0.7. Thus, there is little multicollinearity concern in my research.

4 Regression Model and Results

I am interested in whether managers are more likely to overinvest with increasing power of managerial control. Under the previous equation of (1), I calculate abnormal investment (either over-/under- investment based on investment opportunities) as the error term of the expected investment. Therefore, I define firms whose level of abnormal investment is higher than 75% percentile, or lower than 25 percentile have an over-(under-) investment behavior (Biddle et al., 2009; Chen et al., 2017).

In order to see how the change of managerial entrenchment power will affect the possibility of investment efficiency, I use a multinomial logistic model (MLM)[4]As my main model for H1

[4]. MLM is applied to estimate the likelihood of a category compared with a baseline category. It is an effective estimator when the dependent variable consists of several categories that are not ordinal.

to test the likelihood of over-investment affected by ATPs (Kwak & Clayton-Matthews, 2002). The regression model is as follows:

$$Invpercentile_{i,t} = \beta_0 + \beta_1 E\ Index_{i,t-1} + \beta_2 Lev_{i,t-1} + \beta_3 Oancf_{i,t-1} + \beta_4 BIG4_{i,t-1} + \beta_5 LnAC_{i,t-1} + \beta_6 Gov_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

Here I generate a variable ($Invpercentile_{i,t}$) to deviate the status of the firm's likelihood of over-(under-)investment. It equals to one if the abnormal investment, which is the residual from the Investment regression (Eq. (1)) is in the bottom quartile of the whole sample distribution (suggesting an under-investment behavior) and two if it is between p25 and p75, three if it is in the top quartile (suggesting an over-investment behavior).

H1 predicts that firms with more ATPs (suggesting a lower power of market for corporate control) will be more likely to indulge an over- investment strategy. Therefore, in Table 3, I test the likelihood of firms to be in the top quantile of abnormal investment rather than the normal quantiles (middle two quantiles) and predict that the coefficient between E Index and over-investment is positive. Table 3 shows the results.

In Table 3, the first 3 column shows how E Index affects the likelihood that a firm might be in the highest quantile of abnormal total investment. The coefficients are positive but not significant at the 10% level after including control variables and (or) fixed effects. These results provide evidence that managers protected by more ATPs are more likely to favor themselves by over-investing. Similarly, in column 4 to 6, the relation between E Index and non-capital over-investing are positive and significant at least at the 10% level cross-sectionally. The result further supports the findings in the previous literature that managers protected by more ATPs are more likely to indulge value-destroying acquisitions or increase R&D expenditure (Hubbard, 1990; Masulis et al., 2007). Interestingly, the coefficients of E Index

on the likelihood of over-investing in capital items (PPE) are negative, suggesting that firms are less likely to over-invest

Table 3 ATPs and Likelihood of Over-investment

Predictors	Inv			NCaInv			CaInv		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
E Index	0.07*	0.06	0.06	0.08**	0.06*	0.06*	-0.03	-0.02	-0.02
	(2.54)	(1.95)	(1.80)	(3.02)	(2.24)	(2.27)	(-1.20)	(-0.59)	(-0.69)
Leverage	-1.83***	-0.62*	-0.65*	-1.89***	-0.92***	-0.91***	-1.07***	-0.77***	-0.92***
	(-7.81)	(-2.23)	(-2.30)	(-9.22)	(-3.81)	(-3.68)	(-5.29)	(-3.44)	(-4.02)
Oancf	0.65	1.27*	1.25*	-1.05*	-0.09	-0.06	-0.11	0.24	0.25
	(1.38)	(2.57)	(2.53)	(-2.53)	(-0.20)	(-0.13)	(-0.27)	(0.56)	(0.59)
BIG4	0.08	-0.02	-0.07	0.19	-0.01	-0.00	0.18	0.22	0.14
	(0.45)	(-0.14)	(-0.36)	(1.22)	(-0.07)	(-0.01)	(1.13)	(1.34)	(0.84)
LnAC	0.11*	-0.07	-0.07	0.13***	0.03	0.01	0.26***	0.23***	0.21***
	(2.51)	(-1.42)	(-1.46)	(3.38)	(0.57)	(0.20)	(6.21)	(5.13)	(4.77)
%Institutional	-0.43*	0.01	0.18	-0.52**	-0.01	0.08	0.68***	0.42*	0.89***
	(-2.23)	(0.03)	(0.80)	(-3.10)	(-0.06)	(0.38)	(4.17)	(2.46)	(4.63)
Ln_boardsize	-0.74***	-0.49***	-0.44**	-1.01***	-0.72***	-0.72***	-0.88***	-0.79***	-0.66***
	(-5.24)	(-3.30)	(-2.86)	(-7.99)	(-5.37)	(-5.28)	(-7.54)	(-6.43)	(-5.24)
%Independent	-0.02	-0.51	-0.29	0.71**	-0.05	-0.01	-0.87***	-0.93***	-0.20
	(-0.06)	(-1.82)	(-0.94)	(3.04)	(-0.22)	(-0.03)	(-4.15)	(-4.23)	(-0.82)
CEO duality	-0.07	-0.10	-0.13	-0.10	-0.11	-0.11	-0.12*	-0.11	-0.17**
	(-0.93)	(-1.39)	(-1.71)	(-1.59)	(-1.74)	(-1.62)	(-2.01)	(-1.75)	(-2.64)
Ln_Boardtenure	-0.28**	-0.24*	-0.16	-0.22**	-0.23*	-0.22*	-0.34***	-0.35***	-0.21*
	(-2.89)	(-2.32)	(-1.55)	(-2.63)	(-2.58)	(-2.33)	(-4.18)	(-4.15)	(-2.39)
Year fixed effects	No	No	Yes	No	No	Yes	No	No	Yes
Industry fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
_cons	1.35**	1.81**	1.45*	1.32***	1.05*	1.50**	0.88*	1.26**	0.61
	(3.01)	(3.22)	(2.38)	(3.37)	(2.17)	(2.86)	(2.30)	(2.91)	(1.30)
Peseudo R-Squared	0.02	0.11	0.12	0.02	0.13	0.15	0.02	0.07	0.08
chi-square	243.06	1168.82	1294.46	304.51	1875.84	2081.74	288.44	1054.34	1234.22
N	5113.00	5113.00	5113.00	6852.00	6852.00	6852.00	7597.00	7597.00	7597.00

This table presents results from multinomial logit pooled regressions. $Invpercentile_{i,t}$ is firm's likelihood of over-(under-)investment. It equals to one if the abnormal investment is in the bottom quartile of the whole sample distribution (suggesting an under-investment behavior) and two if it is between p25 and p75, three if it is in the top quartile (suggesting an over-investment behavior). I use total abnormal investment (Inv), capital abnormal investment (CaInv) and non-capital abnormal investment (NCaInv) to measure the level of investment inefficiency. Firm-year observations in the top quantile of abnormal investment are classified as over-investing, and observations in the middle two quartiles are classified as the benchmark group. $E\ Index_{i,t}$ is a measurement of anti-takeover provisions introduced by Bebchuk et al. (2008), including 6 anti-takeover provisions. Higher E Index suggest a stronger managerial entrenchment power and lower market for corporate control. $Lev_{i,t}$ is total liabilities divided by total assets. $Oancf_{i,t}$ is firm's operating free cash flow. $Gov_{i,t}$ is control variables of other governance mechanism, including board size ($Ln\_boardsize_{i,t}$), percentage of independent board members ($\%Independent_{i,t}$), percentage of outstanding shares held by institutional investors ($\%Institutional_{i,t}$), whether CEO also serves as board chairman ($CEO\ duality_{i,t}$), and average tenure of board members ($Ln\_boardtenure_{i,t}$). $Ln\_AC_{i,t}$ is the natural logarithm as the total number of analysts that following the firm in past 12-months prior annual earnings announcement. $BIG4_{i,t}$ is a dummy variable, and it equals to 1 if firm is audited by big audit firms (suggesting a higher audit quality). Industry and (or) year fixed effect are included. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

In capital investment when ATPs are high. One possible explanation is that non-capital investments, such as acquisition, are more preferable for managers than PPE it favors managers

with empire-building, further supporting the managerial wealth hypothesis (Masulis et al., 2007). Results above are consistent with arguments of Gompers et al. (2003) and Masulis et al. (2007) that managers protected by more ATPs are less pressured by short-term performance, cutting-off short-term cash flow and making more inefficient long-term investments such as an acquisition. In appendix 2, the coefficients of E Index are not significant at the 10% level, indicating that the influence of ATPs on firm's inefficient investment is not 2-sided. These results consist with my first hypothesis that firm with a higher level of ATPs (suggesting a weaker market for corporate control) are more likely to invest inefficiently via over-investment (rather than under-investment).

As for control variables, I find a strong negative relationship between the degree of financial leverage and the likelihood of over-investment in that firms undertake. This negative relationship applies to both capital and non-capital investments. In contrast to previous research of Chen et al. (2017) and To, Navone, & Wu (2018), I find analyst coverage positively associates with firm's over-investment, but coefficients are only significant in capital investment. A longer tenure of board members reduces the likelihood of over-investment. This negative influence is significant in all three categories of investment.

In hypothesis 2, I introduce product competition as a moderator, to see whether the effect of ATPs on firm's investment behavior will be affected by different levels of competition. Following previous literature (e.g., Masulis et al., 2007), I use the Herfindahl Index as a proxy of product competition. Here $HHI_{i,t}$ is a 5-year average number of market concentration in a 2-digit SIC industry, then multiplied by minus one (DeFond et al., 1999). Therefore, in my research, a higher HHI indicates an increasing magnitude of product competition.

Again, in Table 4, I proceed with a multinomial logit regression of ATPs and firm's investment decision.

$$Invpercentile_{i,t} = \beta_0 + \beta_1 ATPs_{i,t-1} + \beta_2 HHI_{i,t-1} + \beta_2 EHI_{i,t-1} + \beta_4 Lev_{i,t-1} + \beta_5 Oancf_{i,t-1} + \beta_6 BIG4_{i,t-1} + \beta_7 LnAC_{i,t-1} + \beta_8 Gov_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

I predict that the effect of ATPs on investment inefficiency will be attenuated in an industry with a higher level of competition. Therefore, here I am interested in the interaction variable of E Index and HHI, $EHI_{i,t}$, and predict it to be negative.

In column 1 to 3 of Table 4, the correlation of E Index and the likelihood of over-investment are positive and significant. The interaction coefficients are negative, indicating that higher competition reduces the effect of ATPs on the probability of over-investing in total investment. These coefficients are significant at the 1% level. In other words, the correlation between ATPs and over-investment behavior is attenuated in more competitive industries. However, the joint effect of E Index and product competition on non-capital investment is unclear, as coefficients are positive but not significant in column 4-6. Also, in Appendix 3, column 4-6, I find positive coefficients in EHI when testing the likelihood of firm's being in the bottom quantile. These coefficients are significant at the 10% level. These results suggest that the positive effect of E Index on under-investment exaggerates in a competitive industry. In other words, market for corporate control has a stronger disciplinary influence on under-investment when competition is high.

Column 7-9 of Table 4 show the impact of HHI on the correlation between E Index and capital investment. Both the coefficients of E Index and EHI are negative and significant. These

Table 4 ATPs, Product Competition and Likelihood of Over-investment

Predictors	Inv			NCaInv			CaInv		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
E Index	0.15*	0.16*	0.16*	0.05	0.10	0.10	-0.16**	-0.16**	-0.17**
	(2.25)	(2.29)	(2.34)	(0.88)	(1.62)	(1.62)	(-2.88)	(-2.74)	(-2.85)
HHI	6.62***	1.07	1.09	4.58***	-1.09	-1.44	1.73*	2.21	2.51*
	(5.46)	(0.60)	(0.60)	(4.62)	(-0.69)	(-0.89)	(2.30)	(1.76)	(2.00)
EHI	-1.71***	-1.69***	-1.69***	-0.37	0.03	0.04	-0.78**	-0.93**	-0.92**
	(-4.12)	(-3.87)	(-3.86)	(-1.05)	(0.07)	(0.11)	(-2.68)	(-2.90)	(-2.89)
Leverage	-1.99***	-0.54	-0.55	-2.11***	-0.85**	-0.82**	-0.94***	-0.58*	-0.60*
	(-7.28)	(-1.60)	(-1.63)	(-8.82)	(-2.92)	(-2.80)	(-3.83)	(-2.12)	(-2.18)
Oancf	1.27*	1.72**	1.76**	-0.70	0.40	0.40	0.70	0.96	0.99
	(2.12)	(2.73)	(2.78)	(-1.32)	(0.71)	(0.70)	(1.35)	(1.76)	(1.80)
BIG4	-0.00	-0.02	-0.04	0.12	0.06	0.08	0.42*	0.47*	0.40*
	(-0.01)	(-0.09)	(-0.20)	(0.71)	(0.32)	(0.44)	(2.25)	(2.43)	(2.04)
LnAC	0.15**	-0.08	-0.08	0.17***	0.01	-0.01	0.23***	0.17**	0.18**
	(2.76)	(-1.23)	(-1.35)	(3.63)	(0.15)	(-0.14)	(4.43)	(3.15)	(3.19)
%Institutional	-0.60*	-0.24	-0.12	-0.46*	-0.08	-0.06	0.99***	0.65**	0.74**
	(-2.47)	(-0.93)	(-0.46)	(-2.18)	(-0.35)	(-0.28)	(4.63)	(2.90)	(3.18)
Ln_boardsize	-0.81***	-0.64**	-0.61**	-0.98***	-0.79***	-0.79***	-1.18***	-1.02***	-0.92***
	(-4.33)	(-3.26)	(-3.02)	(-5.96)	(-4.51)	(-4.44)	(-7.50)	(-6.15)	(-5.51)
%Independent	-0.21	-0.69	-0.62	1.01**	0.39	0.23	-0.63*	-0.61	-0.11
	(-0.57)	(-1.77)	(-1.43)	(2.98)	(1.08)	(0.58)	(-2.03)	(-1.91)	(-0.32)
CEO duality	-0.10	-0.17	-0.18*	-0.13	-0.11	-0.10	-0.18*	-0.17*	-0.22**
	(-1.22)	(-1.91)	(-1.98)	(-1.77)	(-1.47)	(-1.22)	(-2.56)	(-2.38)	(-2.89)
Ln_Boardtenure	-0.36**	-0.23	-0.18	-0.21*	-0.10	-0.10	-0.20*	-0.20	-0.07
	(-3.12)	(-1.89)	(-1.39)	(-2.10)	(-0.98)	(-0.92)	(-1.96)	(-1.94)	(-0.63)
Year fixed effects	No	No	Yes	No	No	Yes	No	No	Yes
Industry fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
_cons	2.69***	2.00*	1.88*	1.38*	0.18	0.04	0.78	1.20	0.50
	(4.42)	(2.40)	(2.20)	(2.57)	(0.25)	(0.05)	(1.47)	(1.85)	(0.74)
Peseudo R-Squared	0.05	0.14	0.15	0.05	0.15	0.16	0.02	0.08	0.09
chi-square	412.24	1114.21	1197.10	532.39	1669.98	1786.78	269.19	930.18	1018.19
N	3965.00	3965.00	3965.00	5265.00	5265.00	5265.00	5652.00	5652.00	5652.00

This table presents results from multinomial logit pooled regressions. $Invpercentile_{i,t}$ is firm's likelihood of over-(under-)investment. It equals to one if the abnormal investment is in the bottom quartile of the whole sample distribution (suggesting an under-investment behavior) and two if it is between p25 and p75, three if it is in the top quartile (suggesting an over-investment behavior). I use total abnormal investment (Inv), capital abnormal investment (CaInv) and non-capital abnormal investment (NCaInv) to measure the level of investment inefficiency. Firm-year observations in the top quantile of abnormal investment are classified as over-investing, and observations in the middle two quartiles are classified as the benchmark group. $E\ Index_{i,t}$ is a measurement of anti-takeover provisions introduced by Bebchuk et al. (2008), including 6 anti-takeover provisions. Higher E Index suggest a stronger managerial entrenchment power and lower market for corporate control. $HHI_{i,t}$is Herfindahl Index multiplied by minus one. Higher HHI represents higher product competition. $EHI_{i,t}$ is an interaction variable of E Index and HHI. $Lev_{i,t}$ is total liabilities divided by total assets. $Oancf_{i,t}$ is firm's operating free cash flow. $Gov_{i,t}$ is control variables of other governance mechanism, including board size ($Ln\_boardsize_{i,t}$), percentage of independent board members ($\%Independent_{i,t}$), percentage of outstanding shares held by institutional investors ($\%Institutional_{i,t}$), whether CEO also serves as board chairman ($CEO\ duality_{i,t}$), and average tenure of board members ($Ln\_boardtenure_{i,t}$). $Ln\_AC_{i,t}$ is the natural logarithm as the total number of analysts that following the firm in past 12-months prior annual earnings announcement. $BIG4_{i,t}$ is a dummy variable, and it equals to 1 if firm is audited by big audit firms (suggesting a higher audit quality). Industry and (or) year fixed effect are included. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

results document that high competition makes further efforts to the discouraging power of ATPs on firm's capital investment and make investment more precise. The effects of other

firm-level variables remain similar. Coefficients board-level control variables is consistent with my previous research[5].

5 Additional Test: OLS Regressions

Following previous literature (e.g., Biddle et al. 2009), I use an ordinary least square (OLS) model to investigate the correlation between market for corporate control on firm's investment as an additional test for H1 and H2.

$$H1\text{: } Investment_{i,t} = \beta_0 + \beta_1 E\ Index_{i,t-1} + \beta_2 Lev_{i,t-1} + \beta_3 TQ_{i,t-1} + \beta_4 Oancf_{i,t-1} + \beta_5 BIG4_{i,t-1} + \beta_6 LnAC_{i,t-1} + \beta_7 Gov_{i,t-1} + \varepsilon_{i,t} \quad (4)$$

$Investment_{i,t}$ include three proxies, total investment (TI), capital investment (Caexp) and non-capital investment (NCaexp). $E\ Index_{i,t}$ is a measurement of anti-takeover provisions introduced by Bebchuk et al. (2008). $Gov_{i,t}$, are control variables of other governance mechanisms. I use ordinary least squares (OLS) to estimate the correlation between E Index and firm's investment. I also include year and industry fixed effect (using 2-digit SIC code) to control for the year or industry shocks to firm's investment. The results are shown in Appendix 4.

The coefficients between E Index and total investment is positive, suggesting that ATPs are positively associated with firm's total investment. However, as the coefficient is not significant, I cannot conclude whether firms applying more ATPs will invest more in their total investment.

The coefficient of E Index on non-capital investment is positive and significant at least at the 5% level. As the mean of total asset is $7,568 million, an increase in E Index will result in an

[5] In unreported tables, coefficients of G Index become significant after controlling product competition, further supporting the complementary theory.

increase of non-capital investments in about 0.3% (0.4%) of lagged total assets, that is, $22.7 ($30.3) million on average. In unreported results, the effects of G Index on total investment and non-capital investment are not significant, supporting the argument of Masulis et al. (2007) and Bebchuk et al. (2008) that some takeover defenses are more important than others. Combined with Table 3, these results suggest that an increase in ATPs does reduce managers pressure as they put back long-term cash flow and use it for non-capital investment, such as in R&D expenditure and acquisition. However, these investments are not efficient.

The coefficients of E Index on capital investment are negative and significant. These results suggest that increasing entrenchment power via ATPs will lead to a decrease in capital investment. These results are in accord with the results of the logit model that an increase in E Index will increase the firm's non-capital investment but discourage capital investment. The overall effect of ATPs on firm's investment is not evident because the effects of ATPs on capital and non-capital investments are opposite. These results are aligned with my main empirical results.

Besides dependent variables, I find that Tobin's Q has a positive and significant correlation on firm's investment in all regressions. Firms with more growth opportunities generate more investment. Firms audited by big audit firms invest more in capital, non-capital and total investments, implying that higher audit quality disciplines manager's myopia and makes them more long-term oriented, but the coefficients are not significant. Analyst coverage has significant encouraging power on firm's capital investment. As for inside governance mechanisms, I find strong negative coefficients of board size, the percentage of independent board members presented on board and board average tenure on total investment, capital, and non-capital investment. A larger board may work inefficiently because of a free-rider issue and damage board's monitoring on manager's behavior; longer tenure will reduce the independence of board members. Therefore, CEOs may be more short-term oriented for their

interests and to boost short-term performance at the expense of long-term cash flow (Zhao & Chen, 2008; Zhao et al., 2012). CEO Duality plays a discouraging role in total and non-capital investment as the coefficients are negative and significant. However, according to the results in Appendix 2, firms with CEO who also serves as chairman are more likely to under-invest. Therefore, a proper explanation is that CEO may cut-off long-run cash flow to boost short-term performance (Zhao et al., 2012). All results remain similar when I use sales growth (Salegrowth) instead of Tobin's Q and further control firm size (Size) and market to book ratio (MtB) in a robustness check.

In Appendix 5, I put product competition into account to see whether it influences the effect of ATPs and corporate investment.

$$H2: Investment_{i,t} = \beta_0 + \beta_1 E\ Index_{i,t-1} + \beta_2 HHI + \beta_3 EHI + \beta_4 Lev_{i,t-1} + \beta_5 TQ_{i,t-1} + \beta_6 Oancf_{i,t-1} + \beta_7 BIG4_{i,t-1} + \beta_8 LnAC_{i,t-1} + \beta_9 Gov_{i,t-1} + \varepsilon_{i,t} \quad (5)$$

$HHI_{i,t}$ is a measurement of product competition. A Higher HHI represents a higher level of competition. $EHI_{i,t}$ is the interaction of E Index and HHI. Here I'm interested in β_1 and β_3 . Appendix 5 shows the results.

In appendix 5, the coefficients of E Index are positive in total investment (column 1-3) and non-capital investment (column 4-6). The interaction effects of E Index and HHI (EHI), are negative in all of these columns, suggesting that an increase in product competition will reduce the correlation between E Index and investment. Although these coefficients are insignificant[6],

[6] These coefficients are not significant because the OLS regression cannot catch the likelihood of processing inefficient investment, which has 2 sides (over-/under- investment), but only show the linear relationship between ATPs and percentage change in investment to lagged total assets.

they support my main results in Table 4. Coefficients board-level control variables is consistent with my previous research.

6 Conclusion and Limitation

The previous research raises two main hypotheses to illustrate the relation between market for corporate control and a firm's investment decisions. This research provides evidence on the managerial wealth hypothesis that managers faced fewer take-over pressures are more likely to over-invest in non-capital investment including R&D expenditure and acquisitions. Main results remain the same in cross-sectional tests. These results support my first hypothesis, as well as the findings of Masulis et al. (2007) that the increasing managerial entrenchment power (and lower market for corporate control) stimulate investment inefficiency by over-investing non-capital investment. The OLS and MLM models jointly suggest that an increase in ATPs does reduce managers pressure as they put back long-term cash flow and use it for non-capital investment, such as in R&D expenditure and acquisition. However, these investments are not efficient.

Product competition also plays an essential role as an external governance mechanism. In hypothesis 2, I introduce HHI, a proxy of corporate competition, as a moderator to see whether it influences the effect of ATPs on investment inefficiency. I find that competition reduces the positive effect of E Index on over-/under- investing capital investment and total investment, corresponding to the argument of Giroud & Mueller (2011) that weak governance does more harm to shareholders in non-competitive industries than competitive ones. My results also suggest that protected managers are more likely to under-invest in non-capital investment in more competitive industries. Therefore, market for corporate control and product competition play a synergic role in investment efficiency.

While my findings suggest that market for corporate control and product competition plays an important role in promoting a firm's investment efficiency, an opportunity exists to extend our findings in several ways. Firstly, I can only document a correlation between ATPs and investment inefficiency. One could further explore the causality between market for corporate control and managers' investment behavior. Besides, my research may be biased and have endogeneity issue due to omitting some control variables, such as financial reporting quality. Last but not least, I do not find significant relation between managerial entrenchment power (ATPs) and firm's over-investment behavior in my first hypothesis, due to the fact that my sample from year 1999 to 2016 and replace ATPs Index (G Index, E Index) from year 2007 with that in 2006[7]. It is possible that my data has a potential bias as half of my total sample (from the year 2007 to 2016) have a constant Entrenchment Index. One could improve my research when IRRC release more recent data of anti-takeover provisions.

[7] The IRRC release 24 antitakeover provisions (ATPs) in the years 1990, 1993,1998, 2000, 2002, and 2006. Previous research (e.g., Bebchuk et al., 2008; Gompers et al., 2003) assume that the ATP data remains constant from the last available year to the next.

Appendix

Appendix 1 Variables Definition

Variable	Definition
Panel A Dependent Variables	
TI	Total investment. The sum of capital expenditure (#128), R&D expenditure (#46), acquisitions (#129) minus sales of PPE (#107), scaled by lagged total assets(#6).
Caexp	Capital investment. The difference between capital expenditure (#128) and sale PPE (#107), scaled by lagged PPE(#7).
Ncaexp	Non-capital investment. Sum of R&D expenditure (#46) and acquisitions (#129), scaled by lagged total assets (#6)
Inv	Abnormal Investment. The difference between firm'stotal investment (TI) and expected investment. Expected investment is expected average investment of all the firms in each industry-year group, generated from growth opportunity (TQ). At least 8 observations are required per year-industry to compute the average.
CaInv	Abnormal capital Investment. The difference between firm's capital investment (Caexp) and expected investment. Expected investment is expected average investment of all the firms in each industry-year group, generated from growth opportunity (TQ). At least 8 observations are required per year-industry to compute the average.
NCaInv	Abnormal non-capital Investment. The difference between firm's capital investment (NCaexp) and expected investment. Expected investment is expected average investment of all the firms in each industry-year group, generated from growth opportunity (TQ). At least 8 observations are required per year-industry to compute the average.
Invpercentile	Firm's likelihood of over-(under-)investment. It equals to one if the abnormal investment is in the bottom quartile of the whole sample distribution (suggesting an under-investment behavior) and two if it is between p25 and p75, three if it is in the top quartile (suggesting an over-investment behavior).
Pane B Independent Variables	
G Index	Taken from Gompers et al. (2003), based on 24 antitakeover provisions. Ranges from 0 - 24. Higher G Index suggest more managerial entrencment power and lower market for corporate control.
E Index	Taken from Bebchuke et al. (2008), based on 6 out of 24 antitakeover provisions. Ranges from 0 - 6. Higher E Index suggest more managerial entrencment power and lower market for corporate control.

Panel C Control Varialbes

Firm characteristics	
Size	Firm Size. The natural logarithm of firm's total assets (# 6).
MtB	Market to book ratio. Market value of equity, calculated by firm's outstanding common shares(Compustat #25) multiplying stock price(Compustat #24) at the end of fiscal year, scaled by book value of equity (Compustat #60)
Lev	Leverage. Here I use debt to asset ratio, which is total liabilities(Compustat #9 plus #34) divided by total assets (Compustat #6).
TQ	Tobin's Q. Market value of total assets, which is the book value of assets (Compustat #6) minus book value of common equity (Compustat #60) plus the market value of common equity (Compustat #25 mutiplies Compustat #24), scaled by book value of total assets (Compustat #6).
Salegrowth	Annual percentage change in firm's sales (Compustat #12).
Oancf	Operating cash flow(Compustat #308), scaled by total assets (Compustat #6)
Board characteristics	
Ln_boardsize	Natural logarithm of total number of directors on board.
%Independent	Percentage of independent board members (outsiders) on board.
%Institutional	Percentage of outstanding shares held by institutional investors provided in Thomson Reuters about Institutional (13f) Holdings information generated by SEC.
CEO duality	Dummy variable. 1 if the CEO also serves as chairman of the board, and 0 otherwise.
Ln_boardtenure	Natural logarithm of average boardmember tenure.
Other variables	
LnAC	Natural logarithm of Analyst Coverage. Analyst Coverage(AC) is calculated as total number of analysts that following the firm in past 12-months prior annual earnings announcement.
BIG4	Dummy variable. 1 if firm is audited by top auditing firms (indicating a high audit quality), and 0 otherwise.
HHI	Herfindahl-Hirschman Index for each firm. HHI is the sum of squared market shares(in percentage) in a 2-digit SIC industry. Here I assign HHI value to each firm-year sample equals its industrial average of HHI over the five years prior to the reporting year, then multiplied by minus one. A higher HHI indicates a higher level of product competition.
GHI	Interaction variable of G Index and HHI.
EHI	Interaction variable of E Index and HHI.

Appendix 2 ATPs and Likelihood of Under-Investment

Predictors	Inv			NCaInv			CaInv		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
E Index	0.04	0.02	0.01	0.03	0.03	0.03	-0.05*	-0.00	-0.01
	(1.24)	(0.54)	(0.15)	(1.02)	(1.18)	(1.14)	(-2.28)	(-0.11)	(-0.37)
Leverage	-0.55*	1.24***	1.33***	-0.21	1.40***	1.50***	-1.34***	-0.36	-0.37
	(-2.47)	(4.47)	(4.65)	(-1.09)	(5.68)	(5.83)	(-6.89)	(-1.69)	(-1.71)
Oancf	0.60	1.81***	1.89***	1.26**	2.56***	2.67***	-0.04	0.62	0.68
	(1.26)	(3.54)	(3.65)	(2.89)	(5.34)	(5.45)	(-0.09)	(1.52)	(1.65)
BIG4	0.18	-0.08	-0.12	-0.04	-0.44*	-0.43*	0.05	0.02	-0.02
	(0.96)	(-0.40)	(-0.56)	(-0.23)	(-2.50)	(-2.41)	(0.32)	(0.11)	(-0.13)
LnAC	0.24***	-0.04	-0.06	0.15***	-0.07	-0.11*	0.04	-0.06	-0.07
	(5.14)	(-0.83)	(-1.01)	(3.85)	(-1.57)	(-2.22)	(1.05)	(-1.39)	(-1.82)
%Institutional	-0.80***	-0.33	-0.36	-0.47**	0.07	0.07	0.02	-0.66***	-0.45*
	(-4.29)	(-1.59)	(-1.59)	(-2.81)	(0.35)	(0.33)	(0.10)	(-4.11)	(-2.57)
Ln_boardsize	-0.43**	0.12	0.19	-0.38**	0.25	0.30	-0.60***	-0.29*	-0.20
	(-3.00)	(0.73)	(1.11)	(-3.02)	(1.69)	(1.95)	(-5.41)	(-2.38)	(-1.61)
%Independent	1.03***	0.31	0.54	1.03***	0.10	0.20	0.15	0.29	0.71**
	(3.78)	(1.03)	(1.60)	(4.39)	(0.38)	(0.67)	(0.73)	(1.32)	(2.92)
CEO duality	0.31***	0.28***	0.26**	0.23***	0.22**	0.24***	-0.03	0.05	0.03
	(4.41)	(3.68)	(3.20)	(3.81)	(3.26)	(3.38)	(-0.45)	(0.81)	(0.48)
Ln_Boardtenure	-0.19	-0.25*	-0.13	0.07	0.00	0.07	-0.03	-0.01	0.06
	(-1.95)	(-2.31)	(-1.14)	(0.83)	(0.01)	(0.66)	(-0.43)	(-0.16)	(0.68)
Year fixed effects	No	No	Yes	No	No	Yes	No	No	Yes
Industry fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
_cons	-0.98*	-0.74	-1.07	-1.41***	-2.72***	-2.27***	0.71*	1.00*	0.68
	(-2.11)	(-1.22)	(-1.62)	(-3.48)	(-4.65)	(-3.61)	(1.96)	(2.42)	(1.51)
Peseudo R-Squared	0.02	0.11	0.12	0.02	0.13	0.15	0.02	0.07	0.08
chi-square	243.06	1168.82	1294.46	304.51	1875.84	2081.74	288.44	1054.34	1234.22
N	5113.00	5113.00	5113.00	6852.00	6852.00	6852.00	7597.00	7597.00	7597.00

This table presents results from multinomial logit pooled regressions. $Invpercentile_{i,t}$ is firm's likelihood of over-(under-)investment. It equals to one if the abnormal investment is in the bottom quartile of the whole sample distribution (suggesting an under-investment behavior) and two if it is between p25 and p75, three if it is in the top quartile (suggesting an over-investment behavior). I use total abnormal investment (Inv), capital abnormal investment (CaInv) and non-capital abnormal investment (NCaInv) to measure the level of investment inefficiency. Firm-year observations in the top quantile of abnormal investment are classified as over-investing, and observations in the middle two quartiles are classified as the benchmark group. $E\ Index_{i,t}$ is a measurement of anti-takeover provisions introduced by Bebchuk et al. (2008), including 6 anti-takeover provisions. Higher E Index suggest a stronger managerial entrenchment power and lower market for corporate control. $Lev_{i,t}$ is total liabilities divided by total assets. $Oancf_{i,t}$ is firm's operating free cash flow. $Gov_{i,t}$ is control variables of other governance mechanism, including board size ($Ln\_boardsize_{i,t}$), percentage of independent board members ($\%Independent_{i,t}$), percentage of outstanding shares held by institutional investors ($\%Institutional_{i,t}$), whether CEO also serves as board chairman ($CEO\ duality_{i,t}$), and average tenure of board members ($Ln\_boardtenure_{i,t}$). $Ln\_AC_{i,t}$ is the natural logarithm as the total number of analysts that following the firm in past 12-months prior annual earnings announcement. $BIG4_{i,t}$ is a dummy variable, and it equals to 1 if firm is audited by big audit firms (suggesting a higher audit quality). Industry and (or) year fixed effect are included. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Appendix 3 ATPs, Product Competition and Likelihood of Under-investment

Predictors	Inv			NCaInv			CaInv		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
E Index	-0.76	0.08	0.14	0.24***	0.19**	0.19**	-0.15**	-0.10	-0.11*
	(-1.86)	(0.17)	(0.28)	(4.22)	(2.94)	(2.81)	(-3.09)	(-1.77)	(-1.97)
HHI	5.20***	-5.42**	-4.00*	3.61***	-6.57***	-5.70**	1.37*	1.66	1.79
	(4.30)	(-2.73)	(-1.99)	(3.59)	(-3.83)	(-3.24)	(1.98)	(1.41)	(1.50)
EHI	0.88	-0.08	-0.16	1.66***	1.02*	1.04*	-0.65*	-0.67*	-0.69*
	(1.91)	(-0.14)	(-0.28)	(4.31)	(2.19)	(2.18)	(-2.41)	(-2.13)	(-2.17)
Leverage	-1.00***	1.24***	1.20***	-0.76***	1.35***	1.35***	-1.13***	-0.23	-0.22
	(-3.88)	(3.79)	(3.56)	(-3.38)	(4.55)	(4.44)	(-4.92)	(-0.93)	(-0.88)
Oancf	1.41*	1.86**	1.97**	1.72**	2.94***	3.03***	0.09	0.56	0.62
	(2.32)	(2.87)	(2.99)	(3.15)	(4.87)	(4.95)	(0.19)	(1.09)	(1.20)
BIG4	0.20	0.07	-0.00	0.07	-0.13	-0.14	0.15	0.16	0.11
	(0.97)	(0.29)	(-0.01)	(0.41)	(-0.67)	(-0.66)	(0.98)	(0.95)	(0.68)
LnAC	0.22***	-0.14*	-0.16*	0.14**	-0.19***	-0.22***	-0.07	-0.18***	-0.18***
	(3.98)	(-2.27)	(-2.48)	(3.00)	(-3.32)	(-3.77)	(-1.61)	(-3.66)	(-3.75)
%Institutional	-0.98***	-0.61*	-0.49	-0.43*	-0.09	-0.04	-0.02	-0.69***	-0.65**
	(-4.26)	(-2.45)	(-1.92)	(-2.09)	(-0.39)	(-0.19)	(-0.13)	(-3.49)	(-3.21)
Ln_boardsize	-0.27	0.19	0.35	-0.19	0.38*	0.51**	-0.77***	-0.39*	-0.31
	(-1.45)	(0.89)	(1.64)	(-1.18)	(2.01)	(2.64)	(-5.30)	(-2.45)	(-1.91)
%Independent	0.47	-0.09	0.32	0.90**	0.36	0.43	0.11	0.25	0.57
	(1.26)	(-0.21)	(0.71)	(2.69)	(0.95)	(1.03)	(0.37)	(0.79)	(1.71)
CEO duality	0.32***	0.30***	0.26**	0.22**	0.28***	0.30***	-0.05	0.01	-0.00
	(4.01)	(3.32)	(2.82)	(3.15)	(3.50)	(3.57)	(-0.81)	(0.14)	(-0.07)
Ln_Boardtenure	-0.46***	-0.31*	-0.16	-0.13	-0.01	0.08	-0.00	0.05	0.13
	(-3.96)	(-2.47)	(-1.21)	(-1.27)	(-0.05)	(0.69)	(-0.05)	(0.47)	(1.22)
Year fixed effects	No	No	Yes	No	No	Yes	No	No	Yes
Industry fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
_cons	-4.57***	3.88*	2.04	-0.84	-4.47***	-5.08***	1.65***	1.83**	1.41*
	(-3.79)	(2.24)	(1.14)	(-1.53)	(-5.17)	(-5.76)	(3.45)	(3.02)	(2.24)
Peseudo R-Squared	0.05	0.14	0.15	0.05	0.15	0.16	0.02	0.08	0.09
chi-square	412.24	1114.21	1197.10	532.39	1669.98	1786.78	269.19	930.18	1018.19
N	3965.00	3965.00	3965.00	5265.00	5265.00	5265.00	5652.00	5652.00	5652.00

This table presents results from multinomial logit pooled regressions. $Invpercentile_{i,t}$ is firm's likelihood of over-(under-)investment. It equals to one if the abnormal investment is in the bottom quartile of the whole sample distribution (suggesting an under-investment behavior) and two if it is between p25 and p75, three if it is in the top quartile (suggesting an over-investment behavior). I use total abnormal investment (Inv), capital abnormal investment (CaInv) and non-capital abnormal investment (NCaInv) to measure the level of investment inefficiency. Firm-year observations in the top quantile of abnormal investment are classified as over-investing, and observations in the middle two quartiles are classified as the benchmark group. $E\ Index_{i,t}$ is a measurement of anti-takeover provisions introduced by Bebchuk et al. (2008), including 6 anti-takeover provisions. Higher E Index suggest a stronger managerial entrenchment power and lower market for corporate control. $HHI_{i,t}$is Herfindahl Index multiplied by minus one. Higher HHI represents higher product competition. $EHI_{i,t}$ is an interaction variable of E Index and HHI. $Lev_{i,t}$ is total liabilities divided by total assets. $Oancf_{i,t}$ is firm's operating free cash flow. $Gov_{i,t}$ is control variables of other governance mechanism, including board size ($Ln\_boardsize_{i,t}$), percentage of independent board members ($\%Independent_{i,t}$), percentage of outstanding shares held by institutional investors ($\%Institutional_{i,t}$), whether CEO also serves as board chairman ($CEO\ duality_{i,t}$), and average tenure of board members ($Ln\_boardtenure_{i,t}$). $Ln\_AC_{i,t}$ is the natural logarithm as the total number of analysts that following the firm in past 12-months prior annual earnings announcement. $BIG4_{i,t}$ is a dummy variable, and it equals to 1 if firm is audited by big audit firms (suggesting a higher audit quality). Industry and (or) year fixed effect are included. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Appendix 4 Additional Test for H1: OLS Regression of ATPs and Corporate Investment

Predictors	TI			Ncaexp			Caexp		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
E Index	0.004**	0.003	0.002	0.004***	0.003**	0.003**	-0.004***	-0.003**	-0.003***
Lev	-0.141***	-0.070***	-0.070***	-0.117***	-0.077***	-0.074***	-0.016	-0.006	-0.01
TQ	0.033***	0.029***	0.027***	0.028***	0.022***	0.022***	0.033***	0.036***	0.035***
Oancf	-0.104*	-0.053	-0.047	-0.220***	-0.136***	-0.132***	-0.046	-0.052	-0.047
BIG4	0.013	0.003	0.002	0.022**	0.011	0.013	0.009*	0.008*	0.006
LnAC	0.007	-0.004	-0.004	0.001	0.003	-0.003	0.011***	0.009***	0.009***
%Institutional	-0.014	0.009	0.011	-0.012	0.009	0.004	0.026**	0.014	0.032***
Ln_boardsize	-0.045***	-0.024***	-0.023***	-0.045***	-0.025***	-0.026***	-0.031***	-0.028***	-0.024**
%Independent	-0.019	-0.052**	-0.043*	0.027*	-0.018	-0.023	-0.067***	-0.057***	-0.031**
CEO duality	-0.011**	-0.014***	-0.015***	-0.014***	-0.015***	-0.015***	-0.002	0.001	-0.001
Ln_Boardtenure	-0.031***	-0.028***	-0.024***	-0.020***	-0.022***	-0.022***	-0.024***	-0.021***	-0.017**
Year fixed effect	No	No	Yes	No	No	Yes	No	No	Yes
Industry fixed effect	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
_cons	0.254***	0.295***	0.302***	0.187***	0.154***	0.178***	0.155***	0.190***	0.191***
r2	0.097	0.148	0.153	0.072	0.139	0.143	0.126	0.152	0.165
N	5120	5120	5120	6858	6858	6858	7597	7597	7597

This table presents results from pooled time-series cross-sectional regression OLS coefficients of a model predicting firm's investments. $TI_{i,t}$is firm's total investment (sum of capital & non-capital expenditures)scaled by lagged total assets. $Caexp_{i,t}$ is firm's capital expenditure scaled by lagged PPE. . $NCaexp_{i,t}$ is the sum of R&D expenditure and acquisitions, scaled by lagged total assets. $E\ Index_{i,t}$ is a measurement of anti-takeover provisions introduced by Bebchuk et al. (2008), including 6 anti-takeover provisions. Higher E Index suggest a stronger managerial entrenchment power and lower market for corporate control. $TQ_{i,t}$ is Tobin's Q. $Lev_{i,t}$ is total liabilities divided by total assets. $Oancf_{i,t}$ is firm's operating free cash flow. $Gov_{i,t}$ is control variables of other governance mechanism, including board size ($Ln\_boardsize_{i,t}$), percentage of independent board members ($\%Independent_{i,t}$), percentage of outstanding shares held by institutional investors ($\%Institutional_{i,t}$), whether CEO also serves as board chairman ($CEO\ duality_{i,t}$), and average tenure of board members ($Ln\_boardtenure_{i,t}$). $Ln\_AC_{i,t}$ is the natural logarithm as the total number of analysts that following the firm in past 12-months prior annual earnings announcement. $BIG4_{i,t}$ is a dummy variable, and it equals to 1 if firm is audited by big audit firms (suggesting a higher audit quality). Industry and (or) year fixed effect are included. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Appendix 5 Additional Test for H2: OLS regression of APTs, Product Competition and Corporate Investment

Predictors	Inv			NCaexp			Caexp		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
E Index	0.004	0.002	0.002	0.003	0.016	0.002	-0.001	0.000	-0.001
HHI	0.164***	-0.088	-0.064	0.258***	-0.037	-0.044	-0.03	0.068	0.065
EHI	0.004	-0.007	-0.008	-0.003	-0.014	-0.014	-0.003	-0.005	-0.005
Lev	-0.142***	-0.057**	-0.057**	-0.117***	-0.067***	-0.066***	-0.027***	-0.020*	-0.017
TQ	0.033***	0.030***	0.029***	0.027***	0.024***	0.024***	0.021***	0.023***	0.023***
Oancf	-0.038	0.006	0.011	-0.158***	-0.082*	-0.083	0.027	0.036	0.041
BIG4	0.005	-0.001	-0.002	0.012	0.007	0.007	0.012**	0.011**	0.009**
LnAC	0.011***	-0.003	-0.003	0.007***	0.001	0.000	0.014***	0.012***	0.013***
%Institutional	-0.019	0.001	0.002	-0.012	0.005	0.003	0.047***	0.041***	0.043***
Ln_boardsize	-0.047***	-0.033***	-0.031**	-0.054***	-0.038***	-0.038***	-0.028***	-0.025***	-0.023***
%Independent	-0.049	-0.072**	-0.067*	-0.011	-0.04	-0.046	-0.040***	-0.040***	-0.027**
CEO duality	-0.013**	-0.016***	-0.017***	-0.017***	-0.017***	-0.016***	-0.004	-0.001	-0.002
Ln_Boardtenure	-0.039***	-0.029***	-0.026**	-0.030***	-0.026***	-0.026***	-0.009**	-0.009**	-0.006
Year fixed effect	No	No	Yes	No	No	Yes	No	No	Yes
Industry fixed effect	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
_cons	0.308***	0.295***	0.272***	0.272***	0.172***	0.169***	0.070***	0.134***	0.107***
r2	0.095	0.144	0.082	0.082	0.136	0.138	0.145	0.183	0.196
N	3968	3968	5266	5266	5266	5266	5652	5652	5652

This table presents results from pooled time-series cross-sectional regression OLS coefficients of a model predicting firm's investments. $TI_{i,t}$is firm's total investment (sum of capital & non-capital expenditures)scaled by lagged total assets. $Caexp_{i,t}$ is firm's capital expenditure scaled by lagged PPE. . $NCaexp_{i,t}$ is the sum of R&D expenditure and acquisitions, scaled by lagged total assets. $E\ Index_{i,t}$ is a measurement of anti-takeover provisions introduced by Bebchuk et al. (2008), including 6 anti-takeover provisions. Higher E Index suggest a stronger managerial entrenchment power and lower market for corporate control. $HHI_{i,t}$is Herfindahl Index multiplied by minus one. Higher HHI represents higher product competition. $EHI_{i,t}$ is an interaction variable of E Index and HHI. Here $TQ_{i,t}$ is Tobin's Q. $Lev_{i,t}$ is total liabilities divided by total assets. $Oancf_{i,t}$ is firm's operating free cash flow. $Gov_{i,t}$ is control variables of other governance mechanism, including board size ($Ln\_boardsize_{i,t}$), percentage of independent board members ($\%Independent_{i,t}$), percentage of outstanding shares held by institutional investors ($\%Institutional_{i,t}$), whether CEO also serves as board chairman ($CEO\ duality_{i,t}$), and average tenure of board members ($Ln\_boardtenure_{i,t}$). $Ln\_AC_{i,t}$ is the natural logarithm as the total number of analysts that following the firm in past 12-months prior annual earnings announcement. $BIG4_{i,t}$ is a dummy variable, and it equals to 1 if firm is audited by big audit firms (suggesting a higher audit quality). Industry and (or) year fixed effect are included. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

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