Two Essays on
Competition, Corporate Investments, and Corporate Earnings

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ABSTRACT
(Academic)

The general focus of my dissertation, which consists of two essays, is on how changes in the financial and economic environment surrounding a firm affect managerial incentives and firm policies regarding investment in physical capital, innovation, equity offerings, and repurchases. The first essay in my dissertation examines how product market competition affects firms' investment decisions. While competition among firms benefits consumers via lower prices, greater product variety, higher product quality, and greater innovation, recent studies provide evidence that competition has been declining in the U.S. economy over the past decade. The evidence shows that American firms' profits are at near-record levels relative to GDP and are persistent. Industries have become more concentrated as a result of mergers and acquisitions, and barriers to entry have risen and the rate of new entry has been declining for decades. Taking these findings at face value, we examine empirically whether companies feel less compelled to invest in physical capital and in research and development because they face fewer threats from rival firms.

Using both traditional proxies and recently developed text-based measures of industry concentration, we show that firms operating in competitive industries invest significantly more in both physical capital and research and development relative to their peers in concentrated industries. We also report that the propensity to invest less by managers of monopolistic firms is partially mitigated by superior corporate governance that reduces the agency problem, and by certain product market characteristics such as low pricing power and low product differentiation/entry barriers. However, after accounting for all these mitigating factors, the negative association between industry concentration and investment persists. Our results are robust to including various control variables and exclusion of firms from industries that face significant competition from imports. The results are also robust to controlling for endogeneity caused by missing time-invariant and time-varying industry level factors that could potentially be related to both the level of concentration and investments.

Overall, our results are consistent with the notion that firms in competitive industries have a greater incentive to invest and innovate to survive and thrive in a competitive environment relative to the managers of the firms in more concentrated industries whose incentive to invest and innovate is to maintain their monopoly rents. Our findings have obvious policy implications in that investment and hence economic growth is being adversely affected in the current era of increasing industry concentration and declining competition.

The second essay in my dissertation investigates whether information contained in equity issues and buybacks is fully incorporated into prices such that the market reaction to subsequent earnings announcements is unrelated to those corporate actions. Korajczyk et al. (1991) argue that firms prefer to issue equity when the market is most informed about the quality of the firm to prevent adverse selection costs associated with new equity issues. This implies that equity issues tend to follow credible information releases contained in earnings announcements. However, analyzing a sample of 19,466 SEO pricing dates between 1970 and 2015 and 15,106 buyback announcements between 1994 and 2015 shows that a considerable number of equity offerings and repurchase announcements take place before the announcement of earnings. About 28% of buybacks and 32% of SEO pricings are made in the three weeks prior to an earnings announcement. Given these statistics, we examine whether these corporate actions provide information about upcoming earnings announcements (earnings predictability) to the extent that new information has not been fully incorporated into prices by market participants.

We find evidence of earnings predictability: the market reaction to earnings following buyback announcements is higher by 5.1% than the reaction to earnings following equity issues over the (-1,+30) window when four-factor abnormal returns are used; the difference is 2.2% when unadjusted returns are considered. The results are robust to several alternate sample construction methodologies. There are at least two puzzling effects of earnings predictability that are difficult to reconcile with the market efficiency hypothesis. First, there is an incomplete adjustment to SEO pricings and buyback announcements that results in residual market reaction to earnings announcements. Second, prices continue to drift after earnings announcements: upward for buybacks and downward for SEO pricings. Unlike post-earnings announcement drift, the drift documented here does not depend on the market reaction to earnings announcement. We test several reasons for this anomalous behavior including prior returns, price, size of buyback or SEO, analyst forecast errors, and bid-ask spread. We find that information asymmetry proxies partially explain the persistence of earnings predictability following SEO pricings and buyback announcements.

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ABSTRACT
(Public)

It is well documented that corporate investments in research and development (R&D) and physical capital are important drivers of economic growth and higher standards of living. Recent articles published by academic community and popular press have provided evidence that the overall competition among U.S. firms has declined. The evidence shows that concentration has increased in 75% of the US industries, the economy has lost about 50% of its publicly traded firms, and the rate of new-business formation has fallen. Given the documented association between corporate investments and economic growth & social welfare, a natural question arising would be whether declining competition is detrimental to investment in both physical capital and R&D. The first chapter of my dissertation aims to answer this question by examining whether companies feel less compelled to invest in physical capital and in R&D because they face fewer threats from rival firms. Our findings show that firms operating in concentrated industries invest significantly less in both physical capital and research and development relative to their peers in competitive industries, consistent with the notion that firms in competitive industries have a greater incentive to invest and innovate to survive and thrive in a competitive environment relative to the managers of the firms in more concentrated industries whose incentive to invest and innovate is to maintain their monopoly rents. Our findings have obvious policy implications in that investment and hence economic growth is being adversely affected in the current era of increasing industry concentration and declining competition.

The wealth of the shareholders of publicly traded firms is tied to managers' decisions about corporate actions such as equity offerings, buybacks, dividends, and mergers as these actions can potentially affect the stock prices and the value of shareholders' portfolios. The second part of my dissertation investigates whether buybacks or equity offerings announced within a few weeks prior to earnings provide information about upcoming earnings announcements to the extent that new information has not been fully incorporated into prices by market participants. We find that earnings coming after equity offerings are likely to contain bad news and earnings coming after buybacks are likely to contain good news. This implies that buying the shares of the companies that announce a buyback before their earnings and short selling the shares of the companies that issue equity before their earnings will yield a significant return for the investors.

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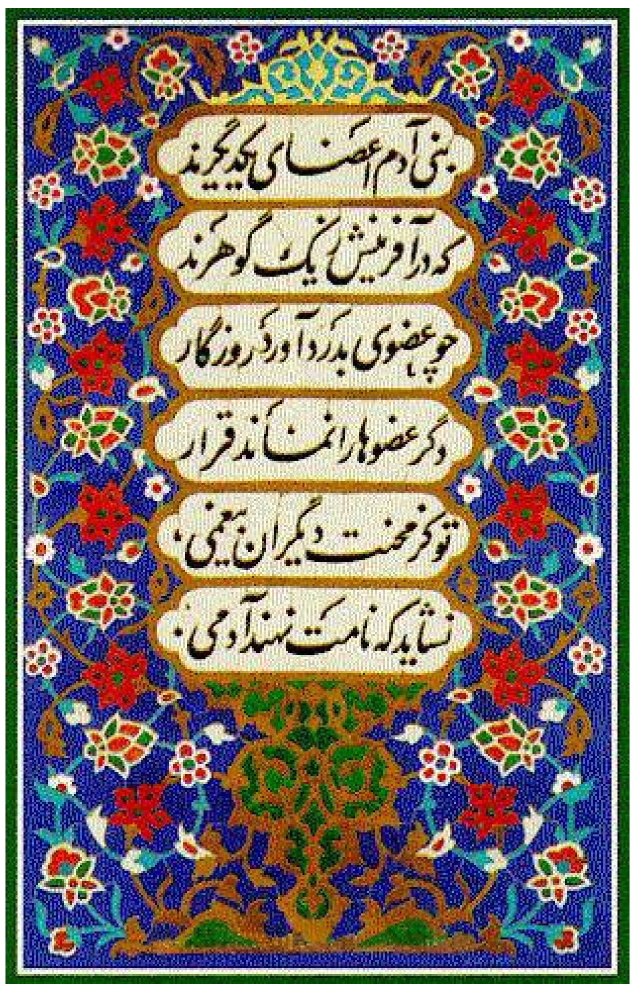
Dedication

I would like to dedicate this dissertation to my loving family, Shirzad, Nazkhatoun, Mohammad, Mehdi, Mahdieh, and Mina. I would also like to dedicate my work to those affected by the events of April 16, 2007 at Virginia Tech. Here is a poem by a Persian poet, Saadi, whom I admire dearly:

Human beings are members of a whole,
In creation of one essence and soul.
If one member is afflicted with pain,
Other members uneasy will remain.
If you have no sympathy for human pain,
The name of human you cannot retain.



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Chapter 1

Product Market Competition and Corporate Investments

1.1 Introduction

The popular press and academic studies have recently documented growing industry concentration accompanied by record domestic profits relative to GDP, and declining competition in the U.S. economy. Grullon et al. (2017) report that industry concentration has increased in 75% of the industries since the beginning of the 21st century accompanied by a loss of almost 50% of their publicly traded firms. Decker et al. (2014) also report that the rate of new-business formation has been trending down. The record high profits earned by firms in concentrated industries are not being competed away. Foulis (The Economist, March 26th, 2016) reports that excess cash generated domestically by U.S. firms is about $800 billion a year and that a very profitable U.S. firm has a 80% chance of being that way 10 years later, up from 50% in the 1990s. The article also attributes the growing industry concentration/falling competition to significant consolidation mergers worth $10 trillion since 2008. Gutiérrez and Philippon (2017) and Grullon et al. (2017) provide empirical evidence of weaker anti-trust enforcement and higher regulatory barriers to entry as reasons for the growing consolidation and industry concentration and sustained high profits. A very significant portion of the high corporate profits are being used to buy back shares. Lazonick (2014) documents that companies in the Fortune 500 Index used 54% of their earnings to buy back shares worth $2.4 trillion from 2003 through 2012. If the high profitability of firms in concentrated industries comes from their market/pricing power then it may come at the expense of consumers paying monopoly prices and the massive buyback could be at the expense of capital investment as suggested in Lazonick (2014).

Our study attempts to empirically test the views in the theoretical literature on the effect of product market competition on corporate investments. The Darwinian view posits that firms in competitive industries are forced to invest and innovate to stay competitive and survive. The alternative Schumpeterian view proposes that monopolistic firms in concentrated industries have an incentive to invest and innovate to maintain their monopoly rents in the future. Arguably, the incentive to invest to survive and prosper is stronger than the incentive to invest to sustain future monopoly rents. Further, monopolistic firms in concentrated industries are relatively immune to the discipline of the product market and the threat of entry and liquidation. Managers of such firms have greater opportunity for managerial slack which could potentially give rise to a greater agency problem resulting in sub-optimally low investment in physical assets and innovation. Product market competition combined with the threat of entry and possible liquidation mitigate managerial slack fostering investment and innovation, consistent with the Darwinian hypothesis. Thus, firms in competitive industries have both a stronger incentive to invest (to survive) and reduced managerial slack/agency problem leading to optimal investment decisions.

Our study supports the Darwinian hypothesis that competition induces greater investment and innovation. Using both traditional proxies and recently developed text-based measures of industry concentration, we show that firms operating in competitive industries invest significantly more in both physical capital and research and development relative to their peers in concentrated industries. We also report that the propensity to invest less by managers of monopolistic firms is partially mitigated by superior corporate governance that reduces the agency problem, and by certain product market characteristics such as low pricing power and low product differentiation/entry barriers. However, after accounting for all these mitigating factors, the negative association between industry concentration and investment persists. Our results are robust to inclusion of time-invariant and time-varying industry fixed effects to control for industry specific differences in capital intensity and the need for R&D that may be unrelated to industry concentration. The results are also robust to exclusion of firms from industries that face significant competition from imports.

The models in Dixit and Stiglitz (1977) and Fudenberg and Tirole (1983) predict a positive relation between industry concentration and corporate investment, consistent with the Schumpeterian view. In Aghion et al. (2005) and Leahy (1993) investment increases with competition, consistent with the Darwinian view. Aghion et al. (1999) introduce agency considerations and the incentive effects of product market competition in analyzing the relationship between competition and investments. In their model, monopolistic firms in concentrated industries are relatively immune from product market discipline and the threat of entry and liquidation. Managers of such firms have greater opportunity for managerial slack which gives rise to an agency problem resulting in suboptimally low investment in physical assets and innovation. Product market competition combined with the threat of entry and possible liquidation mitigate managerial slack fostering investment and innovation, consistent with the Darwinian hypothesis.

Bertrand and Mullainathan (2003) and Giroud and Mueller (2010) invoke the managerial slack concept to explain the results of their studies on the impact of the business combination (BC) laws on firm performance. The BC laws weaken the discipline of the market for corporate control and increase the opportunity for managerial slack. Bertrand and Mullainathan (2003) report that the destruction of old plants and the creation of new plants fall following the passage of the laws, consistent with the managers' preference for the quiet life. Giroud and Mueller (2010) report that the firms' operating performance falls and input and overhead costs increase post-BC laws but only in noncompetitive, monopolistic industries that do not face offsetting product market discipline. These results also suggest that the high profits earned by monopolistic firms are due to their pricing power rather than superior operating performance, a result confirmed by Grullon et al. (2017). Giroud and Mueller (2010) also show that the managerial slack induced agency problem mitigated by competition is more consistent with curbing the managers' preference for the quiet life rather than curbing empire building through overinvesting. Hicks (1935) views the quiet life as the "best of all monopoly profits."

Our study is motivated by the importance of declining competition in the U.S. economy, different views in the theoretical literature on whether investments increase or decrease with industry concentration, and paucity of empirical studies on how competition, or lack of thereof, affects the managers' investment decisions. The importance of the topic is highlighted by the fact that in March 2017 the Stigler Center at the University of Chicago hosted a three-day conference[1] to discuss "one of the most important question of our time: is there a concentration problem in the Unites States?"

In the first part of the study, we test which of the two incentives to invest and innovate dominates: the Darwinian view or the Schumpeterian view, and find that capital investment and R&D investment are negatively related industry concentration, on average, consistent with the notion that the incentive to invest and innovate is greater for firms in competitive industries. Using a large sample of publicly traded U.S. firms over the years 1976 to 2014, we find a statistically and economically significant and negative relation between industry concentration and corporate investment. The portfolio analysis, where we group stocks based on their Herfindahl-Hirschman index (HHI), as a proxy for product market competition in three-digit SIC code industries, reveals a substantial difference between investment expenditures in competitive versus noncompetitive environments. For competitive firms, investment in both physical capital and R&D accounts for 16.92% of their total assets, on average, while noncompetitive firms' total investment (capital expenditure plus R&D) accounts for 9.90% of their total assets. Statistically and economically, the difference in investment rates is highly significant. Regression analyses confirm the univariate results documenting a significant negative relation between industry concentration and corporate investment, controlling for other factors suggested in the investment-cash flow literature that are reported to affect a firm's investment decision.

To address the potential endogeneity problems possibly arising from omitted variables we (i) include control variables from the investment-cash flow literature, variables pertaining to governance quality and product market characteristics, additional variables in an augmented model, and lagged dependent variables in a dynamic model in the robustness section, (ii) address time-invariant industry factors by including 2- and 3-digit industry fixed effects in the regressions following Giroud and Mueller (2011) and Grullon and Michaely (2014), and (iii) address time-varying industry factors

[1] Visit the conference program at https://research.chicagobooth.edu/stigler/events/single-events/march-27-2017.

by performing annual cross-sectional regressions as in Fama and MacBeth (1973). Our results after controlling for endogeneity remain qualitatively similar with a highly significant and negative relation between investment and industry concentration. We also confirm these results using the continuous text-based network industry classification (THHI) of industry concentration suggested by Hoberg et al. (2014) and Hoberg and Phillips (2016) as an alternative to the standard HHI based on industry SIC codes.

We then examine how the investment patterns vary across firms and industries. To the extent that the decline in investment and innovation resulting from increased concentration is a reflection of an agency problem arising from managerial slack, we expect a cross sectional variation in the firms' investment patterns depending on the variation in the severity of the prevailing agency problem. Factors that mitigate/exacerbate opportunities for managerial slack could potentially foster/discourage investment and affect the negative relation between concentration and corporate investments. These include (i) product market characteristics and structure, (ii) external monitoring from institutional ownership and block ownership, and (iii) internal monitoring from superior corporate governance.

For (i), we examine product market conditions that could affect the level of investments. These include (a) the presence of a leader-follower relation between the two firms with the two largest market shares, as opposed to neck-and-neck competition between two firms, (b) real and perceived product differentiation (thru' R&D and advertising expenditures) which allow monopoly rents and serve as an entry barrier promoting the opportunities for managerial slack, enabling the quiet life and leading to lower investments, and (c) the price elasticity of demand (Lerner index) which also reduces the incentive to invest and innovate by allowing monopoly pricing which enables the quiet life. Following Aghion et al. (2005), we expect the presence of a leader-follower relation to spur innovation. We report that, as hypothesized, industries with leaders and followers have higher investment in innovation (but lower investment in physical capacity), and firms with differentiated products (higher advertising expenditures) invest substantially less in both physical assets and R&D as do firms with higher pricing power.

Our measures of the variables pertaining to (ii) and (iii) for external and internal governance are the standard, accepted measures from the empirical literature in corporate finance. We hypothesize a positive association between governance quality and the firms' decision to invest and innovate as internal and external monitoring reduce managerial slack. Our findings, consistent with this hypothesis, show that external monitoring proxied by institutional ownership leads to increased investment in physical assets and R&D. The positive relation between innovation and institutional holdings is also consistent with institutional owners fostering innovation by reducing the "career risk" of risky projects (see Aghion et al., 2013). Blockholder monitoring increases capital expenditure but has no significant effect on R&D expenditure. In the case of internal governance, board independence fosters innovation, as does superior corporate governance with fewer antitakeover provisions (ATPs) incorporated in the (low) entrenchment index of Bebchuk et al. (2009). Fewer ATPs increase the discipline of equity markets, reduce management entrenchment/slack and foster innovation.

Overall, however, we report that even after controlling for all the mitigating factors from product market conditions and internal and external governance, the strong negative association between corporate investment and industry concentration persists, consistent with the Darwinian hypothesis. Our results are robust to (i) sub period analysis, (ii) the use of cutoffs based on the U.S. Department of Justice classification of firms into competitive, oligopolistic or monopolistic categories of the HHI distribution as an alternative to terciles, (iii) inclusion of additional control variables in an augmented baseline regression specification, (iv) replacing R&D expenditure as the dependent variable by the productivity of innovation measured as in Kogan et al. (2017), (v) exclusion for firms that face significant competition from imports, and (vi) the use of industry level regressions.

The recent paper by Gutiérrez and Philippon (2017) asks the same research question as ours: how does product market competition affect corporate investments? However, the financial economic forces as well as the research setting are fundamentally different in the two studies. In Gutiérrez and Philippon (2017), the results are driven by competition shocks in the product market that have a differential impact on the investment decisions of leader and laggard firms. The study also finds that industries with higher excess entry of firms invest more. Our study takes a basic corporate finance approach in which monopolistic firms not facing the discipline of the product market competition invest and innovate less, and competition fosters investment and innovation by mitigating the agency cost associated with the opportunities for managerial slack. Product market conditions including the leader-follower relationship enter our analyses as control variables. Moreover, our results showing a negative relation between concentration and investment for firms hold not only for the period of increasing concentration, but also for the period during which industry concentration is declining. While the results of both papers suggest that investment has declined because of decreased competition, our paper documents a robust negative relation between concentration and investments at the firm level across periods of increasing and decreasing competition.

This paper adds to the existing literature on corporate investment, specifically on the relation between corporate investment and product market competition. Theoretical models in the economic literature have produced conflicting predictions on the effect of product market competition on corporate capital investment, depending on the set of assumptions used in the models. The resolution of such conflict is then an empirical question. Earlier studies by Khanna and Tice (2000) and Frésard and Valta (2015) have examined the firms' response to changes in the competitive environment. Our study attempts to estimate the relation between product market competition and investment using a comprehensive panel dataset that includes manufacturing and non-manufacturing firms and spans the 39 year period from 1976 to 2014 which includes periods of overall decreasing concentration and increasing concentration. Our primary result from the pooled regression that corporate investment and innovation decline significantly with increasing industry concentration is consistent with the managerial slack induced agency problem which promotes the quiet life. Further, the result is robust to the inclusion of factors in the model that may have an influence on the relationship mitigating or exacerbating the agency problem. These include internal and external governance and product market conditions and characteristics.

Our results have obvious policy implications in that investment and hence economic growth is being adversely affected in the current era of increasing industry concentration and declining competition. Economic and government policies should attempt to reverse this trend. The rest of this article is organized as follows. Section 1.2 describes the data, variables, and summary statistics. Section 1.3 provides the basic empirical results, Section 1.4 examines the relationship between investment and product market characteristics, Section 1.5 investigates the link between investment and agency costs, and Section 1.6 examines the robustness of main findings while Section 1.7 concludes.

1.2 Data selection and summary statistics

Our main sample includes U.S. firms listed on NYSE, AMEX, or NASDAQ with CRSP share codes of 10 and 11, that are covered by CRSP and Compustat between 1976 and 2014. We exclude firms for which sales and total assets are either missing or negative and exclude utility (SIC codes 4900-4949) and financial (SIC codes 6000-6999) firms. Following Hou et al. (2015), we use CRSP SIC codes whenever Compustat SIC codes are not available. Some companies change their fiscal year end in the middle of the calendar year. In these cases, there is more than one annual record for the accounting data. We select the last annual record in a given calendar year. Institutional investor quarterly holdings and the percentage of block ownership are obtained from the Thomson Reuters 13(F) Institutional Holdings database. Proxies for internal corporate governance quality including the percentage of independent board members and degree of managerial entrenchment proxied by the E-Index of Bebchuk et al. (2009) are obtained from ISS RiskMetrics database.

1.2.1 Measuring industry concentration

Following Hou and Robinson (2006), Giroud and Mueller (2011), Gu (2016), and Aslan and Kumar (2016), and other papers on product market competition, our main proxy for industry concentration is the Herfindahl-Hirschman index (HHI) at the three-digit SIC code industry level. The HHI, a widely used and well-established proxy for product market competition, is defined as

$$HHI_{jt} = \sum_{i=1}^{N_j} s_{ijt}^2,$$

where s_{ijt} is the market share of firm i in industry j in year t. We use Compustat data on firms' sales to compute market shares. The HHI measure calculated with Compustat data is our main proxy for industry concentration throughout this paper. Since this measure is constructed at the national level, it tends to overstate the level of competition for certain industries including large grocery stores such as Kroger, which operates only in certain regions of the country. And it tends to understate the level of competition in industries characterized by significant competition from imports. This makes the HHI measure a noisy proxy for the level of competition, and thereby reduces the likelihood of finding a significant relation between this measure and investments. Our results exhibit a significant negative relation between HHI and investments despite such noise.

The standard SIC-based HHI measure is not free from criticism. For example, Ali et al. (2009) compare the Compustat-based HHI with industry concentration measures collected from the Census of Manufactures publications provided by the U.S. Census Bureau, which are based on all public and private firms in an industry. They suggest using U.S. Census-based concentration measures as they align better with industry price-cost margins and with firm size measures such as net sales, total assets, and market capitalization. The Census-based measures, however, have at least two shortcomings. First, they are only available for manufacturing industries. Second, the measures are only computed every 5 years.

To address both the critiques of Compustat-based, standard HHI, and the drawbacks of U.S. Census-based measures of concentration, in robustness checks, we use a text-based network industry classification (THHI) introduced by Hoberg and Phillips (2010), Hoberg et al. (2014), and Hoberg and Phillips (2016). The THHI, which is derived from business descriptions in annual firm 10-Ks, is a network way of identifying competitors to each firm. The descriptions in annual firm 10-Ks are legally required to be accurate, as Item 101 of Regulation S-K legally requires that firms describe the significant products they offer to the market, and these descriptions must also be updated and representative of the current fiscal year of the 10-K. In the THHI framework, competitors are firms residing in close proximity in product space to each firm based on a continuous measure of similarity. A key benefit of THHI is that industry composition is updated annually, which means the product market space itself dynamically changes over time.[2]

We also construct dummy variables for industry concentration: HHI-M, and HHI-H. These dummy variables indicate whether the HHI of a firm lies in the medium (oligopolistic), or the highest (monopolistic) tercile of its empirical distribution, respectively. As opposed to using the exact value of the HHI, using HHI dummies mitigates measurement problems, which, as discussed earlier, are sometimes an issue with the HHI. Moreover, the dummy variables allow for a more intuitive economic interpretation of the coefficient estimates. Our results hold if we follow the guidelines of the U.S. Department of Justice and Federal Trade Commission and define HHI-M as 1 when the HHI is between 1500 and 2500, and HHI-H as 1 when the HHI is above 2500.

1.2.2 Measuring investment

A reliable measure of corporate investment is a proxy that is linearly associated with investment opportunities and is deflated by the capital stock such as total assets (Hayashi, 1982). To incorporate these properties into our proxy for investments, we follow Smith and Watts (1992), Minton and

[2]We thank Hoberg and Phillips for making the text-based network industry classifications (THHI) and 10-K based industry classification (FHHI) data available online. Visit http://hobergphillips.usc.edu/.

Schrand (1999), and Whited (2006) and use the following investment proxies in our empirical tests:

- Proxy for physical investment (Capex/TA): The dollar value of capital expenditure (Compustat item CAPX) scaled by the prior year end total assets (item AT).
- Proxy for investment in innovation (R&D/TA): The dollar value of R&D expenditure (item XRD) scaled by the prior year end total assets (item AT). Following the standard practice in the literature, we set the R&D expenditure to zero whenever it is missing in the Compustat database.

1.2.3 Control variables

In our empirical tests, we use a series of control variables suggested by the investment and patents literature. In this section, we briefly describe these variables and their construction.

- Market value of equity (Size): The calendar year closing price (item PRCC_C) times the total number of shares outstanding (item CSHO) converted to 2010 dollars.
- Tobin's Q (TQ): Total assets (item AT) plus the market value of equity (MVE) minus the sum of the common stockholders' equity (item CEQ) and balance sheet deferred taxes (item TXDB) scaled by total assets (item AT) as a proxy for growth opportunities.
- Cash flow (CF/TA): Income before extraordinary items (item IB) plus depreciation (item DP) plus deferred taxes (item TXDB, if available) scaled by the prior year end total assets (item AT), in order to control for the availability of cash for making the investment.
- Leader-follower (Leader): The difference between the first highest and the second highest market share in an industry in a given year as one of the proxies for the product market conditions which may affect the investment.
- Product differentiation (Pdiff): Advertising expenses (item XAD) scaled by total sales (item SALE) as a proxy for product differentiation, a product market characteristic which may affect investments. Following the standard practice in the literature, we set the advertising expenses to zero whenever it is missing in the Compustat database.
- Lerner index (L-Index): Sales (item SALE) minus the sum of the cost of goods sold (item COGS) and the selling, general and administrative expenses (item XSGA) scaled by total sales (item SALE) as a proxy for pricing power, a product market characteristic which may affect investments. Following Aghion et al. (2005), when there is data missing for these items, the operating income after depreciation (item OIADP) is used to calculate the Lerner index. We exclude depreciation from operating income to take into account the cost of physical capital (Grullon et al., 2017). Our main results are qualitatively similar if we use a version of the Lerner index that does not exclude depreciation from operating income.

- Total institutional ownership (InstOwn): The ratio of total shares held by institutions to the total shares outstanding calculated quarterly for each firm, as one of the proxies for the quality of governance provided by shareholders.
- Block institutional ownership (BlockOwn): The sum of all ownership positions greater than 5% held by institutional investors, as one of the proxies for the quality of governance provided by shareholders.
- Board independence (BoardInd): The ratio of the number of outside unaffiliated directors to the total number of directors on the board, as one of the proxies for the quality of governance provided by the board.
- Degree of managerial entrenchment (E-Index): The entrenchment index described in Bebchuk et al. (2009) as one of the proxies for the quality of corporate governance. It uses six shareholder rights-decreasing provisions a firm has. The index ranges from a feasible low of zero to a high of six; a high score is associated with weak shareholder rights.
- Capital intensity (PPE/TA): Net amount of property, plant and equipment (item PPENT) scaled by the prior year end total assets (item AT) as a proxy for tangibility.
- Leverage: The sum of long-term debt (item DLTT) and short-term debt (item DLC) scaled by total assets (item AT).
- Life cycle (RE/TA): Retained earnings (item RE) scaled by total assets (item AT), as a proxy for the life-cycle stage at which a firm currently finds itself.
- Sales growth (SalesGrowth): The percent change in sales (item SALE) from one year to another year.

At times, some of the key ratios we use in our empirical analyses pose outlier problems. To cope with extreme values and mitigate their effect, we follow Giroud and Mueller (2011) and Valta (2012) and winsorize all ratios at the top and bottom two percentiles of their underlying distributions. Our results remain qualitatively unchanged when we apply a winsorization to the top one percent, or when we exclude firms with book equity below $250,000 or total assets below $500,000.

1.2.4 Summary statistics

For the aggregate sample, Table 1.1 presents the number of observations (N), first quartile (Q1), mean, median, third quartile (Q3), and standard deviations for the variables used in our empirical tests. This table shows that the median and mean of the HHI are 1693 and 2196, respectively, which correspond to moderately concentrated industries. An average firm in our sample spends 8.41% of its total assets on physical investment and 4.89% on R&D. The average firm has a market value of $1.969 billion measured in 2010 dollars, and a Tobin's Q of 1.89. Cash flow accounts for 5.64% of the total assets of an average firm in our sample.

Table 1.1: Summary statistics for aggregate sample

The sample includes U.S. firms listed on NYSE, AMEX, or NASDAQ with CRSP share codes of 10 and 11, that are covered by CRSP and Compustat between 1976 and 2014. Utility (SIC codes 4900-4949) and financial (SIC codes 6000-6999) firms and firms for which sales and total assets are either missing or negative are excluded. The table reports the summary statistics for the sample. Number of observations (N), first quartile (Q1), mean, median, third quartile (Q3), and standard deviations are reported. HHI is the Herfindahl-Hirschman index at the three-digit SIC code industry level. THHI is a text-based network industry classification introduced by Hoberg et al. (2014), and is derived from business descriptions in annual firm 10-Ks. See Section 1.2.1 for more details. The description of remaining control variables is provided in Section 1.2.3 in the paper. All ratios are winsorized at the 2nd and 98th percentiles.

	N	Q1	Mean	Median	Q3	Std.
HHI	150,898	998.70	2196.28	1692.97	2717.86	1750.35
THHI	70,084	988.40	2530.65	1701.85	3254.75	2242.65
Capex/TA (%)	151,362	2.29	8.41	5.00	10.11	10.00
R&D/TA (%)	153,291	0.00	4.89	0.00	5.15	9.59
Size ($Millions)	154,690	31.36	1969.66	133.39	647.07	12472.31
TQ	149,479	1.00	1.89	1.35	2.11	1.50
CF/TA (%)	152,606	1.47	5.64	10.42	17.86	22.89
Leader (%)	150,898	4.46	18.70	12.43	25.37	19.93
Pdiff (%)	156,904	0.00	1.15	0.00	1.17	2.48
L-Index	156,902	0.02	−0.14	0.09	0.16	1.01
InstOwn (%)	131,794	9.13	35.55	29.41	58.43	29.03
BlockOwn (%)	133,428	0.00	11.66	7.00	18.86	13.84
BoardInd (%)	20,539	60.00	69.64	72.73	83.33	17.56
E-Index	29,642	1.00	2.50	3.00	3.00	1.42
PPE/TA (%)	153,103	11.94	33.06	25.72	46.74	27.12
Leverage (%)	156,412	4.52	23.67	20.29	36.69	21.00
RE/TA (%)	155,145	−22.72	−23.98	11.84	33.40	117.97
SalesGrowth (%)	153,292	−1.67	20.99	10.17	26.88	50.33

About 35.55% of an average firm's stock is held by institutional investors and 11.66% of its shares are held by institutional blockholders. About 69.64% of the board of directors of an average firm in our sample are independent, unaffiliated members, and the firm has a Bebchuk et al. E-Index of 2.50. Overall, we observe large cross-sectional differences in investment proxies and firm characteristics which will increase the power of our empirical models designed to establish the impact of concentration levels on corporate investments. In untabulated results, we calculate the Pearson's correlation between the main control variables along with the significance levels. Analyzing the results reveals that the correlation between the HHI and firm size is only 2%, confirming that the HHI is not simply a proxy for firm size. We provide formal inferences in the next section.

1.3 Basic results: Investment and industry concentration

We investigate the relation between investment and product market competition empirically and examine whether or not physical and innovative investments are different in competitive versus monopolistic industries. We provide evidence from both analysis of portfolios and from regressions. Figure 1.1 plots the general trend in HHI, and total investment (capital expenditures plus research and development spending) over time. The figure shows that the industry concentration increased in the 1970s, but then declined in the 1980s. The decline in HHI could be a result of the deregulation wave over that period (Winston, 1998; Grullon et al., 2017). The concentration has been increasing almost monotonically since the late 1990s. The upward trend in HHI could be a result of much higher rates of mergers and acquisitions relative to the number of remaining public firms over this period (Grullon et al., 2017). The level of total investment since the late 1990s, however, is significantly lower than the historical average. In this paper, we empirically test whether there is a negative association between the industry concentration and firm level investment in both physical assets and innovation after controlling for the key determinants of investments suggested by literature and for the possible confounding effects.

1.3.1 Portfolio analysis

We first examine the relation between product market competition and investment using portfolios. Each year, we classify stocks into three categories based on the industry concentration level (HHI); low HHI or competitive industries (the lowest tercile), medium HHI or oligopolistic industries (the medium tercile), and high HHI or monopolistic industries (the highest tercile). We then calculate the cross-sectional mean, median, and standard deviation of the relevant firm characteristics, as well as the industry characteristics for each competition category for each year. Finally, we compute the time-series averages of these cross-sectional estimates for each category. The results are presented in Table 1.2. The last two columns of the table show the differences in the mean values of these time series averages between competitive and monopolistic firms along with their t statistics. The results show substantial differences in the characteristics of competitive, oligopolistic, and monopolistic

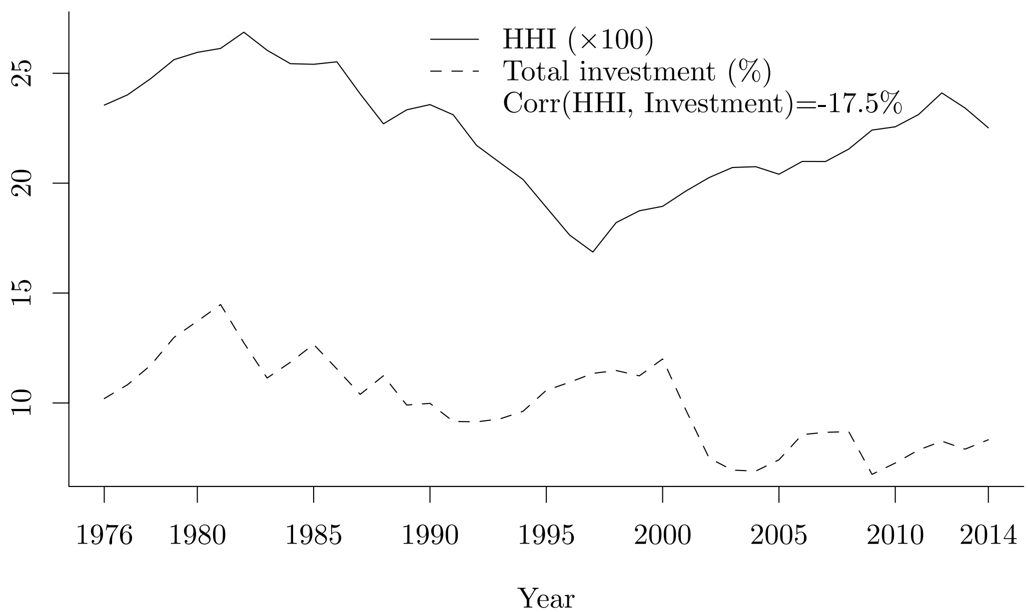

Figure 1.1: Aggregate trends in investment and industry concentration

This figure plots the level of concentration and average investment for publicly traded firms from 1976 to 2014. The proxy for industry concentration is the Herfindahl-Hirschman index (HHI) at the three-digit SIC code industry level calculated by squaring the market share of each firm competing in an industry, and then summing the resulting numbers. Investment is the sum of physical investment and innovative investment. Proxy for physical investment is dollar value of capital expenditure and proxy for investment in innovation is the dollar value of R&D expenditures.

Table 1.2: Portfolio analysis of the firms' characteristics: Sorted on HHI

The sample includes U.S. firms listed on NYSE, AMEX, or NASDAQ with CRSP share codes of 10 and 11, that are covered by CRSP and Compustat between 1976 and 2014. Utility (SIC codes 4900-4949) and financial (SIC codes 6000-6999) firms and firms for which sales and total assets are either missing or negative are excluded. The table reports the firms' characteristics separately for competitive, oligopolistic, and monopolistic firms. Each year, stocks are classified into three categories based on the industry concentration level (HHI); low HHI or competitive industries, medium HHI or oligopolistic industries, and high HHI or monopolistic industries. The cross-sectional mean, median, and standard deviation of firms characteristics as well as industry characteristics are then calculated for each competition category. Finally, the time-series averages of these cross-sectional estimates are calculated across all categories. The last two columns of the table show the differences in the mean values along with their t statistic. HHI is the Herfindahl-Hirschman index at the three-digit SIC code industry level. The description of remaining control variables is provided in Section 1.2.3 in the paper. All ratios are winsorized at the 2nd and 98th percentiles. Symbols $***$, $**$, and $*$ indicate significance at the 1%, 5%, and 10% levels, respectively.

	Low HHI (Competitive)			Medium HHI (Oligopolistic)			High HHI (Monopolistic)			Difference (Com–Mon)	
	Mean	Median	Std.	Mean	Median	Std.	Mean	Median	Std.	Mean	t Value
HHI	881.37	875.59	272.40	1692.18	1692.97	421.65	4021.66	3329.89	1904.06	−3140.28	−365.97
Capex/TA (%)	8.98	5.07	10.75	8.39	5.15	9.77	7.76	4.85	9.06	1.21	19.03
R&D/TA (%)	7.94	1.66	12.07	4.95	0.00	9.44	2.14	0.00	5.54	5.80	97.05
Size ($Millions)	1760.38	127.57	11402.37	1867.73	143.78	12003.78	2472.27	151.45	14435.59	−711.89	−8.64
TQ	2.12	1.48	1.69	1.87	1.35	1.49	1.68	1.27	1.25	0.44	46.31
CF/TA (%)	2.59	9.74	26.62	5.66	10.45	22.73	8.49	11.11	18.60	−5.90	−40.28

firms.

There is a monotonic pattern in the physical investment ratios across industry concentration categories. Firms operating in monopolistic industries are, on average, spending 1.21% less on physical investment compared to their peer firms in competitive industries. R&D expenses also show a monotonic pattern and significant differences across the competition categories. Competitive firms spend 7.94% of their total assets on R&D, and oligopolistic firms spend 4.95% of their total assets on R&D while monopolistic firms spend only 2.14% of their total assets on R&D. The 5.80% difference between R&D expenses in competitive and noncompetitive industries is significant at a 1% level (t=97.05).

An average firm operating in a competitive environment is \$1.760 billion in size and an average firm operating in a noncompetitive environment is \$2.472 billion in size. Monopolistic and oligopolistic firms have fewer growth opportunities (proxied by Tobin's Q) compared to their peers in competitive industries. The extent of a firm's cash flow is negatively related to the level of product market competition. Cash flow is 2.59% of the total assets of an average competitive firm, whereas for an average noncompetitive firm, cash flow is 8.49% of the total assets. Overall, the univariate results in Table 1.2 support the Darwinian view of competition and investments; competition provides firms with incentives to invest and innovate more to escape competition and/or stay competitive in the product market and managers who do not feel the competitive threat from rival firms make lower investment in new projects as well as R&D. Finally, substantially lower spending on R&D by monopolistic firms is in line with the predictions of the classic Arrowian view about the impact of market structure on innovation. Arrow (1962) argues that a monopolist has fewer incentives to invest in R&D than a competitive firm because it gains less from innovation than a competitive firm as the former is replacing itself as a monopolist.

1.3.2 Regression analysis

To provide a multivariate analysis, we analyze the relation between industry concentration and investment using a regression framework. Our baseline models are augmentations of regressions common to the investment literature (see Fazzari et al., 1988; Kaplan and Zingales, 1997; Lamont, 1997). More specifically, we run the following cross-sectional regression:

$$\frac{Capex_{i,t+1}}{TA_{i,t}} \Big/ \frac{R\&D_{i,t+1}}{TA_{i,t}} = \beta_0 + \beta_1 HHIProxy_{j,t} + \beta_2 TQ_{i,t} + \beta_3 \frac{CF_{i,t}}{TA_{i,t-1}} + \alpha_j + \lambda_t + \epsilon_{i,t} \qquad (1.1)$$

where i indexes firms and t indexes calendar year. The dependent variable is either the capital expenditure scaled by the prior year end total assets ($Capex/TA$) or the R&D expenditure scaled by the prior year end total assets ($R\&D/TA$). We follow Baker et al. (2003), Brown et al. (2009), and Brown and Petersen (2009), and scale both capital expenditure and R&D expenses by total assets to maintain a common scale factor for all regressions throughout the paper. $HHIProxy$ represents our industry concentration proxy. We use the logarithm of the Herfindahl-Hirschman index, $Log(HHI)$, as our first choice. The second choice includes the HHI dummies: $HHI-M$ which is 1 if the HHI of firm i in year t lies in the medium tercile of its empirical distribution and 0 otherwise, and $HHI-H$ which is 1 if the HHI of firm i in year t lies in the highest tercile of its empirical distribution and 0 otherwise. Using the HHI dummies as opposed to using the continuous HHI measure alleviates potential measurement errors, and allows us to investigate the impact of change in industry concentration on firm's investment separately for competitive and monopolistic industries.

TQ is Tobin's Q; the classic investment predictor which is included to control for investment opportunities. CF/TA is the firm's cash flow scaled by the prior year end total assets. A firm's cash flow may affect investment spending because of a financing hierarchy in which internal funds have a cost advantage over new debt or equity finance. Under these circumstances, firms' investment and financing decisions are interdependent (Fazzari et al., 1988). Cash flow could also act as a proxy for investment opportunities not captured by Tobin's Q (Kaplan and Zingales, 1997). Finally, α_j controls for industry fixed effects, and λ_t represents year dummies to control for any time trends, possible seasonality in investment, and to remove common macroeconomic shocks from our estimates. Following Giroud and Mueller (2011) and Hoberg et al. (2014), all right-hand variables are lagged and all ratios have been winsorized at the 2% and the 98% of their empirical distribution to mitigate the effect of outliers.

First, we investigate the effect of the industry concentration on firms' physical and innovative investments without controlling for industry fixed effects. We report the results with industry fixed effects in the next section of the paper to control for (i) industry level factors unrelated to the concentration level such as capital intensity that may affect investments and innovation, and (ii) possible endogeneity concerns that may arise from omitted industry level factors that have a simultaneous effect on both concentration and investments. We show that the significance of our results for the concentration level is robust to inclusion or exclusion of the industry fixed effects. The regression estimates reported in Table 1.3 include only year fixed effects and the coefficient of interest in this table is for the $HHIProxy$. The reported standard errors are robust to heteroskedasticity and are clustered by firm to remove any pattern of within-firm serial correlation.

Models 1 to 4 present results of estimating Equation (1.1) in which the dependent variable is the capital expenditure scaled by lagged total assets. Model 1 and 2 in Table 1.3 estimate the basic impact of competition intensity on the mean physical investment. For Model 1, we include the logarithm of the HHI (as a proxy for industry concentration) to investigate whether product market competition affects managers' decisions to expand physical capacity. The results show that capital expenditure is negatively related to the industry concentration level after controlling for year fixed effects, and the negative relation is statistically highly significant.

For Model 2, we use the HHI dummies, HHI-M and HHI-H, as opposed to the continuous HHI. The estimated coefficients suggest that firms operating in high-concentration (monopolistic) industries have lower physical investment by a significantly larger amount compared to the firms in low-

Table 1.3: Investment and product market competition: Basic results

This table reports the results of regressions of physical and innovative investment on competition proxies and a set of control variables. The sample includes U.S. firms listed on NYSE, AMEX, or NASDAQ with CRSP share codes of 10 and 11, that are covered by CRSP and Compustat between 1976 and 2014. Utility (SIC codes 4900-4949) and financial (SIC codes 6000-6999) firms and firms for which sales and total assets are either missing or negative are excluded. The dependent variable includes the capital expenditure scaled by the prior year end total assets (Capex/TA) and the R&D expenditure scaled by the prior year end total assets (R&D/TA). HHI is the Herfindahl-Hirschman index at the three-digit SIC code industry level. HHI-M is a dummy variable which is 1 if the HHI of firm i in year t lies in the medium tercile of its empirical distribution and 0 otherwise. HHI-H is a dummy variable which is 1 if the HHI of firm i in year t lies in the highest tercile of its empirical distribution and 0 otherwise. The description of remaining control variables is provided in Section 1.2.3 in the paper. All control variables are lagged and all ratios have been winsorized at the 2% and the 98% of their empirical distribution. Heteroskedasticity-robust standard errors are clustered by firm and reported in parentheses. N shows the number of observations and symbols $***$, $**$, and $*$ indicate significance at the 1%, 5%, and 10% levels, respectively.

	Capex/TA				R&D/TA			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log(HHI)	-0.456^{***}		-0.476^{***}		-3.317^{***}		-2.603^{***}	
	(0.077)		(0.079)		(0.090)		(0.079)	
HHI-M		-0.489^{***}		-0.540^{***}		-2.643^{***}		-2.004^{***}
		(0.108)		(0.108)		(0.132)		(0.117)
HHI-H		-0.770^{***}		-0.852^{***}		-5.312^{***}		-4.168^{***}
		(0.125)		(0.129)		(0.151)		(0.132)
TQ			1.131^{***}	1.131^{***}			2.420^{***}	2.436^{***}
			(0.037)	(0.037)			(0.058)	(0.058)
CF/TA			9.275^{***}	9.290^{***}			-1.135^{***}	-1.077^{***}
			(0.267)	(0.267)			(0.350)	(0.351)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No	No	No	No	No
Adjusted R^2	0.041	0.041	0.106	0.107	0.087	0.083	0.235	0.233
N	132,583	132,583	124,329	124,329	133,928	133,928	125,574	125,574

concentration (competitive) industries. We investigate the robustness of this industry concentration effect in Models 3 and 4. For Model 3, we include the control variables suggested by the investment literature. In particular, we follow Kaplan and Zingales (1997), Lamont (1997), and Alti (2003) and control for Tobin's Q (TQ) and cash flow scaled by the prior year end total assets (CF/TA). The coefficient of the variable of interest, the logarithm of HHI, remains negative and statistically highly significant.

The coefficients of the remaining control variables are consistent with the findings in the investment-cash flow sensitivity literature. Firms with high growth opportunities invest more in physical capital and a firm's physical investment is sensitive to its own cash flow indicating that firms face a wedge between the internal and external cost of funds. The results show that both control variables have significant explanatory power, despite the Q theory prediction that only Tobin's Q should matter. The investment literature interprets the results as evidence that financial constraints have a significant effect on investment (Fazzari et al., 1988), or as evidence that cash flow is a proxy for investment opportunities not captured by Tobin's Q (Kaplan and Zingales, 1997; Erickson and Whited, 2000; Alti, 2003).

Model 4 is a specification of Equation (1.1) where we use the HHI dummies, HHI-M and HHI-H, as opposed to the continuous HHI and control for investment opportunities and cash flow. The results again confirm the findings reported in previous specifications. The estimated coefficients suggest that firms operating in high-concentration (monopolistic) industries have lower physical investment by a significantly larger amount compared to the firms in low-concentration (competitive) industries even after controlling for the widely accepted determinants of investment. Similar to Model 2, the coefficients of the other control variables are consistent with the findings of the investment-cash flow sensitivity literature. Firms with high growth opportunities have higher capital expenditures and their investment in physical capital is positively related to their cash flows. We include these control variables in all the other specifications in this paper.

Understanding the relation between competition intensity and R&D is of importance because corporate R&D expenditures are key components of innovative activities which foster technological progress and are primary sources of economic growth and welfare. In Model 5, similar to Model 1 from capital expenditure regressions, we include only the logarithm of HHI to examine the basic impact of industry concentration on R&D investment. The coefficient of competition intensity is negative, large in magnitude and statistically significant at a 1% confidence level, implying that managers make considerably lower investment in innovative activities when they face fewer threats from competition in the product market. The magnitude of the negative coefficient of competition intensity is much larger than the negative coefficient of competition intensity reported in Model 1, suggesting that the industry concentration's negative effect on investment in R&D is more severe than for investment in physical capital, which can potentially lead to lower economic growth and social welfare in the long run.

In Model 6, we replace the continuous HHI with the HHI dummies to investigate how change in industry concentration affects the R&D investment. The results support our conjecture that managers make lower investment when the competition in the industry is lower. We observe a negative relation between industry concentration and R&D investment. The estimates show that investment in R&D is statistically and economically significantly lower in high-concentration (monopolistic) industries relative to low-concentration (competitive) industries

In order to examine whether our results are robust to inclusion of other known determinants of investments, we include Tobin's Q and cash flow[3] variables in our R&D regressions and report the results in Models 7 and 8. We observe a similar pattern to what we documented in Models 5 and 6. Higher industry concentration firms have significantly lower spending on research and innovation after controlling for firm characteristics that may affect managers' decisions to invest in innovative activities and after controlling for unobserved time fixed effects influencing firms' investment decisions. We document a positive coefficient on Tobin's Q implying that firms with higher growth opportunities spend more on research and development of new products as predicted by the Q theory of investment.

We document a negative relation between cash flow and R&D investment. Prior studies (for example, Fazzari et al., 1988; Whited, 1992; Alti, 2003) provide empirical evidence that a firm's internally generated operating cash flow has a positive effect on corporate capital expenditures. Therefore, to the extent that capital investments and R&D expenditures have similar determinants, we expect operating cash flow to correlate positively with future R&D. However, we find that there is a significant negative correlation between last year's internally generated operating cash flow and current R&D expenditures. However, this negative relation between operating cash flow and R&D expenditures is consistent with prior empirical literature.

Bhagat and Welch (1995) who empirically explore the determinants of corporate R&D expenditures in five OECD regions including the United States also find that last year's cash flow is significantly negatively correlated with current R&D expenditures for U.S. firms. They argue that it is possible that managers with low operating cash flows invest in R&D with the expectation that high future operating cash flows will pay for the incurring R&D expenditures. Atanassov et al. (2016), who examine the relationship between political uncertainty and R&D investment, also document a negative relation between cash flow and R&D intensity.

Overall, the evidence in Table 1.3 indicates that, on average, there exists a meaningful difference between corporate investment in competitive markets and corporate investment in noncompetitive markets. In all specifications in which we control for growth opportunities, cash flow, and year fixed effects, the competition intensity has a negative and highly significant coefficient. This implies that, on average, firms in less competitive industries have lower capital and R&D investment than firms in more competitive industries. The regression results in Table 1.3 are consistent with the univariate results in Table 1.2 and support the Darwinian view that competition fosters greater investment

[3]Following Brown et al. (2009), for the regressions of innovative activities, we add back R&D expenses to our measure of cash flow to avoid a mechanical relation between R&D and cash flow.

and innovation.

1.3.3 Endogeneity and time-invariant industry fixed effects

A potential source of endogeneity in our regressions is the possible omission of industry level factors that may affect industry concentration and the level of investments. To address this concern, in this section we follow Giroud and Mueller (2011) and Grullon and Michaely (2014) and use time-invariant industry fixed effects in our regressions even though HHI is an industry-level variable. This also controls for industry level factors such as capital intensity that may not be related to the concentration level. In the next section, we address the concern of potential endogeneity caused by the possible omission of time-varying industry level factors in our regressions.

Controlling for time-invariant, omitted-variable endogeneity is important because there are likely to be industry level factors which are unrelated to the current level of concentration in the industry, such as the capital intensity of the industry, which could have a significant impact on the level of investments in plant and equipment and R&D. For example, for the same level of concentration, airlines are expected to have lower expenditures on R&D and possibly higher level of capital expenditures, as compared to pharmaceuticals. And a significant part of this expenditure would be invariant to their current level of concentration. The industry fixed effects would capture such time-invariant differences across industries while the HHI would capture the effect of different and changing levels of concentration on investments.

Table 1.4 contains the coefficient estimates of Equation (1.1) including both industry and year fixed effects. Panel A controls for industry fixed effects at the 2-digit SIC code level and Panel B controls for industry fixed effects at the 3-digit SIC code level. Similar to Table 1.3, we report the estimates using either the log of HHI or the HHI dummies. In both panels, we find negative and statistically significant coefficients on the proxies for industry concentration, conforming to the prediction of the Darwinian view on the impact of product market competition on corporate investment. Comparison of the regression estimates in Tables 1.3 and Table 1.4 shows that the inclusion of industry fixed effects does not alter our main findings but (i) partially addresses the endogeneity caused by time-invariant, unobserved industry characteristics and (ii) greatly improves the explanatory power of our models. Adjusted R^2 values are significantly larger in models with industry fixed effects, suggesting that there are significant industry level factors unrelated to the current level of concentration in the industry that affect the capital expenditures and R&D expenditures. Accordingly, we include industry fixed effects in all subsequent regressions. Following Grullon and Michaely (2014), the industry fixed effects included in subsequent regressions are estimated at the two-digit SIC code level to avoid multicollinearity between HHI (calculated at the three-digit SIC code level) and the industry fixed effects.

Table 1.4: Investment and product market competition: Time-invariant industry fixed effects

This table reports the results of regressions of physical and innovative investment on competition proxies and a set of control variables. The sample, dependent variables, and control variables are similar to those in Table 1.3. All control variables are lagged and all ratios have been winsorized at the 2% and the 98% of their empirical distribution. Heteroskedasticity-robust standard errors are clustered by firm and reported in parentheses. N shows the number of observations and symbols ∗∗∗, ∗∗, and ∗ indicate significance at the 1%, 5%, and 10% levels, respectively.

	Capex/TA				R&D/TA			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: 2-digit industry fixed effects								
Log(HHI)	−0.517***		−0.510***		−1.840***		−1.593***	
	(0.069)		(0.067)		(0.089)		(0.081)	
HHI-M		−0.633***		−0.631***		−1.540***		−1.288***
		(0.097)		(0.095)		(0.119)		(0.107)
HHI-H		−0.892***		−0.913***		−2.941***		−2.523***
		(0.106)		(0.104)		(0.143)		(0.129)
TQ			1.304***	1.303***			1.924***	1.924***
			(0.035)	(0.035)			(0.049)	(0.049)
CF/TA			7.218***	7.237***			−1.432***	−1.397***
			(0.219)	(0.219)			(0.308)	(0.309)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.208	0.209	0.267	0.267	0.303	0.303	0.391	0.391
N	132,449	132,449	124,206	124,206	133,785	133,785	125,442	125,442
Panel B: 3-digit industry fixed effects								
Log(HHI)	−0.413***		−0.471***		−0.361***		−0.420***	
	(0.094)		(0.092)		(0.070)		(0.067)	
HHI-M		−0.718***		−0.785***		−0.150*		−0.217***
		(0.102)		(0.100)		(0.082)		(0.078)
HHI-H		−0.646***		−0.803***		−0.325***		−0.429***
		(0.135)		(0.132)		(0.085)		(0.082)
TQ			1.350***	1.351***			1.555***	1.555***
			(0.034)	(0.034)			(0.045)	(0.045)
CF/TA			6.711***	6.717***			−1.154***	−1.143***
			(0.210)	(0.210)			(0.289)	(0.289)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.240	0.241	0.298	0.298	0.434	0.433	0.489	0.488
N	132,449	132,449	124,206	124,206	133,785	133,785	125,442	125,442

1.3.4 Endogeneity and time-varying industry fixed effects

In addition to the omitted time-invariant industry level factors, there may be omitted time-varying industry level factors such as the dynamic and evolving nature of the relevant technology, changing level of international competition, and other life-cycle variables that could raise endogeneity concerns. To address this concern, we re-estimate the regressions on the cross-section of firms on a year-by-year basis with industry fixed effects and calculate the average of the coefficients using the approach as in Fama and MacBeth (1973). This approach allows the coefficient on the industry fixed effects variables to be different each year, thereby controlling for time-varying omitted industry level variables. This approach also allows us to examine the robustness of the negative relation between concentration and investments on a yearly basis. The year-by-year regressions of Equation (1.1) over the period 1976 to 2014 produce 39 sets of coefficients. Table 1.5 reports average coefficients with associated standard errors, average regression adjusted R^2, and average observations per year.

The coefficients on industry concentration dummy variables conform with the results of the pooled regressions reported in Tables 1.3 and 1.4. The HHI-H dummy is negatively related to both physical and innovative investment. The coefficient on Tobin's Q is positively related to investment and the coefficient on cash flow is also consistent with previous findings, with the exception of an insignificant coefficient for cash flow in R&D regressions. Finally, the control variables explain a substantial portion of cross-sectional variation in investments, with an average adjusted R^2 of more than 30% when capital expenditure is the dependent variable and an average adjusted R^2 of more than 39% when R&D expenditure is the dependent variable.

Panel A of Figure 1.2 plots the estimated coefficients of the HHI-H dummy variable from Fama-MacBeth regressions each year when capital expenditure is the dependent variable. Panel B of this graph shows the same estimates using the R&D expenditure as the dependent variable. With an exception of 2011 in Panel A, the estimated values are negative for all years in both panels, implying a persistent inverse relation between firms' investment and industry concentration. Overall, the estimates reported in Table 1.5 and Figure 1.2 show that managers in firms of noncompetitive industries invest less in both physical assets and R&D relative to managers facing forces of competition in the product market.

1.3.5 Alternative concentration measures

In this section, we examine whether our main results are robust to different measures of industry concentration. In particular, we use the text-based HHI (THHI) defined in section 1.2.1. An advantage of using the text-based measure of industry concentration is that this measure by construction mitigates the potential endogeneity issue in studies linking competition to financial policies. One could argue that firm managers who set the investment decisions, also choose the product market strategies. While a firm's own managers set the firm's investment policies, text-based proxies reflect moves by rival firms competing in a firm's product space (see Hoberg et al., 2014).

Table 1.5: Investment and product market competition: Fama-MacBeth regressions

This table reports the results of regressions of physical and innovative investment on competition proxies and a set of control variables. The sample includes U.S. firms listed on NYSE, AMEX, or NASDAQ with CRSP share codes of 10 and 11, that are covered by CRSP and Compustat between 1976 and 2014. Utility (SIC codes 4900-4949) and financial (SIC codes 6000-6999) firms and firms for which sales and total assets are either missing or negative are excluded. The dependent variable includes the capital expenditure scaled by the prior year end total assets (Capex/TA) and the R&D expenditure scaled by the prior year end total assets (R&D/TA). HHI is the Herfindahl-Hirschman index at the three-digit SIC code industry level. HHI-M is a dummy variable which is 1 if the HHI of firm i in year t lies in the medium tercile of its empirical distribution and 0 otherwise. HHI-H is a dummy variable which is 1 if the HHI of firm i in year t lies in the highest tercile of its empirical distribution and 0 otherwise. The description of remaining control variables is provided in Section 1.2.3 in the paper. All control variables are lagged and all ratios have been winsorized at the 2% and the 98% of their empirical distribution. Standard errors are reported in parentheses. N shows the number of observations and symbols $***$, $**$, and $*$ indicate significance at the 1%, 5%, and 10% levels, respectively.

	Capex/TA		R&D/TA	
	(1)	(2)	(3)	(4)
Log(HHI)	−0.332***		−1.830***	
	(0.044)		(0.172)	
HHI-M		−0.111		−1.853***
		(0.089)		(0.311)
HHI-H		−0.631***		−3.200***
		(0.075)		(0.352)
TQ	1.356***	1.356***	1.868***	1.845***
	(0.098)	(0.098)	(0.055)	(0.053)
CF/TA	9.643***	9.628***	−0.439	−0.387
	(1.339)	(1.341)	(0.660)	(0.650)
Industry fixed effects	Yes	Yes	Yes	Yes
Average adjusted R^2	0.304	0.304	0.392	0.394
Average N/year	3,269	3,269	3,301	3,301

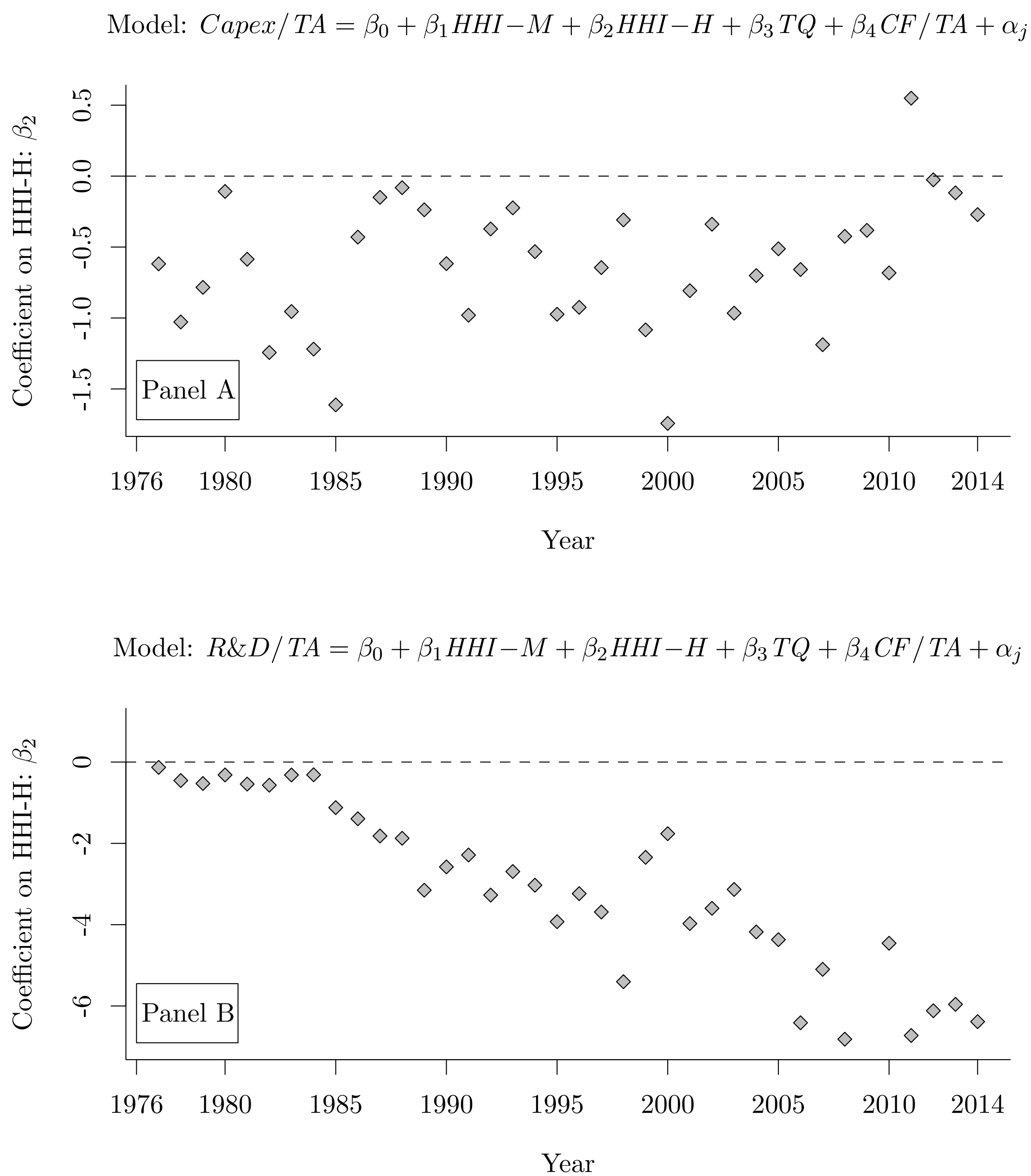

Figure 1.2: Relation between investments and the high-concentration dummy variable by year

Panel A shows the plots of the estimated coefficients of the HHI-H dummy variable when capital expenditure is the dependent variable. Panel B of this graph shows the same estimates using R&D expenditure as the dependent variable. The estimates are from Fama-MacBeth type regressions from 1976 to 2014. HHI-H is a dummy variable which is 1 if the HHI of firm i in year t lies in the highest tercile of its empirical distribution and 0 otherwise.

Furthermore, the text-based HHI measure, unlike the standard SIC-based HHI, (i) adjusts over time as product markets evolve, (ii) allows for product markets themselves to evolve over time, (iii) allows for the possibility that two firms that are rivals to a third firm might not directly compete against each another, (iv) provides more reliable measures in the case of multi-industry firms and in the case where markets and industries are not quite same, and lastly (iv) allows for within industry continuous measures of similarity to be computed. Given these advantages, we reestimate our baseline model in Equation (1.1) using the text-based measure (THHI) as our proxy for industry concentration and compare the results with those obtained by using the standard SIC-based HHI.

The results of this exercise in analyzing corporate investment are reported in Table 1.6. Models 1 to 4 report the results of regressing capital expenditure on investment opportunities and industry concentration proxies. Each specification includes the same set of control variables except for the concentration proxy. We use the log of standard HHI in Model 1, the standard HHI dummies in Model 2, the log of text-based HHI in Model 3, and the text-based HHI dummies in Model 4 as our proxies for industry concentration. Models 1 and 2 in Table 1.6 are similar to Models 1 and 2 in Table 1.4 but the model is estimated over a subset of the sample where the THHI is not missing. We do this analysis to have a more meaningful comparison between the standard HHI and the text-based proxy since the text-based HHI is available only after 1996.

We document a negative and significant association between different measures of industry concentration and investments in physical capital, suggesting that firms in less competitive industries tend to invest less in physical capital even after using more dynamic and complex measures of competition intensity. The last four columns use investment in R&D as the dependent variable regressed on the same set of control variables as Models 1 to 4. Consistent with our prior findings, there is a strong negative association between different measures of industry concentration and innovation activities.[4] The negative coefficients on competition intensity proxies are larger in magnitude and remain statistically significant at a 1% confidence level. The coefficients on the investment opportunities proxies including Tobin's Q and cash flow are also consistent with our prior findings.

Overall, the evidence in Table 1.6 is consistent with the Darwinian view on the impact of market structure on investment. Lastly, a comparison of the adjusted R^2 across different models shows that the models with the standard HHI are able to generate a competing adjusted R^2 in explaining the cross-section of firms' investment decisions. Given this finding, we use the standard HHI as our main proxy for industry concentration as it is equally powerful as the text-based measures but it allows us to cover a much longer time period in our sample (39 years coverage for the standard HHI as opposed to 19 years coverage for the text-based HHI).

[4] Balakrishnan and Darendeli (2017) use textual analyses of 10-K reports to develop a proxy measure of localized/state level competition, as opposed to the industry level competition measured by the traditional variants of HHI. They report a positive association between localized competition and innovation consistent with our findings.

Table 1.6: Investment and product market competition: Alternative measures of concentration

This table reports the results of regressions of physical and innovative investment on competition proxies and a set of control variables. The sample includes U.S. firms listed on NYSE, AMEX, or NASDAQ with CRSP share codes of 10 and 11, that are covered by CRSP and Compustat between 1996 and 2013. Utility (SIC codes 4900-4949) and financial (SIC codes 6000-6999) firms and firms for which sales and total assets are either missing or negative are excluded. The dependent variable includes the capital expenditure scaled by the prior year end total assets (Capex/TA) and the R&D expenditure scaled by the prior year end total assets (R&D/TA). HHI is the Herfindahl-Hirschman index at the three-digit SIC code industry level. THHI is a text-based network industry classification introduced by Hoberg et al. (2014), and is derived from business descriptions in annual firm 10-Ks. See Section 1.2.1 for more details. The description of remaining control variables is provided in Section 1.2.3 in the paper. All control variables are lagged and all ratios have been winsorized at the 2% and the 98% of their empirical distribution. Heteroskedasticity-robust standard errors are clustered by firm and are reported in parentheses. N shows the number of observations and symbols $***$, $**$, and $*$ indicate significance at the 1%, 5%, and 10% levels, respectively.

	Capex/TA				R&D/TA			
	Concentration proxy:				Concentration proxy:			
	HHI	HHI	THHI	THHI	HHI	HHI	THHI	THHI
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log(Concentration)	−0.459***		−0.555***		−2.155***		−0.754***	
	(0.090)		(0.074)		(0.143)		(0.073)	
Concentration-M		−0.086		−0.605***		−1.788***		−0.801***
		(0.129)		(0.111)		(0.173)		(0.130)
Concentration-H		−0.663***		−0.813***		−3.526***		−1.470***
		(0.147)		(0.138)		(0.237)		(0.145)
TQ	1.005***	1.008***	1.046***	1.048***	1.988***	1.990***	1.676***	1.677***
	(0.036)	(0.036)	(0.039)	(0.039)	(0.062)	(0.062)	(0.059)	(0.059)
CF/TA	3.963***	3.963***	4.208***	4.254***	−3.320***	−3.258***	−2.224***	−2.178***
	(0.232)	(0.232)	(0.252)	(0.252)	(0.422)	(0.422)	(0.397)	(0.397)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.331	0.331	0.266	0.265	0.413	0.413	0.477	0.477
N	58,679	58,679	55,673	55,673	59,107	59,107	56,040	56,040

1.4 Investment and product market characteristics

Next, we test whether the negative association between investment and industry concentration is a manifestation of product market characteristics that may affect managers investment decisions. In particular, we control for the existence of leaders and followers in an industry, product differentiation, and pricing power. In addition, to the extent Tobin's Q is a noisy measure of a firm's growth and investment opportunities, these product market characteristics provide additional control for growth and investment opportunities. Hence, we augment our baseline specifications with several product market characteristics that could affect investment opportunities and the relation between industry concentration and investment.

Aghion et al. (2005) develop a model wherein a leader-follower type of competition discourages laggard firms from innovating but encourages firms engaged in neck-and-neck competition to innovate. In the model, both leaders and followers in an industry can innovate and innovation incentives depend on the difference between post-innovation and pre-innovation rents. The model shows that in industries where there is a neck-and-neck competition as opposed to a leader-follower scenario, more competition may encourage investment aimed at escaping competition. To take this prediction into our model, we calculate the difference between the first highest and second highest market share of the firms in each 3-digit SIC code level and define a leader-follower dummy variable (LeaderDum) which is 1 if the difference assigned to firm i in year t is above its median and 0 otherwise. Hence, LeaderDum=1 implies that there is more of a leader-follower relation between the two firms with the largest market shares in the industry, and LeaderDum=0 implies that there is more of a neck-and-neck competition between the two firms with the largest market shares in the industry.

Another channel that may affect the relation between industry concentration and investment is product differentiation. Based on previous work (Schmalensee, 1983), we use advertisement expenses scaled by total sales (Pdiff) as a proxy for product differentiation. Finally, one may argue that the industry concentration proxy captures firms' ability to price above marginal cost (pricing power). To control for this possibility and examine whether the negative correlation between investment and industry concentration stems from higher pricing power, we follow prior studies (Elzinga and Mills, 2011) and include Lerner index (L-Index) in our augmented regression as a proxy for pricing power. We include these three control variables individually and collectively in our baseline specification from Equation (1.1), using the HHI dummies as our industry concentration measures.

The results, presented in Table 1.7, show that competition intensity remains a significant predictor of both physical and innovative investments and the effect is economically large, even after controlling for the three product market characteristics, which may affect the relation between competition and investments, individually or collectively. The negative and highly statistically significant coefficients on the industry concentration proxies (HHI-M and HHI-H) in all eight specifications show that our industry concentration proxies are not simply capturing the effect of leader-follower investment

Table 1.7: Investment and product market characteristics

This table reports the results of regressions of physical and innovative investment on competition proxies and a set of control variables. The sample includes U.S. firms listed on NYSE, AMEX, or NASDAQ with CRSP share codes of 10 and 11, that are covered by CRSP and Compustat between 1976 and 2014. Utility (SIC codes 4900-4949) and financial (SIC codes 6000-6999) firms and firms for which sales and total assets are either missing or negative are excluded. The dependent variable includes the capital expenditure scaled by the prior year end total assets (Capex/TA) and the R&D expenditure scaled by the prior year end total assets (R&D/TA). HHI is the Herfindahl-Hirschman index at the three-digit SIC code industry level. HHI-M is a dummy variable which is 1 if the HHI of firm i in year t lies in the medium tercile of its empirical distribution and 0 otherwise. HHI-H is a dummy variable which is 1 if the HHI of firm i in year t lies in the highest tercile of its empirical distribution and 0 otherwise. LeaderDum is a dummy variable which is 1 if the difference between the first highest and the second highest market share in an industry in a given year is above its median and 0 otherwise. Pdiff is the advertising expenses scaled by total sales. L-Index is the Lerner index and is defined as the total sales minus the sum of the cost of goods sold and the selling, general and administrative expenses scaled by total sales. When there is data missing for the these items, the operating income after depreciation is used to calculate the Lerner index. The description of remaining control variables is provided in Section 1.2.3 in the paper. All control variables are lagged and all ratios have been winsorized at the 2% and the 98% of their empirical distribution. Heteroskedasticity-robust standard errors are clustered by firm and are reported in parentheses. N shows the number of observations and symbols $***$, $**$, and $*$ indicate significance at the 1%, 5%, and 10% levels, respectively.

	Capex/TA				R&D/TA			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
HHI-M	−0.501***	−0.626***	−0.616***	−0.487***	−1.415***	−1.281***	−1.006***	−1.151***
	(0.098)	(0.095)	(0.095)	(0.098)	(0.111)	(0.106)	(0.094)	(0.099)
HHI-H	−0.674***	−0.899***	−0.882***	−0.640***	−2.759***	−2.503***	−1.964***	−2.226***
	(0.113)	(0.104)	(0.104)	(0.113)	(0.141)	(0.127)	(0.111)	(0.126)
TQ	1.304***	1.308***	1.271***	1.278***	1.922***	1.934***	1.401***	1.406***
	(0.034)	(0.034)	(0.035)	(0.035)	(0.049)	(0.049)	(0.044)	(0.044)
CF/TA	7.225***	7.197***	8.180***	8.115***	−1.387***	−1.485***	7.315***	7.254***
	(0.219)	(0.220)	(0.263)	(0.264)	(0.309)	(0.312)	(0.311)	(0.312)
LeaderDum	−0.360***			−0.346***	0.356***			0.419***
	(0.074)			(0.074)	(0.088)			(0.079)
Pdiff		−5.233***		−4.925***		−8.240***		−6.391***
		(1.812)		(1.807)		(2.463)		(2.086)
L-Index			−0.389***	−0.383***			−3.812***	−3.811***
			(0.057)	(0.057)			(0.095)	(0.095)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.268	0.267	0.268	0.269	0.391	0.391	0.483	0.483
N	124,206	124,205	124,206	124,205	125,442	125,441	125,442	125,441

strategies, product differentiation, or pricing power. The results of these tests not only strengthen the robustness of the industry concentration effect on investments but also suggest that the industry concentration contains information about corporate investment not captured by other measures commonly used in the investment literature.

The coefficients on product market characteristics appear with expected signs predicted by theory and provide informative insights about managers' decisions to invest. The firms in an industry with a leader-follower relation between the two firms with the largest market shares invest less in expanding physical capacity but invest more in R&D expenditures, as compared to firms in industries where the two firms with the largest market shares are in more of a neck-and-neck competition. In industries with differentiated products, advertising, which is designed to influence demand and therefore prices, contributes to entry barriers by raising the ante for the firms seeking to enter the industry (Spence, 1980). The negative coefficient on advertising expenditures implies that managers invest less in both physical capital and innovation when there is greater potential to create product differentiation through advertising. Because the competitiveness of an industry is shown to be strongly influenced by its entry conditions (von Weizsäcker, 1980), the negative correlation between barriers to entry and investment further provides evidence for Darwinian view where managers make lower investments when competition intensity in the industry is lower.

Finally, we document a negative and statistically significant coefficient on the Lerner index. This finding suggests that managers make lower investment in both physical assets and innovative activities when they have higher pricing power. Increased ability in pricing above marginal cost is another signal for declining competition in the industry and the negative sign for the Lerner index reinforces our main finding that higher industry concentration is associated with lower investment in both physical capacity and R&D.

1.5 Investment and agency costs

The portfolio and regression analyses in Section 1.3 establish a significant negative relation between corporate investment and industry concentration. We have argued that this finding is consistent with Darwinian view wherein monopoly firms in concentrated industries not facing the discipline of product market competition reduce physical investment and innovation. In Section 1.4, we examine how product market factors may affect corporate investments by enabling or perturbing managers incentive to underinvest. In this section, we extend our analyses to study the effect of external and internal corporate governance on investments, and on the relation between industry concentration and investments, in an agency cost framework.

1.5.1 External corporate governance

We employ two measures of external corporate governance: (i) institutional ownership estimated as the sum of all ownership positions held by institutions, and (ii) block ownership defined as sum of all ownership positions greater than 5%. Following Dittmar and Mahrt-Smith (2007) and Giroud and Mueller (2011), we include these governance proxies as dummy variables in our specifications. More specifically, we define an institutional ownership dummy (InstOwnDum) as 1 if the total institutional ownership for firm i in year t is above its median and 0 otherwise, and a block institutional ownership dummy (BlockOwnDum) as 1 if the block institutional ownership for firm i in year t is above its median and 0 otherwise. Employing dummy variables allows for an intuitive economic interpretation of the coefficients. In addition, the dummy variables should mitigate any measurement problems, which are sometimes an issue with institutional ownership data (Lewellen, 2011).

We report our results in in Table 1.8. Models 1 and 3 in Table 1.8 present the results of the impact of institutional holding/monitoring on capital investment and on R&D expenditure, respectively. Models 2 and 4 similarly report the results for block-holding/monitoring. All four coefficients of the external governance variables are positive and the coefficients in the first three models are statistically significant. Our finding that external monitoring proxied by institutional and block holding induces investment in physical assets and R&D is consistent with an agency cost where managers cut investments in the absence of product market competition. Aghion et al. (2013) also document a positive association between innovation and institutional holdings. In their model institutional owners foster innovation by insulating the managers from reputational consequences of bad outcomes thereby reducing the managers' career concerns associated with risky long-term projects. In addition, the results show that higher industry concentration is associated with lower investment in physical capital and innovative activities even after controlling for the effect of external corporate governance on managers' investment decisions.

1.5.2 Internal corporate governance

The next part of our analysis examines how the quality of internal corporate governance affects managers' investment decisions and whether the industry concentration remains a significant predictor of investments after controlling for the impact of internal governance on corporate investments. We employ two measures of such governance: (i) board independence measured as the percentage of independent directors on the board and included in the augmented regression as a dummy variable (BoardIndDum) which takes a value of 1 if the percentage of independent directors of firm i in year t is above the median, and 0 otherwise, and (ii) the entrenchment or E-Index as defined by Bebchuk et al. (2009).

The E-Index is based on six provisions in the corporate charter. Two are anti-takeover provisions (ATPs) and four are provisions designed to curb shareholder rights. The index is constructed by assigning a score of 1 for each provision and obtained from the Institutional Shareholder Service

Table 1.8: Investment and external corporate governance

This table reports the results of regressions of physical and innovative investment on competition proxies and a set of control variables. The sample includes U.S. firms listed on NYSE, AMEX, or NASDAQ with CRSP share codes of 10 and 11, that are covered by CRSP and Compustat between 1976 and 2014. Utility (SIC codes 4900-4949) and financial (SIC codes 6000-6999) firms and firms for which sales and total assets are either missing or negative are excluded. The dependent variable includes the capital expenditure scaled by the prior year end total assets (Capex/TA) and the R&D expenditure scaled by the prior year end total assets (R&D/TA). HHI is the Herfindahl-Hirschman index at the three-digit SIC code industry level. HHI-M is a dummy variable which is 1 if the HHI of firm i in year t lies in the medium tercile of its empirical distribution and 0 otherwise. HHI-H is a dummy variable which is 1 if the HHI of firm i in year t lies in the highest tercile of its empirical distribution and 0 otherwise. InstOwnDum is a dummy variable which is 1 if the total institutional ownership, defined as the sum of all ownership positions held by institutional investors, for firm i in year t is above its median and 0 otherwise. BlockOwnDum is a dummy variable which is 1 if the block institutional ownership, defined as the sum of all ownership positions greater than 5% held by institutional investors, for firm i in year t is above its median and 0 otherwise. The description of remaining control variables is provided in Section 1.2.3 in the paper. All control variables are lagged and all ratios have been winsorized at the 2% and the 98% of their empirical distribution. Heteroskedasticity-robust standard errors are clustered by firm and are reported in parentheses. N shows the number of observations and symbols $***$, $**$, and $*$ indicate significance at the 1%, 5%, and 10% levels, respectively.

	Capex/TA		R&D/TA	
	(1)	(2)	(3)	(4)
HHI-M	-0.670^{***}	-0.673^{***}	-1.359^{***}	-1.361^{***}
	(0.099)	(0.099)	(0.116)	(0.117)
HHI-H	-1.025^{***}	-1.012^{***}	-2.723^{***}	-2.728^{***}
	(0.108)	(0.108)	(0.144)	(0.145)
TQ	1.236^{***}	1.248^{***}	1.937^{***}	1.934^{***}
	(0.035)	(0.035)	(0.051)	(0.051)
CF/TA	6.614^{***}	6.755^{***}	-0.940^{***}	-1.704^{***}
	(0.228)	(0.222)	(0.333)	(0.326)
InstOwnDum	0.302^{***}		1.140^{***}	
	(0.082)		(0.105)	
BlockOwnDum		0.139^{**}		0.041
		(0.069)		(0.085)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.271	0.269	0.400	0.396
N	108,061	109,093	109,178	110,224

(ISS) database. For the years in which ISS does not report scores, we follow Gompers et al. (2003) and Bebchuk et al. (2009) and use the index from the latest available year. Like the board index, and following Dittmar and Mahrt-Smith (2007), we include the E-Index as a dummy variable (E-IndexDum) in the augmented regression. Specifically, E-IndexDum is set to 1 if the index score for firm i in year t is *below* its median and 0 otherwise. Thus, as defined, E-IndexDum=1 implies superior governance.

Table 1.9: Investment and internal corporate governance

This table reports the results of regressions of physical and innovative investment on competition proxies and a set of control variables. The sample includes U.S. firms listed on NYSE, AMEX, or NASDAQ with CRSP share codes of 10 and 11, that are covered by CRSP and Compustat between 1976 and 2014. Utility (SIC codes 4900-4949) and financial (SIC codes 6000-6999) firms and firms for which sales and total assets are either missing or negative are excluded. The dependent variable includes the capital expenditure scaled by the prior year end total assets (Capex/TA) and the R&D expenditure scaled by the prior year end total assets (R&D/TA). HHI is the Herfindahl-Hirschman index at the three-digit SIC code industry level. HHI-M is a dummy variable which is 1 if the HHI of firm i in year t lies in the medium tercile of its empirical distribution and 0 otherwise. HHI-H is a dummy variable which is 1 if the HHI of firm i in year t lies in the highest tercile of its empirical distribution and 0 otherwise. BoardIndDum is a dummy variable which is 1 if the percentage of outside directors on the board of firm i in year t is above its median and 0 otherwise. E-IndexDum is a dummy variable which is 1 if the entrenchment index of Bebchuk et al. (2009) for firm i in year t is below its median and 0 otherwise. The description of remaining control variables is provided in Section 1.2.3 in the paper. All control variables are lagged and all ratios have been winsorized at the 2% and the 98% of their empirical distribution. Heteroskedasticity-robust standard errors are clustered by firm and are reported in parentheses. N shows the number of observations and symbols $***$, $**$, and $*$ indicate significance at the 1%, 5%, and 10% levels, respectively.

	Capex/TA		R&D/TA	
	(1)	(2)	(3)	(4)
HHI-M	-0.472^{**}	-0.653^{***}	-1.583^{***}	-1.605^{***}
	(0.199)	(0.168)	(0.257)	(0.226)
HHI-H	-0.950^{***}	-1.069^{***}	-2.688^{***}	-2.981^{***}
	(0.217)	(0.183)	(0.331)	(0.284)
TQ	0.613^{***}	0.622^{***}	1.062^{***}	1.126^{***}
	(0.070)	(0.068)	(0.115)	(0.119)
CF/TA	9.058^{***}	9.720^{***}	3.702^{***}	2.374^{**}
	(0.680)	(0.645)	(1.064)	(0.972)
BoardIndDum	0.061		0.299^{**}	
	(0.126)		(0.148)	
E-IndexDum		-0.067		0.532^{***}
		(0.122)		(0.172)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.457	0.419	0.391	0.376
N	16,869	24,365	16,968	24,531

We present the regression estimates in Table 1.9. In Model 1, BoardIndDum is the proxy for governance and the investment in physical assets is the dependent variable, while in Model 3, investment in R&D is the dependent variable. Board independence significantly encourages investment in R&D but not in physical asset. Models 2 and 4 present the association between the E-Index proxy for governance and capital and R&D investment, respectively. We report that the coefficient of the E-Index dummy variable is positive and significant for R&D but not for capital investment.

Our finding that low values of the E-index implying superior governance with fewer ATPs encourage innovation is consistent with the hypothesis of Grossman and Hart (1988) and Harris and Raviv (1988, 1989) that ATPs serve to entrench incumbent managers thereby reducing the effectiveness of the market discipline. Chemmanur and Tian (2017) find support for the alternative hypothesis that ATPs encourage longer-term innovation by insulating managers from the pressures short term equity market investors and hostile takeover threats. Finally, we note from Table 1.9 that the relation between investment and industry concentration continues to be significantly negative in the augmented regressions including internal governance variable that may affect investments. The results in Tables 1.8 and 1.9, taken together, once again support the Darwinian view and show that the negative association between industry concentration and investments persists even after taking into account the mitigating effect of superior corporate governance on managers' investment decisions.

1.6 Additional robustness tests

We conduct additional robustness tests to examine whether our main results hold under alternative industry concentration classifications, different subperiods, and alternative specifications.

1.6.1 Competition from overseas

The measures of industry concentrations including both standard HHI and text-based THHI do not account for competition from imports, which implies that these measures tend to understate the level of competition especially in industries facing fierce competition from overseas producers, e.g., automobile manufacturers. To address this concern, we exclude firms from industries that face significant competition from imports and repeat our regressions for the remaining firms from industries that are primarily domestic and do not face intensive competition from overseas. In particular, we follow Mian and Sufi (2014) and classify industries into tradable and non-tradable sectors at the two-digit SIC code level and include only non-tradable industries in our regressions. Non-tradable industries include mainly firms in services and restaurants such as local transit services (SIC=41), trucking and warehousing (SIC=42), communications (SIC=48), merchandise stores (SIC=53), food stores (SIC=54), automotive dealers (SIC=55), apparel stores (SIC=56), furniture stores (SIC=57), eating and drinking places (SIC=58), hotels and lodging places (SIC=70), personal services (SIC=72), business services (SIC=73), auto repair services (SIC=75), motion pictures (SIC=78), amusement services (SIC=79), health services (SIC-80), educational services (SIC=82), social services (SIC=83), museums (SIC=84), engineering services (SIC=87), etc. While no such classification can be perfect and some of the non-tradable industries included in this subsample face some competition from imports, most of the industries that face significant competition from imports are excluded. The results of this analysis, which are reported in Table 1.10, show a significant negative relation between industry concentration and investments in physical assets and R&D for the subsample of domestic firms not facing significant competition from imports. These results suggest that our findings of a negative relation between industry concentration and corporate investments in physical assets and R&D for the overall sample are not being driven by any biases in our concentration measure arising from competition from imports, and support the Darwinian view.

1.6.2 HHI cutoffs

As the second robustness test, we use the guidelines of the U.S. Department of Justice and Federal Trade Commission rather than relying on the HHI terciles to identify the concentration in each industry. Specifically, we define an industry as unconcentrated if the HHI is below 1500 (HHI-L), moderately concentrated if the HHI is between 1500 and 2500 (HHI-M), and highly concentrated if the HHI is greater than 2500 (HHI-H). We then reestimate Equation (1.1) and report the results in Table 1.11. The sign, magnitude, and significance of estimated coefficients for both physical assets and R&D regressions are similar to those reported in Tables 1.3 and 1.4. The results in all specifications again confirm that firms in highly concentrated industries have lower physical and innovative investments after controlling for the variables suggested by the investment literature and for year and industry fixed effects.

1.6.3 Dynamic specifications

Prior studies suggest that payouts are sticky, are tied to long-term sustainable earnings, and are smoothed from year to year (Brav et al., 2005; Skinner, 2008). One could argue that, similar to payouts, investment spending is also sticky and follows a dynamic path. To examine whether the negative association between industry concentration and investments persists after controlling for potential dynamic characteristics of investment decisions, we estimate a dynamic version of our baseline model given in Equation (1.1). In particular, we augment the baseline model by adding the lag of physical or innovative investment to the right hand side of the model and reestimate the model controlling for industry and year fixed effects. The results reported in Table 1.12 once again show a statistically significant and negative coefficients on the proxies for industry concentration in both physical capital and R&D regressions, consistent with the Darwinian view. Furthermore, the positive and statistically significant coefficients on the lagged investment proxies in both physical capital and R&D models suggest that investment decisions are indeed sticky and dependent on the

Table 1.10: Investment and product market competition: Excluding competition from imports

This table reports the results of regressions of physical and innovative investment on competition proxies and a set of control variables. The sample includes U.S. firms listed on NYSE, AMEX, or NASDAQ with CRSP share codes of 10 and 11, that are covered by CRSP and Compustat between 1976 and 2014. Utility (SIC codes 4900-4949) and financial (SIC codes 6000-6999) firms and firms for which sales and total assets are either missing or negative are excluded. The dependent variable includes the capital expenditure scaled by the prior year end total assets (Capex/TA) and the R&D expenditure scaled by the prior year end total assets (R&D/TA). HHI is the Herfindahl-Hirschman index at the three-digit SIC code industry level. HHI-M is a dummy variable which is 1 if the HHI of firm i in year t lies in the medium tercile of its empirical distribution and 0 otherwise. HHI-H is a dummy variable which is 1 if the HHI of firm i in year t lies in the highest tercile of its empirical distribution and 0 otherwise. The description of remaining control variables is provided in Section 1.2.3 in the paper. All control variables are lagged and all ratios have been winsorized at the 2% and the 98% of their empirical distribution. Heteroskedasticity-robust standard errors are clustered by firm and are reported in parentheses. N shows the number of observations and symbols $***$, $**$, and $*$ indicate significance at the 1%, 5%, and 10% levels, respectively.

	Capex/TA				R&D/TA			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log(HHI)	−0.280**		−0.272**		−1.382***		−1.358***	
	(0.137)		(0.135)		(0.122)		(0.121)	
HHI-M		−0.166		−0.144		−1.379***		−1.310***
		(0.186)		(0.184)		(0.163)		(0.154)
HHI-H		−0.574***		−0.683***		−1.980***		−1.944***
		(0.208)		(0.206)		(0.185)		(0.185)
TQ			1.310***	1.311***			1.343***	1.346***
			(0.060)	(0.060)			(0.073)	(0.073)
CF/TA			6.705***	6.729***			0.989**	1.063**
			(0.417)	(0.416)			(0.485)	(0.487)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.164	0.164	0.224	0.225	0.241	0.238	0.301	0.298
N	43,696	43,696	40,805	40,805	44,238	44,238	41,284	41,284

Table 1.11: Investment and product market competition: Basic specification using the HHI cutoffs

This table reports the results of regressions of physical and innovative investment on competition proxies and a set of control variables. The sample includes U.S. firms listed on NYSE, AMEX, or NASDAQ with CRSP share codes of 10 and 11, that are covered by CRSP and Compustat between 1976 and 2014. Utility (SIC codes 4900-4949) and financial (SIC codes 6000-6999) firms and firms for which sales and total assets are either missing or negative are excluded. The dependent variable includes the capital expenditure scaled by the prior year end total assets (Capex/TA) and the R&D expenditure scaled by the prior year end total assets (R&D/TA). HHI is the Herfindahl-Hirschman index at the three-digit SIC code industry level. HHI-M is a dummy variable which is 1 if the HHI of firm i in year t is between 1500 and 2500 and 0 otherwise. HHI-H is a dummy variable which is 1 if the HHI of firm i in year t is above 2500 and 0 otherwise. The description of remaining control variables is provided in Section 1.2.3 in the paper. All control variables are lagged and all ratios have been winsorized at the 2% and the 98% of their empirical distribution. Heteroskedasticity-robust standard errors are clustered by firm and are reported in parentheses. N shows the number of observations and symbols $***$, $**$, and $*$ indicate significance at the 1%, 5%, and 10% levels, respectively.

	Capex/TA				R&D/TA			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log(HHI)	−0.517***		−0.510***		−1.840***		−1.593***	
	(0.069)		(0.067)		(0.089)		(0.081)	
HHI-M		−0.772***		−0.742***		−2.185***		−1.764***
		(0.096)		(0.094)		(0.129)		(0.115)
HHI-H		−0.761***		−0.782***		−2.916***		−2.511***
		(0.101)		(0.100)		(0.141)		(0.126)
TQ			1.304***	1.301***			1.924***	1.918***
			(0.035)	(0.035)			(0.049)	(0.049)
CF/TA			7.218***	7.240***			−1.432***	−1.391***
			(0.219)	(0.219)			(0.308)	(0.308)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.208	0.208	0.267	0.267	0.303	0.304	0.391	0.391
N	132,449	132,449	124,206	124,206	133,785	133,785	125,442	125,442

investment decisions made in the past.

Table 1.12: Investment and product market competition: Dynamic specifications

This table reports the results of regressions of physical and innovative investment on competition proxies and a set of control variables. The sample includes U.S. firms listed on NYSE, AMEX, or NASDAQ with CRSP share codes of 10 and 11, that are covered by CRSP and Compustat between 1976 and 2014. Utility (SIC codes 4900-4949) and financial (SIC codes 6000-6999) firms and firms for which sales and total assets are either missing or negative are excluded. The dependent variable includes the capital expenditure scaled by the prior year end total assets (Capex/TA) and the R&D expenditure scaled by the prior year end total assets (R&D/TA). HHI is the Herfindahl-Hirschman index at the three-digit SIC code industry level. HHI-M is a dummy variable which is 1 if the HHI of firm i in year t lies in the medium tercile of its empirical distribution and 0 otherwise. HHI-H is a dummy variable which is 1 if the HHI of firm i in year t lies in the highest tercile of its empirical distribution and 0 otherwise. The description of remaining control variables is provided in Section 1.2.3 in the paper. All control variables are lagged and all ratios have been winsorized at the 2% and the 98% of their empirical distribution. Heteroskedasticity-robust standard errors are clustered by firm and are reported in parentheses. N shows the number of observations and symbols $***$, $**$, and $*$ indicate significance at the 1%, 5%, and 10% levels, respectively.

	Capex/TA		R&D/TA	
	(1)	(2)	(3)	(4)
Log(HHI)	−0.220***		−0.326***	
	(0.039)		(0.022)	
HHI-M		−0.388***		−0.297***
		(0.057)		(0.037)
HHI-H		−0.425***		−0.526***
		(0.061)		(0.037)
TQ	0.723***	0.722***	0.332***	0.332***
	(0.023)	(0.023)	(0.019)	(0.019)
CF/TA	5.113***	5.125***	−0.780***	−0.772***
	(0.134)	(0.134)	(0.120)	(0.120)
Capex/TA-Lagged	0.464***	0.463***		
	(0.005)	(0.005)		
R&D/TA-Lagged			0.751***	0.751***
			(0.005)	(0.005)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.475	0.475	0.792	0.792
N	123,881	123,881	125,442	125,442

1.6.4 Subperiod analysis

For the next robustness test, we split the sample into two subperiods and reestimate Equation (1.1) to examine whether a particular period is responsible for the negative association between investment and industry concentration. We choose the two periods based on Figure 1.1. The first subperiod is 1976 to 1997 when industry concentration is declining for a big portion of the period, and the second subperiod is 1998 to 2014 when industry concentration is increasing over time. The results, which are reported in Table 1.13, show that the negative association between industry concentration and investments does not depend on the direction of the changes in concentration over time. Irrespective of whether industry concentration is increasing or decreasing over time, firms in monopolistic industries have lower level of investment in both physical assets and R&D. In unreported tables, we split the sample to three and five evenly-spaced subperiods and draw the same conclusions.

Table 1.13: Investment and product market competition: Subperiod analysis

This table reports the results of regressions of physical and innovative investment on competition proxies and a set of control variables. The sample includes U.S. firms listed on NYSE, AMEX, or NASDAQ with CRSP share codes of 10 and 11, that are covered by CRSP and Compustat between 1976 and 2014. Utility (SIC codes 4900-4949) and financial (SIC codes 6000-6999) firms and firms for which sales and total assets are either missing or negative are excluded. The dependent variable includes the capital expenditure scaled by the prior year end total assets (Capex/TA) and the R&D expenditure scaled by the prior year end total assets (R&D/TA). HHI is the Herfindahl-Hirschman index at the three-digit SIC code industry level. HHI-M is a dummy variable which is 1 if the HHI of firm i in year t lies in the medium tercile of its empirical distribution and 0 otherwise. HHI-H is a dummy variable which is 1 if the HHI of firm i in year t lies in the highest tercile of its empirical distribution and 0 otherwise. The description of remaining control variables is provided in Section 1.2.3 in the paper. All control variables are lagged and all ratios have been winsorized at the 2% and the 98% of their empirical distribution. Heteroskedasticity-robust standard errors are clustered by firm and are reported in parentheses. N shows the number of observations and symbols $***$, $**$, and $*$ indicate significance at the 1%, 5%, and 10% levels, respectively.

	Capex/TA		R&D/TA	
	1976-1997	1998-2014	1976-1997	1998-2014
	(1)	(2)	(3)	(4)
HHI-M	−0.326***	−0.149	−1.165***	−1.777***
	(0.116)	(0.131)	(0.126)	(0.181)
HHI-H	−0.524***	−0.702***	−1.891***	−3.593***
	(0.126)	(0.151)	(0.125)	(0.248)
TQ	1.681***	0.972***	1.820***	1.980***
	(0.054)	(0.037)	(0.063)	(0.064)
CF/TA	10.684***	3.780***	1.134***	−3.503***
	(0.326)	(0.239)	(0.364)	(0.442)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.236	0.330	0.369	0.415
N	69,686	54,520	70,559	54,883

1.6.5 Augmented model

There could be other firm characteristics affecting investment decisions that are not captured by investment opportunities proxies i.e., Tobin's Q and cash flow. For example, how much a firm spends on risky R&D projects could depend on the firm's life cycle and the monitoring from debt holders. In this section, we estimate an augmented version of Equation (1.1) where we control for leverage as a proxy for the level of debt holders monitoring on investment decisions, for retained earnings and past sales growth as proxies for the life cycle of the firm, and for the size of the firm. We report the results in Table 1.14. Similar to the main results, the regression models in this table control for year and industry fixed effects and the standard errors are corrected for heteroskedasticity and are clustered by firm.

The negative and statistically highly significant coefficients on the log of HHI and the HHI dummies in all specifications once again conform to the predictions of Darwinian view. We also find that while leverage has an insignificant impact on investment in physical capital, it is significantly negatively correlated with R&D expenditures. This evidence, which is consistent with prior findings (Bhagat and Welch, 1995; Ho et al., 2006), implies that firms with significant R&D opportunities are less likely to issue debt due to agency costs and information asymmetry problems which are more likely to occur in R&D investments, as compared to other capital investments.

Furthermore, we find that both capital expenditures and R&D expenditures are negatively related to the retained earnings suggesting that firms in the early stages of their life cycle invest less in both physical assets and innovation. Firms with higher sales growth make higher physical and innovative investments. Lastly, larger firms spend more on expanding physical capacity but spend less on innovation, on average. This finding is consistent with prior studies showing that larger firms are less likely to be innovative than their smaller counterparts. While large firms have shown to be more innovative in some industries, the opposite is true in others (Acs and Audretsch, 1987). The net effect of size on innovation is negative in our sample.

1.6.6 Productivity of innovation

For innovative activities, our study, thus far, has focused on the input into the innovative process i.e., R&D expenditures. While this measure has been extensively used in prior work, it measures innovation only indirectly as the efficiency of the research sector varies over time or due to other economic forces (Kortum, 1993), and it indicates only the budgeted resources allocated towards trying to produce innovative activity, but not the actual amount of resulting innovations. To address this concern, we examine the effect of industry concentration on the *productivity* of innovation by using a new measure of the economic importance of firms' innovative activities.

Kogan et al. (2017) propose a measure that captures the economic dollar value of new inventions and is comparable both across industries and across time. The measure is constructed by combining a novel data set of patent grants over the period 1926 to 2010 with stock market data and is shown to be

Table 1.14: Investment and product market competition: Augmented specification

This table reports the results of regressions of physical and innovative investment on competition proxies and a set of control variables. The sample includes U.S. firms listed on NYSE, AMEX, or NASDAQ with CRSP share codes of 10 and 11, that are covered by CRSP and Compustat between 1976 and 2014. Utility (SIC codes 4900-4949) and financial (SIC codes 6000-6999) firms and firms for which sales and total assets are either missing or negative are excluded. The dependent variable includes the capital expenditure scaled by the prior year end total assets (Capex/TA) and the R&D expenditure scaled by the prior year end total assets (R&D/TA). HHI is the Herfindahl-Hirschman index at the three-digit SIC code industry level. HHI-M is a dummy variable which is 1 if the HHI of firm i in year t lies in the medium tercile of its empirical distribution and 0 otherwise. HHI-H is a dummy variable which is 1 if the HHI of firm i in year t lies in the highest tercile of its empirical distribution and 0 otherwise. The description of remaining control variables is provided in Section 1.2.3 in the paper. All control variables are lagged and all ratios have been winsorized at the 2% and the 98% of their empirical distribution. Heteroskedasticity-robust standard errors are clustered by firm and reported in parentheses. N shows the number of observations and symbols ∗∗∗, ∗∗, and ∗ indicate significance at the 1%, 5%, and 10% levels, respectively.

	Capex/TA		R&D/TA	
	(1)	(2)	(3)	(4)
Log(HHI)	−0.457***		−1.218***	
	(0.067)		(0.067)	
HHI-M		−0.609***		−0.876***
		(0.093)		(0.091)
HHI-H		−0.825***		−1.803***
		(0.103)		(0.106)
TQ	1.089***	1.089***	1.150***	1.153***
	(0.037)	(0.037)	(0.046)	(0.046)
CF/TA	7.255***	7.256***	6.557***	6.575***
	(0.257)	(0.257)	(0.310)	(0.310)
Leverage	−0.169	−0.153	−5.225***	−5.216***
	(0.235)	(0.234)	(0.205)	(0.205)
Log(Size)	0.110***	0.110***	−0.046*	−0.048*
	(0.025)	(0.025)	(0.025)	(0.025)
RE/TA	−0.113***	−0.106**	−3.328***	−3.321***
	(0.043)	(0.043)	(0.092)	(0.092)
SalesGrowth	1.800***	1.800***	0.239***	0.247***
	(0.077)	(0.077)	(0.065)	(0.065)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.279	0.279	0.503	0.502
N	122,812	122,812	124,022	124,022

superior to patent counts and patent forward citations measures. Comparing conventional measures of innovation output such as patent counts across industries and time has proven challenging as patenting propensities vary across industries and time. This disparity in the propensity to patent across industries and time is discussed by Scherer (1983), Mansfield (1986), and Acs and Audretsch (1988). The new measure is in terms of dollars which makes it a more useful and direct measure of technological innovation.[5]

Table 1.15 presents results of regressing the market value of patents scaled by lagged total assets on a comprehensive set of firm characteristics and our proxies for industry concentration. Similar to our baseline model, we control for industry and year fixed effects. For Models 1 and 2, we use the control variables from our baseline regression presented in Equation (1.1) to examine whether product market competition affects the productivity of innovative activities. For Models 3 and 4, we use an augmented version of the baseline regression where we control for a series of factors, suggested by the patents literature (Chemmanur and Tian, 2017), that may affect a firm's innovation productivity. Across all models, we find a negative and statistically significant coefficient on industry concentration proxies suggesting that higher industry concentration is associated with lower market value of patents i.e., lower productivity of innovation.

The results also show that firms that are larger, firms with higher growth opportunities, and firms with larger R&D spending have higher productivity of innovation. The coefficient for capital expenditures is negative and statistically significant suggesting that firms in industries which are more capital intensive have a lower degree of innovation. Overall, the results from this table combined with those reported in Tables 1.3 and 1.4 show that higher industry concentration is associated with both lower innovation efforts proxied by R&D expenditures and lower innovation outputs proxied by economic value of patents. These findings once again support the Darwinian view that firms facing lower product market competition innovate less.

1.6.7 Industry level regressions

Lastly, we reestimate our baseline model at the industry level. This analysis allows us to examine the effect of industry concentration on the aggregate investments at the industry level. Moreover, these results are not affected by firm level differences in investments within the industry resulting from differences in individual firm characteristics. We use total assets as the weights to calculate the weighted averages. The results of this analysis, which are presented in Table 1.16, show that there is a statistically highly significant and negative association between industry concentration and industry-level investments in all specifications with the exception of coefficient for the log of HHI in Model 1 which appears with the expected sign but is statistically insignificant. These results suggest that the negative relation between concentration and investments is not being driven by individual firm characteristics and managerial incentives.

[5]We thank Kogan et al. for making the data on patents and their economic value available online. Visit https://kelley.iu.edu/nstoffma/.

Table 1.15: Productivity of innovation and product market competition

This table reports the results of regressions of market value of patents on competition proxies and a set of control variables. The sample includes U.S. firms listed on NYSE, AMEX, or NASDAQ with CRSP share codes of 10 and 11, that are covered by CRSP and Compustat between 1976 and 2014. Utility (SIC codes 4900-4949) and financial (SIC codes 6000-6999) firms and firms for which sales and total assets are either missing or negative are excluded. The dependent variable is the market value of the patents scaled by the prior year end total assets (MP/TA). HHI is the Herfindahl-Hirschman index at the three-digit SIC code industry level. HHI-M is a dummy variable which is 1 if the HHI of firm i in year t lies in the medium tercile of its empirical distribution and 0 otherwise. HHI-H is a dummy variable which is 1 if the HHI of firm i in year t lies in the highest tercile of its empirical distribution and 0 otherwise. R&D/TA is research and development expenditures scaled by the prior year end total assets. Capex/TA is capital expenditures scaled by the prior year end total assets. The description of remaining control variables is provided in Section 1.2.3 in the paper. All control variables are lagged and all ratios have been winsorized at the 2% and the 98% of their empirical distribution. Heteroskedasticity-robust standard errors are clustered by firm and are reported in parentheses. N shows the number of observations and symbols $***$, $**$, and $*$ indicate significance at the 1%, 5%, and 10% levels, respectively.

	MP/TA			
	(1)	(2)	(3)	(4)
Log(HHI)	−0.914***		−0.972***	
	(0.176)		(0.150)	
HHI-M		−1.000***		−0.984***
		(0.195)		(0.174)
HHI-H		−1.460***		−1.472***
		(0.277)		(0.236)
TQ	2.854***	2.856***	2.185***	2.188***
	(0.084)	(0.084)	(0.084)	(0.084)
CF/TA	3.902***	3.912***	−1.082**	−1.064**
	(0.641)	(0.641)	(0.503)	(0.504)
Log(Size)			1.484***	1.480***
			(0.074)	(0.074)
R&D/TA			13.820***	13.889***
			(1.099)	(1.095)
Capex/TA			−3.701***	−3.717***
			(1.184)	(1.184)
PPE/TA			−0.380	−0.362
			(0.608)	(0.610)
Leverage			−0.363	−0.396
			(0.493)	(0.493)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.361	0.361	0.436	0.436
N	31,367	31,367	31,010	31,010

Table 1.16: Investment and product market competition: Industry-level analysis

This table reports the results of regressions of physical and innovative investment on competition proxies and a set of control variables. The sample includes U.S. firms listed on NYSE, AMEX, or NASDAQ with CRSP share codes of 10 and 11, that are covered by CRSP and Compustat between 1976 and 2014. Utility (SIC codes 4900-4949) and financial (SIC codes 6000-6999) firms and firms for which sales and total assets are either missing or negative are excluded. The dependent variable includes the weighted average of capital expenditure at the three-digit SIC code industry level scaled by the prior year end total assets (Capex/TA) and the weighted average of R&D expenditure at the three-digit SIC code industry level scaled by the prior year end total assets (R&D/TA). HHI is the Herfindahl-Hirschman index at the three-digit SIC code industry level. HHI-M is a dummy variable which is 1 if the HHI of firm i in year t lies in the medium tercile of its empirical distribution and 0 otherwise. HHI-H is a dummy variable which is 1 if the HHI of firm i in year t lies in the highest tercile of its empirical distribution and 0 otherwise. The description of remaining control variables is provided in Section 1.2.3 in the paper. All control variables are lagged and all ratios have been winsorized at the 2% and the 98% of their empirical distribution. Heteroskedasticity-robust standard errors are clustered by industry at the three-digit SIC code level and reported in parentheses. N shows the number of observations and symbols $***$, $**$, and $*$ indicate significance at the 1%, 5%, and 10% levels, respectively.

	Capex/TA		R&D/TA	
	(1)	(2)	(3)	(4)
Log(HHI)	−0.105		−0.245**	
	(0.162)		(0.117)	
HHI-M		−0.470		−0.814***
		(0.320)		(0.301)
HHI-H		−0.661**		−0.871***
		(0.327)		(0.327)
TQ	0.911***	0.907***	0.497***	0.488***
	(0.203)	(0.203)	(0.147)	(0.146)
CF/TA	15.229***	15.213***	3.074***	3.091***
	(2.496)	(2.489)	(0.911)	(0.905)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.367	0.368	0.400	0.405
N	8,893	8,893	8,917	8,917

1.7 Conclusions

The results of this paper suggest that the level of product market competition in an industry has significant effects on firms' investment decisions. We find that physical investments and innovative investments are significantly higher for industries with lower levels of concentration that face greater competitive threats from their rivals as a result. We examine whether the lower investment for firms in more concentrated industries is simply an outcome of an agency problem between managers and shareholders. Using standard proxies for the quality of shareholder monitoring and corporate governance, we find that while better monitoring and corporate governance generally has a positive impact on investments, the negative relation between investment and industry concentration persists. The results are robust to the inclusion of several control variables, and alternative measures of industry concentration. The main results also persist when we control for product market characteristics that also have an effect on managers' investment decisions. More specifically, we control for the presence of a leader-follower competition in an industry, product differentiation, and pricing power, but the negative impact of industry concentration on investments persists. Our results are robust to inclusion of time-invariant and time-varying industry fixed effects to control for industry specific differences in capital intensity and the need for R&D that may be unrelated to industry concentration. The results are also robust to exclusion of firms from industries that face significant competition from imports. Overall, our results are consistent with the notion that firms in competitive industries have a greater incentive to invest and innovate to survive and thrive in a competitive environment relative to the managers of the firms in more concentrated industries whose incentive to invest and innovate is to maintain their monopoly rents.

Our findings have policy-making implications. There is a wide consensus among economists that investment and innovation are the driving engines for economic growth and the well-being of society. Our results show investment in both physical capital and innovation is significantly lower for firms in industries with a higher level of concentration (lower level of competition). This finding implies that if policy makers are seeking to promote economic growth, improve social welfare, and provide great improvements in living standards, in channeling resources to productive uses, and in providing consumers with quality and choices, they need to follow policies which promote competition in the product markets. Optimizing the antitrust structure, closely monitoring mergers that lead to higher market share and too much pricing power, easing copyright and patent laws, and making the process of startups and small firms entering the market easier are some of the potential steps that policy makers can take to encourage competition among firms.

Chapter 2

Predictability of Earnings Following Equity Issues and Buyback Announcements

2.1 Introduction

It is generally accepted that managers have more information about the firm than investors (Myers and Majluf, 1984; Miller and Rock, 1985; Healy and Palepu, 2001). Given this information asymmetry, managers can make informed decisions about corporate actions such as equity offerings, buybacks, dividends, insider trading, and mergers, in an effort to maximize value of the firm for current shareholders (Baker and Wurgler, 2002; Jenter, 2005; Dittmar and Thakor, 2007; Chan et al., 2007; DeAngelo et al., 2010; Dong et al., 2012; Dittmar and Field, 2015; Tarsalewska, 2018). Market participants evaluate these corporate actions to update their information about the firm and expected future firm performance.

In this paper, we examine whether information contained in corporate actions is fully incorporated into prices such that the market reaction to subsequent earnings announcements is unrelated to those corporate actions. Fu and Haung (2016) show that long-run stock return outperformance following buybacks and long-run stock underperformance following seasoned equity offerings (SEOs) have disappeared in the most recent decade. We complement their study by examining stock returns around earnings announcements that immediately follow these corporate actions noting that the next earnings announcement is probably a good indicator of the efficacy with which market participants reflect information disseminated through corporate actions.

This is in contrast to the vast literature in finance that has provided evidence of market inefficiency by documenting abnormal security returns over long observation periods (several months and years) following certain corporate events.[1] Several recent studies, however, show serious limitations of long-term return studies including the choice of benchmark models and matching algorithms. Kothari and Warner (1997, 2007) show that tests for multi-year abnormal performance around firm-specific events are severely misspecified and the lack of a perfect benchmark model of normal returns over horizons considered in long-term studies does not permit for reliable inferences. Therefore, to reliably test our hypotheses, we adopt a short-horizon framework that captures information revealed in the next corporate event, an earnings announcement. On average, earnings announcements should not generate any predictable market reaction provided information contained in prior corporate actions has been fully reflected in prices. However, if markets do not fully incorporate such information, they may react differentially and predictably based on the nature of the preceding event.

We choose equity issues and buyback announcements as the corporate actions of interest for several reasons. First, managers can use their superior information to pick an appropriate time for issuing equity and announcing buybacks.[2] Second, the announcement of these corporate actions is voluntary and can be easily moved by a few weeks or months, unlike for mergers or asset sales where the announcement is a function of the status of negotiations between the contracting parties. Third, equity issuance and buybacks are two sides of the same coin (change in number of shares outstanding) so one can be considered a control group for the other. Finally, the frequency of equity offerings and buybacks, relative to other corporate actions, provides a large sample for analysis.

To test our hypothesis, we begin by examining the market reaction around earnings that follow buyback announcements and pricing of equity offerings. We find evidence of earnings predictability. First, we observe that there is incomplete adjustment to SEO pricings and buyback announcements that results in residual market reaction to earnings announcements. Second, we find that prices continue to drift after earnings announcements: upward for buybacks and downward for SEO pricings. More specifically, we find that the average raw return is +3.3% in a (+2,+30) window around earnings following buybacks closest to but 2 or more days prior to the earnings announcements compared with a raw return of 1.6% for SEO pricings. Similar results are observed for four-factor abnormal returns: a return of +1.3% around earnings following buyback announcements compared with -3.2% for SEO pricings over a (+2,+30) day window.[3] A zero net cost portfolio of long buybacks

[1] These events include open market buybacks (Ikenberry et al., 1995), seasoned equity offerings (Spiess and Affleck-Graves, 1995), initial public offerings (Ritter, 1991), dividend initiations and omissions (Michaely et al., 1995), stock splits (Ikenberry et al., 1996), mergers (Agrawal et al., 1992), spinoffs (Cusatis et al., 1993), tender offers (Lakonishok and Vermaelen, 1990), and short interest announcements (Boehmer et al., 2010).

[2] For example, the studies of Taggart, Jr. (1977), Marsh (1982), Asquith and Mullins (1986), Korajczyk et al. (1991), Loughran et al. (1994), Jung et al. (1996), Pagano et al. (1998), Hovakimian et al. (2001), and Eckbo et al. (2007) show that the seasoned equity issues and initial public equity issues coincide with high valuations. Buybacks, on the other hand, coincide with low valuation, as shown in Ikenberry et al. (1995). Studies of long-run stock returns following corporate finance decisions show firms issue equity when the cost of equity is relatively low and repurchase equity when the cost is relatively high. See Stigler (1964), Ritter (1991), Loughran and Ritter (1995), Spiess and Affleck-Graves (1995), Brav and Gompers (1997), and Jegadeesh (2000) for more details. Studies of earning forecasts and realizations around equity issues show that firms tend to issue equity when investors are too enthusiastic about earnings prospects. Loughran and Ritter (1997), Rajan and Servaes (1997), Teoh et al. (1998a, 1998b), and Denis and Sarin (2001) are some sample studies in this category.

[3] The difference between raw and abnormal returns is unusually high for SEO issues. We reestimate abnormal

and short equity issues will generate a raw return of 1.7% and a four-factor adjusted return of 4.5% over a (+2,+30) day window before transaction costs. The return differential is smaller for shorter windows, for example, a difference of 1.2% in raw returns and a difference of 2.7% in abnormal returns over the (+2,+15) window. All returns are statistically and economically significant.

We conduct several tests and show that our main results are robust to alternate sample construction methodologies. In particular, we find that the results do not come from small stocks: the results are not materially affected when firms with market caps of less than $100 million are excluded. This is particularly important because long-term underperformance following equity issues is concentrated in the bottom tercile (Brav, 2000) or bottom quartile of firm size (Denis and Sarin, 2001). The results remain large and statistically significant over different subperiods.

Next, we report that returns around earnings following buyback announcements and equity issues are distinct from the well-documented post earnings announcement drift (PEAD) where stocks in the top and bottom deciles of returns continue to drift in the same direction: stocks with a strong positive reaction to earnings continue to increase in value whereas stocks with a strong negative reaction continue to decrease in value. Unlike PEAD, the drift documented here does not depend on the initial market reaction to earnings announcement. Instead, we find a positive drift for earnings following buybacks and a negative drift for earnings following equity offerings irrespective of the magnitude and sign of first-day returns or earnings surprises. We examine this idea by forming deciles of earnings surprises and showing that abnormal returns around earnings announcements documented in this paper are independent of the magnitude and direction of earnings surprises. Notice that PEAD refers to an accounting-based anomaly in which stock prices of firms with positive (negative) earnings surprise in the recent quarter tend to drift upward (downward) in a subsequent quarter. We, however, find that stock prices of firms with earnings preceded by buybacks (or SEOs) tend to drift upward (or downward) regardless of whether earnings announcements contain positive, negative, or no surprises.

We do not believe that the predictability of earnings reported here can be explained by confounding events. Given the large samples used in this analysis, nonsystematic confounding events constitute white noise that should not affect the results. On the other hands, systematic confounding events, such as earnings management, should be anticipated by market participants and not cause earnings predictability. The literature documents that managers have incentives to manipulate earnings prior to SEOs or buybacks which in turn affects returns around subsequent corporate events. For example, firms use accrual earnings management (Teoh et al., 1998a,b; DuCharme et al., 2004; Gong et al., 2008; Cohen and Zarowin, 2010; Du and Shen, 2018), real earnings management (Kothari et al., 2016), and expectations management (Brockman et al., 2008) to influence equity market investors. The literature has generally concluded that earnings management can explain,

returns using different platforms including Eventus, STATA, and SAS, and test a few observations with Excel, all of which confirm these results. We also test the abnormal returns using a three-factor model and a one-factor model. Using alternate periods for parameters estimation does not significantly alter the results. It seems that much of the four-factor adjustment arises from high values of systematic risk of firms issuing equity.

at least partly, stock return performance following stock buybacks and issuances. Therefore, one could argue that abnormal returns around earnings preceded by SEOs and buybacks are the result of managerial strategic manipulation and do not reflect the market's failure to fully incorporate information contained in corporate actions. In our empirical tests, we allow for sufficient time between announcements of buybacks or equity offerings and subsequent announcements of earnings to make sure that our results are not contaminated by the impact of potential earnings management. We believe that the market reaction to SEO pricings and buyback announcements should have accounted for these systematic manipulations, leaving no surprises in earnings following corporate actions. We also show that our results hold after 2002 in which the literature has found no evidence of earnings management for issuing and repurchasing firms (Fu and Haung, 2016).

We propose information asymmetry as an explanation for mispricing and return predictability. We test the information asymmetry argument by using the average bid-ask spread, analysts' forecast error, and the standard deviation of analysts' forecasts as proxies for information asymmetry. Controlling for firm and market specific effects, we find that the average bid-ask spread is statistically significantly related to returns following SEO pricings and buyback announcements.

This study adds to the existing literature on role of information asymmetry in corporate decision making. Korajczyk et al. (1991) investigate the role of information asymmetry on pricing and timing of equity issues. Using earnings releases as a natural proxy for informative events, they find strong evidence that equity issues cluster in the first half of the period between information releases. In particular, they find that if there is any asymmetric information when a new project arrives, firms have an incentive to delay an equity issue and wait until the next information release. In contrast, we find that despite firms' incentive to issue equity after earnings announcements that reduce information asymmetry, a considerable fraction of equity offerings and buybacks occurs only a few days before earnings announcements. These buybacks and SEOs convey information about the firms' subsequent earnings prospects and make returns around earnings predictable.[4]

Lie (2005) and Gong et al. (2008) examine abnormal returns during three days centered on earnings that occur a few quarters before or after buyback announcements. The main focus of those papers, however, is on long-term abnormal returns and operating performance following open-market buyback announcements. Similarly, Denis and Sarin (2001) examine three-day abnormal returns surrounding quarterly earnings announcements over quarters -8 to +20 relative to an equity issue. They find that the abnormal returns are significantly negative in only 3 of 20 post-issue quarters, which occur in almost random quarters. Though the average for all 20 post-issue quarters is statistically negative, it is not economically important at -0.28%. In contrast to their study, we believe that earnings predictability, if any, must occur in the earnings announcement immediately

[4]In examining the nature of information conveyed by open-market buyback announcements, Bartov (1991) analyzes the surprise in actual earnings announcements relative to consensus forecasts but finds weak results. Instead, we focus on the market reaction to earnings announcements. We believe that the market's reaction to earnings announcement is a more appropriate tool than analyst forecasts to test our hypotheses because analyst forecasts have to be corrected for biases and those corrections themselves are likely to introduce new biases generating mixed results (Lim, 2001; Hong and Kubik, 2003).

following equity issues or buyback announcements where the inability of the market to incorporate information in corporate actions is likely to be more evident.

Furthermore, much of the prior literature has focused on long-term stock returns and operating performance of firms, which may be subject to benchmarking issues.[5] As assets are priced based on expected discounted cash flows, Cochrane (2011) notes that we will never be able to disentangle cash flow errors from changes in discount rates. In the case of issuing firms, Spiess and Affleck-Graves (1995), Loughran and Ritter (1995), and Brav et al. (2000) report that issuing firms underperform matching groups of nonissuing firms by 20–60% over three-to-five years following the offering date. Even though the sheer magnitude of this underperformance seems difficult to reconcile, Eckbo et al. (2000) argue that the differences in expected returns across issuers and nonissuing matched firms reflect a failure of the matching algorithms to control for a set of macroeconomic risk factors rather than market underreaction to the equity offerings announcements.

Similarly, Bessembinder and Zhang (2013) show that these documented returns are due to incorrect firm matching that fails to control for substantial differences in illiquidity, idiosyncratic volatility, return momentum, market beta, and investment across control and matched groups. After correcting for mismatches in firm characteristics, they show that long-term abnormal returns following equity issues are statistically zero. In addition, fundamental changes in firm characteristics such as cash position and firm's cost of capital can occur and affect long-term returns (Li et al., 2009; Bolton et al., 2013). Fu and Haung (2016) show that the long-run abnormal returns following SEOs disappear after 2002 and the disappearance is related to the changes in the market environment including more sophisticated investors, lower trading costs, better liquidity, and more transparent information disclosure. With regard to operating performance, Loughran and Ritter (1997) find that the operating performance of issuing firms substantially improves prior to the offering and declines sharply after the offering, resulting in low stock returns during the five years after the offerings. Edelen et al. (2014), on the other hand, show that operating underperformance largely disappears after controlling for the change in institutional investors.

In the case of repurchasing firms, Ikenberry et al. (1995) document an average abnormal buy-and-hold return of 2.9% per year following the announcement. Peyer and Vermaelen (2009) show that long-run excess returns after open-market buyback programs still exist after 25 years and are as large and as significant as reported by previous studies. Fu and Haung (2016), however, cast doubt on the persistence of buyback anomalies. Compared to prior studies on stock buybacks, they use a much larger sample containing 14,309 stock buybacks over the 1984-2012 period and find no evidence of outperformance following buybacks after 2002. They attribute the disappearance of abnormal returns to the view that the stock market has become more efficient over recent years due to an increase in institutional ownership, improvement in regulations, and corporate governance.

[5] Several studies show that the long-term return methodologies are sensitive to the choice of benchmark. For example, Fama (1998) argues that most long-term return anomalies tend to disappear with reasonable changes in technique. Similarly, Kothari and Warner (1997), Barber and Lyon (1997), and Lyon et al. (1999) show that using wrong benchmarks in measuring long-term abnormal returns would lead to erroneous inference on the significance of the event of interest.

Lie (2005) documents that operating performance improves following buyback announcements and the improvement is limited to those firms that actually repurchase shares during the same fiscal quarter. On the other hand, Grullon and Michaely (2004) find no evidence that repurchasing firms experience a considerable improvement in their operating performance relative to their peer firms. In another study, Dittmar and Field (2015) use a dataset of buyback price data, obtained from 10-K and 10-Q filings, to examine whether managers can time the market in making repurchasing decisions. They find that firms are able to repurchase stock at prices below the average for that year. Our study abstracts from the limitations of long-term studies and focuses instead on short windows around earnings announcements immediately following buyback announcements and equity issues to provide a cleaner evaluation of mispricing and earnings predictability.

The rest of this article is organized as follows: Section 2.2 describes the data, and summary statistics. Section 2.3 provides empirical results and Section 2.4 examines the robustness of main findings and implications. Section 2.5 compares PEAD and the drift documented in this study. Finally, Section 2.6 explores the determinants of abnormal returns while Section 2.7 concludes.

2.2 Sample selection and summary statistics

2.2.1 Data sources

We obtain data on equity issuance and buybacks from Thomson Reuters SDC Platinum database, dates of earnings announcements from the Institutional Brokers Estimate System (IBES) database, and information on stock prices and returns from the Center for Research in Security Prices (CRSP) database. Compustat is used to calculate book value of equity for each firm. Firm-level data among different databases are matched using historical CUSIPs. We require firms included in the sample to have data on CRSP files at the time of announcement and have corresponding earnings announcement information on IBES.

Following Grullon and Michaely (2004), we include regulated firms (e.g. financial and utility firms) in the buyback and SEOs sample as they represent a significant fraction of the total sample. Also, following Fu and Haung (2016), we exclude buybacks by tender offers or through privately negotiated deals. In addition, to be consistent with Ikenberry et al. (1995), we analyze all open-market stock buyback announcements regardless of whether or not the programs were actually completed. These selection criteria generate a sample of 15,106 share buyback announcements between 1994 and 2015. Our sample of SEOs consists of new stock issues priced between 1970 and 2015, that are not IPOs. Following DeAngelo et al. (2010) and Fu (2010), we exclude SEOs made by closed-end funds, real estate investment trusts, and American Depository Receipts. This screening process generates a sample of 19,466 SEOs. Note that we use SEO pricing dates in our analyses which are different from SEO announcement dates.

2.2.2 Sample statistics

The left hand side of Table 2.1 presents summary statistics for the sample of buyback announcements by year. The median market cap of a buyback firm is $481 million and firms announce a median buyback of 5.38% of shares outstanding.[6]

The right hand side of Table 2.1 reports SEO pricings by year. The median percent of equity issues is 14.22% of shares outstanding. Previous studies (Korajczyk et al., 1991) argue that firms prefer to issue equity when the market is most informed about the quality of the firm. Hence, one should observe clustering of equity issues and buybacks after earnings releases. To visually examine this finding, Figure 2.1 plots the distribution of buybacks and SEOs around the closest quarterly earnings announcement. Panel A of Figure 2.1 shows the frequency of stock buybacks and Panel B presents the frequency of equity pricings. These panels show that there is clustering of both SEO pricings and buyback announcements after earnings announcements. About 28% of buybacks and 32% of SEO pricings are announced during the first three weeks after earnings announcements date and this percentage decreases monotonically as we move further away from the earnings announcements date. However, a considerable number of offerings take place before announcement of earnings. About 23% of stock buybacks and 17% of SEO pricings are made in the three weeks prior to earnings announcement.

Table 2.2 reports the sample sizes used for different analyses in this paper. Panel A has the total number of buybacks and SEO pricings. Panel B reports the number of buybacks and SEO pricings that are closest to but prior to earnings announcements. Panel C shows the size of subsamples used for main analyses in the paper. These include all buybacks and SEO pricings that are closest to but 2 or more days prior to the earnings announcements. In constructing the observation windows, we maintain a minimum gap of 2 trading days between the start or end of each window and the announcement date of a corporate action so that there is no direct contamination of earnings by the corporate action. The results hold if we change the minimum gap to 5 days. Samples reported in Panels D and E are subsamples of Panel C in which small firms (market cap≤100 million) and financial and utility firms are excluded, respectively. Panel F is a subsample of Panel C obtained by imposing a minimum requirement of buyback or equity issuance (buybacks>5% and SEOs>10%). The minimum requirements are intended to exclude less important corporate actions. Finally, Panels G and H show the size of subsamples for subperiods.

[6] All market capitalizations are in 2013 dollars, based on the All Urban Consumers (CPI-U) index from the U.S. Department of Labor, Bureau of Labor Statistics.

Table 2.1: Summary statistics for repurchasing and issuing firms

This table presents the time profile and summary statistics for the sample of repurchasing firms over the 1994 to 2015 period and the sample of issuing firms over the 1970 to 2015 period. The second column reports the number of buybacks in each year, the third column states the median percent of shares outstanding to be repurchased, and the fourth column shows the median market cap of repurchasing firms. Similar information for equity issues is presented in columns 5 to 7. Market cap values are in 2013 dollars using CPI-U inflation data.

	Buybacks			SEOs		
Year	N	% of shares	Market cap	N	% of shares	Market cap
1970				105	8.66	1195
1971				271	11.39	664
1972				239	11.15	854
1973				146	10.78	918
1974				93	10.42	748
1975				189	11.42	897
1976				207	11.81	620
1977				145	13.14	534
1978				197	12.48	454
1979				172	12.87	416
1980				354	14.55	322
1981				397	13.34	308
1982				427	8.49	868
1983				775	14.47	327
1984				238	13.02	268
1985				382	17.22	250
1986				493	16.86	261
1987				298	17.06	283
1988				131	19.73	200
1989				223	19.34	203
1990				193	17.98	305
1991				477	17.54	345
1992				518	17.74	366
1993				659	20.57	324
1994	679	5.07	330	394	19.62	363
1995	693	5.07	229	572	20.02	400
1996	929	5.19	223	703	21.20	401
1997	815	5.34	291	681	18.71	517
1998	1377	5.44	232	553	13.77	883
1999	1093	5.45	239	442	15.95	981
2000	945	5.77	213	409	11.30	1692
2001	830	5.10	179	397	14.04	962
2002	656	5.12	269	377	13.34	754
2003	494	5.10	531	450	13.20	806
2004	570	5.04	1182	513	13.93	835

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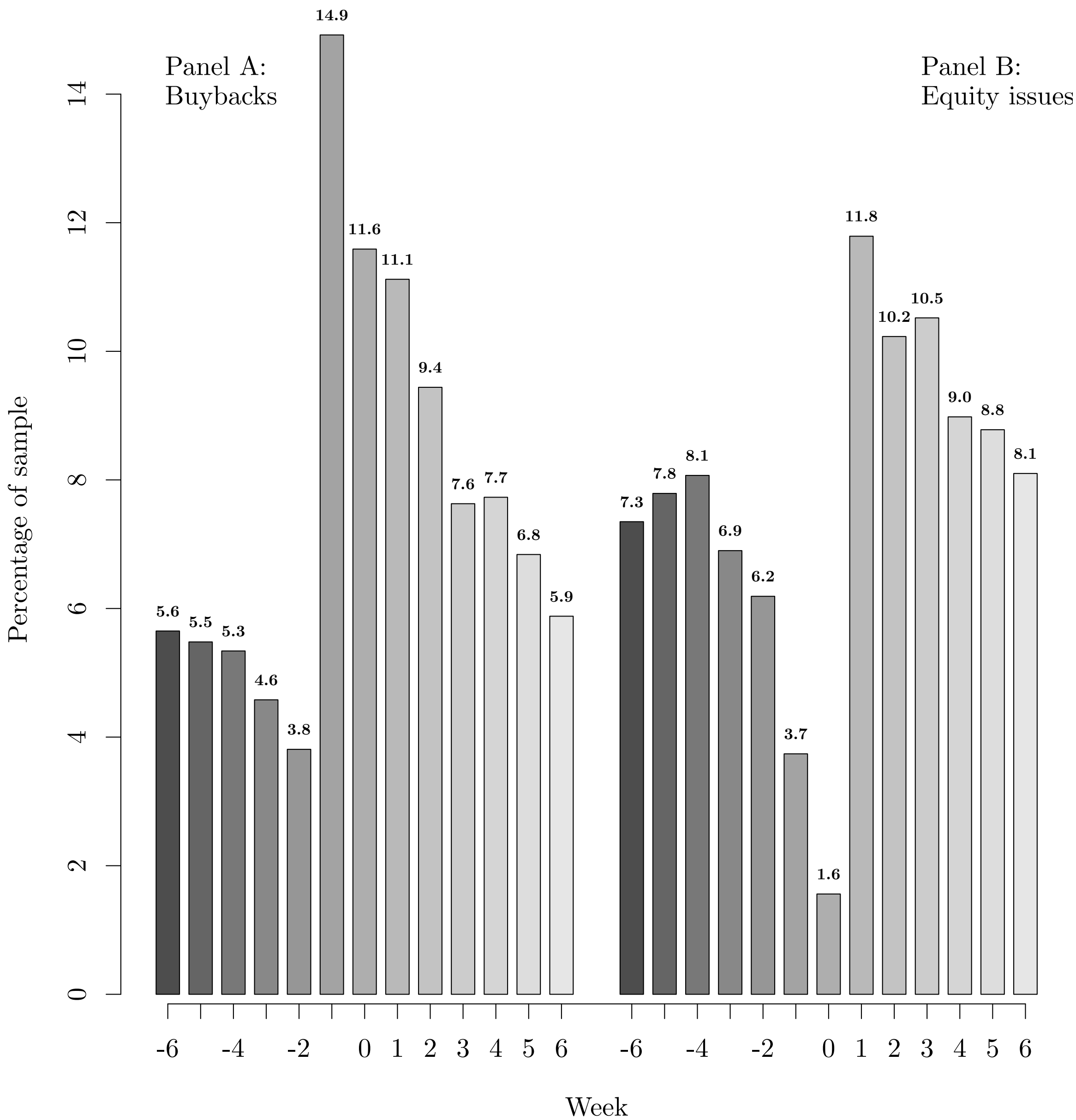

Figure 2.1: Distribution of buybacks and SEOs around earnings announcements

Panel A shows the histogram of repurchasing firms and Panel B depicts the histogram of issuing firms. Each bin in this graph represents 5 trading days. Positive sign indicates "after" and negative sign indicates "before" earnings announcement date. The bin labeled 0 indicates the event day which is the earnings announcement date.

Table 2.1: Continued from previous page

Year	Buybacks			SEOs		
	N	% of shares	Market cap	N	% of shares	Market cap
2004	570	5.04	1182	513	13.93	835
2005	660	5.20	1346	403	15.65	804
2006	647	5.31	1228	450	14.50	906
2007	813	6.00	877	389	14.87	867
2008	749	7.16	354	266	11.14	1337
2009	269	6.00	463	801	12.61	433
2010	423	6.14	1351	754	12.54	415
2011	542	6.15	1407	624	12.86	468
2012	430	5.95	1186	721	11.97	565
2013	426	5.30	1478	842	12.29	646
2014	517	5.26	1711	726	11.92	705
2015	549	6.06	1293	670	12.40	937
Total	15,106	5.38	481	19,466	14.22	551

2.3 Results

2.3.1 Returns around earnings announcements

The main analysis in the paper relates to returns around earnings announcements that follow corporate actions to evaluate whether we can predict the nature of those earnings based on prior corporate actions. We choose all buybacks and SEO pricings that are closest to but 2 or more days prior to the earnings announcements.[7] The estimation of model parameters is based on the 251 to 31 day period prior to the event date. The left panel of Table 2.3 reports returns around earnings announcements for repurchasing firms that announce a buyback up to 2 days prior to earnings announcements. The repurchasing firms earn a positive, statistically significant abnormal return of 0.5% (t=4.602) from one day before announcement to one day after earnings announcement. The raw return over the same period is 0.80% (t=7.385). We also find a positive and statistically significant abnormal return of 1.1% (t=7.226) over a three-week period (+2,+15) after the announcement date and a return of 1.3% (t=6.068) over a six-week period (+2,+30). The abnormal returns increase to 1.7% (t=7.509) over the (-1,+30) window which includes announcement returns. The returns remain positive and statistically significant over other observation windows irrespective of whether they are reported as raw returns or four-factor abnormal returns.[8]

As for buybacks in the left panel, the middle panel reports abnormal returns around earnings

[7] We test the results with other windows. For example, we consider firms where the announcement of buybacks or SEO pricings occurs 6 to 15 days or 6 to 30 days before earnings and estimate the earnings announcement returns. The findings are consistent with the main results discussed in this section.

[8] In untabulated results, we also calculate the returns around the announcement of earnings for firms that announce a buyback program after earnings. We document significantly negative returns around the earnings announcement date. This finding implies that buybacks announced after an earnings announcement usually follow poor earnings.

Table 2.2: Distribution of buybacks and SEOs

This table reports the size of samples used for different analyses. Panel A shows the total sample size. Panel B shows the number of buybacks or SEO pricings which are closest to but prior to the earnings announcements. Panel C shows the number of buybacks or SEO pricings which are closest to but 2 or more days prior to the earnings announcements. Panel D shows the number of buybacks or SEO pricings which are closest to but 2 or more days prior to the earnings announcements and have a market cap greater than $100 million. Panel E shows the number of buybacks or SEO pricings which are closest to but 2 or more days prior to the earnings announcements and are not financial or utility firms. Panel F shows the number of buybacks or SEO pricings which are closest to but 2 or more days prior to the earnings announcements and are greater than 5% of shares outstanding for repurchasing firms and greater than 10% of shares outstanding for issuing firms. Panel G shows the number of buybacks or SEO pricings which are closest to but 2 or more days prior to the earnings announcements and are announced between 1994 and 2004. Panel H shows the number of buybacks or SEO pricings which are closest to but 2 or more days prior to the earnings announcements and are announced between 2005 and 2015.

	Buybacks	SEOs
Panel A: Total number of observations	15,106	19,466
Panel B: Number of observations closest to but prior to the earnings announcements	6,026	9,148
Panel C: Number of observations closest to but 2 or more days prior to the earnings announcements	4,737	8,846
Panel D: Number of observations closest to but 2 or more days prior to the earnings announcements with market cap>$100 million	3,407	7,299
Panel E: Number of observations closest to but 2 or more days prior to the earnings announcements excluding financial and utility firms	2,760	5,793
Panel F: Number of observations closest to but 2 or more days prior to the earnings announcements with buybacks>5% and SEOs>10%	2,741	5,976
Panel G: Number of observations closest to but 2 or more days prior to the earnings announcements between 1994 and 2,004	3,309	2,347
Panel H: Number of observations closest to but 2 or more days prior to the earnings announcements between 2005 and 2015	1,428	2,453

Table 2.3: Returns around earnings announcement dates

This table reports returns around earnings announcement dates for both repurchasing and issuing firms. The analysis is conducted for firms that announce buybacks or price an equity offering up to 2 days prior to the next earnings announcement. In addition to raw returns, value-weighted four-factor (Fama-French-Carhart) abnormal returns are reported. The last two columns show the difference between returns around earnings announcement dates for repurchasing firms and issuing firms. The t statistics are reported in parentheses below each estimate. N shows the number of observations. The methodology used to compute the CARs for the four factor model is as follows. Assume an asset pricing model: $R_{it} = \alpha_i + \beta_{im} R_{mt} + \beta_{is} SMB_t + \beta_{ih} HML_t + \beta_{iu} UMD_t + \epsilon_{it}$. An estimation period from day 251 to day 31 before event date is used to calculate the parameters of the model provided there are at least 15 daily returns available for estimation. The CAR at time τ_2 relative to time τ_1 is then computed as:

$$CAR_{(\tau_1,\tau_2)} = \frac{1}{n} \sum_{\tau=\tau_1}^{\tau_2} \sum_{i=1}^{n} (R_{it} - \hat{\alpha}_i - \hat{\beta}_{im} R_{mt} - \hat{\beta}_{is} SMB_t - \hat{\beta}_{ih} HML_t - \hat{\beta}_{iu} UMD_t)$$

Day 0: Earnings announcement date						
	Buybacks (Up to 2 days before earnings)		SEOs (Up to 2 days before earnings)		Buybacks - SEOs (Difference)	
Window	Four-factor	Raw	Four-factor	Raw	Four-factor	Raw
(-1,+1)	0.005	0.008	−0.002	0.004	0.007	0.004
	(4.602)	(7.385)	(−2.763)	(5.147)	(5.362)	(3.243)
(0,+1)	0.003	0.005	−0.002	0.001	0.006	0.004
	(3.351)	(5.246)	(−3.800)	(2.164)	(4.864)	(3.267)
(-1,+3)	0.006	0.011	−0.004	0.005	0.011	0.007
	(5.278)	(9.316)	(−5.351)	(5.268)	(7.393)	(4.551)
(-1,+5)	0.008	0.015	−0.007	0.005	0.015	0.009
	(6.157)	(11.177)	(−7.461)	(5.589)	(9.373)	(5.712)
(-1,+30)	0.017	0.041	−0.034	0.019	0.051	0.022
	(7.509)	(17.691)	(−16.940)	(10.355)	(16.767)	(7.232)
(+2,+15)	0.011	0.021	−0.016	0.009	0.027	0.012
	(7.226)	(14.240)	(−13.383)	(7.488)	(14.083)	(6.464)
(+2,+30)	0.013	0.033	−0.032	0.016	0.045	0.017
	(6.068)	(16.188)	(−17.323)	(9.112)	(16.061)	(6.497)
N	4,737	4,737	8,846	8,846		

announcements for issuing firms that priced SEOs up to 2 days before earnings announcements. The results show statistically negative returns around and after earnings announcements. For example, the four-factor abnormal return shows a loss of -1.6% (t=-13.383) over three weeks after the earnings announcement though the raw returns are positive (0.9%, see Footnote 3) and statistically significant.[9] The right panel shows the difference between returns around earnings announcements for repurchasing firms and issuing firms. The results show that the return differentials are statistically and economically significant over different observation windows. For instance, a portfolio that is long in buybacks and short in SEOs will produce raw returns of 1.2%, 1.7%, and 2.2% over (+2,+15), (+2,+30), and (-1,+30) windows, respectively. The portfolio will generate four-factor adjusted returns of 2.7%, 4.5%, and 5.1% over the same windows. Overall, the results show that earnings are predictable when they are preceded by buybacks or SEO pricings: positive market reaction to earnings preceded by buyback announcements and negative market reaction to earnings preceded by SEO pricings. The results reported in Table 2.3 are also shown in Figure 2.2.

2.4 Robustness tests

We conduct multiple robustness tests by altering the sample selection criteria. These tests support the results reported above.

2.4.1 Excluding small size firms

Prior empirical evidence of long-term abnormal performance has found that underperformance of issuing firms is concentrated among the smallest firms (Fama, 1998; Denis and Sarin, 2001). In addition, mean returns may be driven by small firms because those firms may experience large negative or positive returns in response to a corporate action. Such results are not meaningful because small firms form a small fraction of the overall size of the market and may also be illiquid. Therefore, as the first robustness check, we recalculate the returns around earnings announcements excluding firms with a market cap below $100 million. The results are presented in Panel A of Table 2.4. Similar to the main results presented in Table 2.3, we observe a positive market reaction to earnings announcements for firms that announce buybacks up to 2 days before earnings and a negative market reaction to earnings announcements for firms that price SEOs up to 2 days prior to earnings. These findings show that our results are not confined only to small firms which tend to show greater uncertainty regarding their value and to have higher trading costs. The return differentials reported in the last two columns of Panel A remain large and statistically significant after excluding small, high trading cost firms.

[9] In untabulated results, we also calculate the returns around the announcement of earnings for firms that price an SEO after earnings. We document significantly positive returns around the earnings announcement date. This finding implies that SEOs priced after an earnings announcement usually follow good earnings.

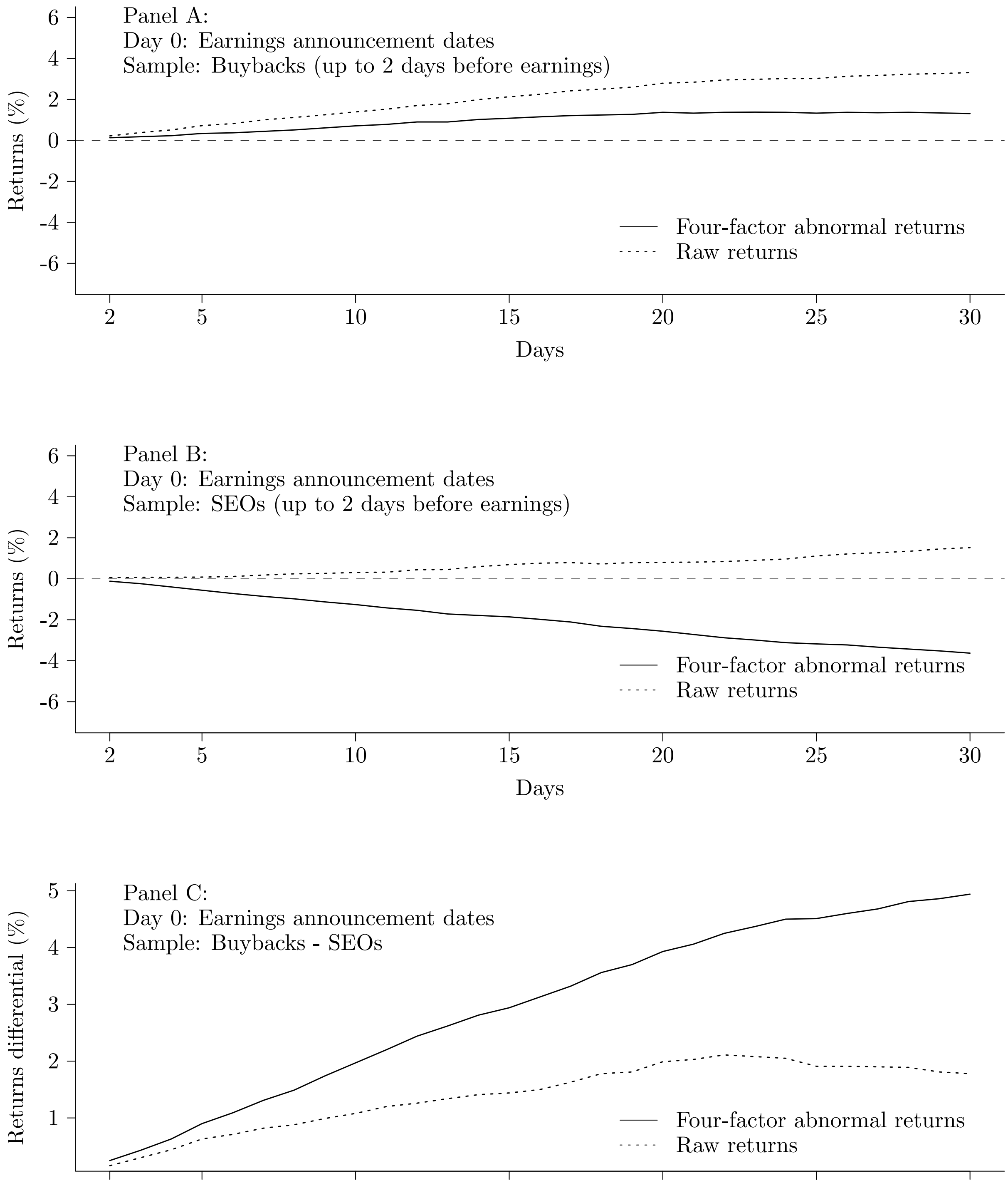

Figure 2.2: Returns around earnings for repurchasing and issuing firms

This figure shows cumulative average abnormal returns (CARs) and raw returns around earnings announcement. Panel A plots the returns around the earnings announcement date for repurchasing firms that made their buyback announcement up to 2 days before earnings. Panel B plots the returns around earnings announcement date for issuing firms that priced an equity offering up to 2 days before earnings. Panel C plots the difference between returns around earnings announcement dates for repurchasing firms and issuing firms. In all graphs, the returns are plotted from 2 days after to 30 days after earnings announcement.

Table 2.4: Returns around earnings announcement dates: Robustness tests

This table reports returns around earnings announcement dates for both repurchasing and issuing firms. The analysis is conducted for firms that announce buybacks or price an equity offering up to 2 days prior to the next earnings announcement. Panel A reports the returns around earnings announcements for both repurchasing and issuing firms excluding small firms with a market cap below $100 million. Panel B reports the returns around earnings announcements excluding financial and utility firms. Panel C reports the returns around earnings announcement dates excluding firms that announce a buyback of less than 5% or announce an equity issuance of less than 10% of their shares outstanding. The last two columns in each panel show the difference between returns around earnings announcement dates for repurchasing firms and issuing firms. In addition to raw returns, four-factor (Fama-French-Carhart) abnormal returns are reported in all panels. The t statistics are reported in parentheses below each estimate. N shows the number of observations. See Table 2.3 for the methodology used for calculating abnormal returns.

Day 0: Earnings announcement date						
	Buybacks (Up to 2 days before earnings)		SEOs (Up to 2 days before earnings)		Buybacks - SEOs (Difference)	
Window	Four-factor	Raw	Four-factor	Raw	Four-factor	Raw
Panel A: Excluding small firms						
(-1,+1)	0.004	0.007	−0.001	0.005	0.005	0.002
	(3.235)	(5.410)	(−1.590)	(6.477)	(3.594)	(1.248)
(0,+1)	0.003	0.005	−0.001	0.002	0.004	0.002
	(2.537)	(3.968)	(−2.249)	(3.768)	(3.314)	(1.595)
(-1,+3)	0.006	0.011	−0.005	0.005	0.010	0.006
	(4.435)	(7.740)	(−5.335)	(5.619)	(6.618)	(3.378)
(-1,+5)	0.008	0.015	−0.007	0.007	0.015	0.008
	(5.728)	(9.628)	(−6.990)	(6.469)	(8.653)	(4.342)
(-1,+30)	0.017	0.039	−0.036	0.021	0.053	0.018
	(6.929)	(15.490)	(−17.311)	(10.919)	(16.456)	(5.560)
(+2,+15)	0.010	0.020	−0.017	0.010	0.027	0.010
	(6.977)	(12.821)	(−14.344)	(8.106)	(14.469)	(5.277)
(+2,+30)	0.013	0.032	−0.035	0.016	0.048	0.016
	(6.078)	(14.723)	(−18.340)	(9.236)	(16.665)	(5.638)
N	3,407	3,407	7,299	7,299		
Panel B: Excluding regulated firms						
(-1,+1)	0.007	0.011	−0.002	0.004	0.009	0.007
	(4.311)	(6.408)	(−2.265)	(4.018)	(4.861)	(3.340)
(0,+1)	0.004	0.007	−0.003	0.001	0.007	0.006
	(2.931)	(4.549)	(−3.054)	(1.638)	(4.066)	(3.113)
(-1,+3)	0.009	0.015	−0.005	0.005	0.014	0.010
	(4.993)	(7.723)	(−4.560)	(4.169)	(6.665)	(4.209)
(-1,+5)	0.010	0.018	−0.008	0.006	0.019	0.012
	(5.090)	(8.716)	(−6.396)	(4.531)	(7.789)	(4.718)
(-1,+30)	0.026	0.049	−0.046	0.021	0.072	0.027
	(7.261)	(13.751)	(−15.837)	(7.950)	(15.606)	(6.113)
(+2,+15)	0.014	0.024	−0.022	0.009	0.036	0.015
	(6.137)	(10.475)	(−12.839)	(5.527)	(12.700)	(5.108)
(+2,+30)	0.019	0.038	−0.043	0.017	0.062	0.021
	(5.929)	(12.196)	(−16.285)	(6.956)	(15.015)	(5.179)
N	2,760	2,760	5,793	5,793		

Continued on next page

Table 2.4: Continued from previous page

Panel C: Excluding buybacks<5% and SEOs<10%						
(-1,+1)	0.007	0.009	−0.002	0.004	0.009	0.005
	(4.839)	(6.441)	(−2.066)	(4.182)	(5.197)	(3.154)
(0,+1)	0.005	0.006	−0.002	0.001	0.007	0.005
	(3.602)	(4.804)	(−3.077)	(1.720)	(4.671)	(3.211)
(-1,+3)	0.009	0.013	−0.005	0.005	0.013	0.009
	(5.423)	(8.147)	(−4.394)	(4.125)	(6.947)	(4.464)
(-1,+5)	0.011	0.018	−0.008	0.005	0.019	0.013
	(6.465)	(10.145)	(−6.414)	(3.934)	(8.962)	(6.076)
(-1,+30)	0.024	0.046	−0.038	0.018	0.063	0.027
	(7.740)	(14.305)	(−14.918)	(7.619)	(15.437)	(6.860)
(+2,+15)	0.015	0.026	−0.019	0.007	0.034	0.018
	(7.467)	(12.232)	(−12.451)	(4.830)	(13.471)	(7.134)
(+2,+30)	0.017	0.036	−0.037	0.014	0.054	0.022
	(6.206)	(12.876)	(−15.306)	(6.518)	(14.642)	(6.131)
N	2,741	2,741	5,976	5,976		

2.4.2 Excluding regulated firms

Regulated firms account for a significant fraction of our sample and were not excluded from the sample used to estimate the main results. Financial firms (SIC codes 6000–6999) may issue equity or repurchase their own stock to meet capital requirements and regulations. Similarly, utility firms' capital structure (SIC code 4900–4999) can be subject to regulatory supervision, which raises the possibility that observed SEOs and buybacks are a product of regulations. Therefore, we rerun our main analysis excluding firms in the regulated industries. The results are reported in Panel B of Table 2.4.

The sign and statistical significance of the results are unchanged. As earlier, the returns are positive and significant for firms that announce buybacks up to 2 days before earnings but are negative and significant for firms that price SEOs up to 2 days before announcing earnings. For example, over a three-week period (+2,+15), the mean abnormal return is significantly positive (1.4%, t=6.137) if the buyback announcement is made up to 2 days before announcement of earnings. For issuing firms, however, the abnormal return is significantly negative (-2.2%, t=-12.839) if the issue is priced up to 2 days before announcement of earnings. Compared to the results presented in Table 2.3, the return differentials are stronger when regulated firms are dropped from the sample. For example, a long-short portfolio will generate a raw return of 2.1% (t=5.179) and a four-factor adjusted return of 6.2% (t=15.015) over a (+2,+30) day window.

2.4.3 Excluding small corporate actions

As another robustness test, we drop firms that announce a buyback of less than 5% or price an equity issuance of less than 10% of their shares outstanding. This test ensures that our results are not driven by less important corporate actions. The results are in Panel C of Table 2.4. We find the same pattern as we found for the full sample: positive and statistically significant market reaction to earnings following buybacks and negative and statistically significant market reaction to earnings following SEO pricings causing the predictability in earnings. The return differentials remain statistically and economically significant over different observation windows.

2.4.4 Subperiod analysis

For the next robustness test, we split the sample into two subperiods for buyback and SEO samples to examine whether a particular period is responsible for the results. The subperiods are: 1994 to 2004, and 2005 to 2015. The results in Table 2.5 show that these periods exhibit similar earnings predictability but the results for the second period are somewhat weaker though they continue to be statistically and economically significant. The weaker results over the most recent decade are in line with the findings of Fu and Haung (2016) who document insignificant market reaction to announcements of buybacks and SEOs in the recent years. In contrast to their study, however, we study earnings announcements following buybacks and SEOs that allow us to capture market reaction over a subsequent informational event. Our findings show that earnings following corporate actions in recent years still surprise the market. The statistically and economically significant return differentials are present in both time periods though they are smaller in the second period.

There is a large literature on earnings management around stock buybacks (e.g., Gong et al., 2008), and SEOs (e.g., Teoh et al., 1998b; Rangan, 1998; Jo and Kim, 2007). These studies find a negative relation between earnings management and post-event stock return performance. For example, Gong et al. (2008) find that both post-buyback abnormal returns and reported improvement in operating performance are driven, at least in part, by pre-buyback downward earnings management rather than growth in profitability. It is thus likely that the abnormal performance following the post-buyback/issuance earnings announcements, documented in this paper, is due to earnings management. Fu and Haung (2016), however, find no evidence of earnings management after 2002 for repurchasing and issuing firms and relate this finding to the changing market environment including more efficient markets, and more transparent and credible information disclosure. Since our subperiod analysis shows that our results hold over periods with no or little earnings management, we believe our results are not due to earnings management prior to buybacks or equity issues.

Table 2.5: Returns around earnings announcement dates: Subperiod analysis

This table reports the returns around earnings announcements for both repurchasing and issuing firms for two subperiods: 1994 to 2004 and 2005 to 2015. The analysis is conducted for firms that announce buybacks or price SEOs up to 2 days prior to the next earnings announcement. In addition to raw returns, four-factor (Fama-French-Carhart) abnormal returns are reported. The last four columns show the difference between returns around earnings announcement dates for repurchasing firms and issuing firms. The t statistics are reported in parentheses below each estimate. N shows the number of observations. See Table 2.3 for the methodology used for calculating abnormal returns.

	Day 0: Earnings announcement date											
	Buybacks (Up to 2 days before earnings)				SEOs (Up to 2 days before earnings)				Buybacks - SEOs (Difference)			
	1994 to 2004		2005 to 2015		1994 to 2004		2005 to 2015		1994 to 2004		2005 to 2015	
Window	Four-factor	Raw	Four-factor	Raw	Four-factor	Raw	Four-factor	Raw	Four-factor	Raw	Four-factor	Raw
(-1,+1)	0.006	0.010	0.002	0.002	−0.001	0.006	−0.008	−0.004	0.008	0.005	0.010	0.006
	(4.960)	(8.173)	(0.875)	(1.163)	(−0.961)	(3.617)	(−5.334)	(−2.407)	(3.861)	(2.188)	(3.945)	(2.392)
(0,+1)	0.004	0.007	0.001	0.001	−0.002	0.002	−0.007	−0.004	0.007	0.005	0.007	0.004
	(3.876)	(6.247)	(0.359)	(0.298)	(−1.739)	(1.624)	(−4.859)	(−2.730)	(3.797)	(2.713)	(3.162)	(1.866)
(-1,+3)	0.007	0.014	0.004	0.005	−0.007	0.005	−0.010	−0.004	0.015	0.009	0.014	0.010
	(5.133)	(9.510)	(1.785)	(2.466)	(−4.078)	(2.725)	(−5.440)	(−2.147)	(6.368)	(3.676)	(4.879)	(3.270)
(-1,+5)	0.009	0.018	0.006	0.008	−0.012	0.006	−0.013	−0.007	0.021	0.012	0.019	0.015
	(5.666)	(11.173)	(2.570)	(3.298)	(−6.019)	(2.975)	(−6.797)	(−3.361)	(8.215)	(4.394)	(6.400)	(4.696)
(-1,+30)	0.020	0.050	0.012	0.021	−0.067	0.014	−0.037	0.003	0.087	0.035	0.049	0.018
	(6.889)	(17.228)	(3.082)	(5.564)	(−14.212)	(3.439)	(−8.834)	(0.654)	(15.717)	(6.934)	(8.630)	(3.325)
(+2,+15)	0.011	0.026	0.009	0.010	−0.034	0.005	−0.015	−0.001	0.045	0.021	0.024	0.011
	(6.380)	(14.641)	(3.434)	(3.636)	(−12.663)	(2.052)	(−5.765)	(−0.509)	(14.078)	(6.853)	(6.518)	(2.936)
(+2,+30)	0.014	0.039	0.010	0.018	−0.065	0.009	−0.029	0.006	0.079	0.031	0.039	0.012
	(5.254)	(15.452)	(3.039)	(5.608)	(−15.091)	(2.221)	(−7.434)	(1.715)	(15.640)	(6.675)	(7.657)	(2.433)
N	3,309	3,309	1,428	1,428	2,347	2,347	2,453	2,453				

2.4.5 Returns around announcement of corporate actions (buybacks and SEOs)

Finally, we provide evidence that our sample is consistent with prior work by estimating returns around announcement of buybacks and SEOs and comparing them with the results documented in the literature. If a buyback program is announced, in line with prior work (e.g., Peyer and Vermaelen, 2009), we expect the stock price to move to a higher level and if an equity offering is priced, we expect the stock price to drop to a lower level (e.g., Jegadeesh, 2000; Denis and Sarin, 2001). To verify these prior findings, we create symmetric samples around the earnings announcement date in order to compare returns among samples with the same observation windows: the samples consist of firms that announce a buyback or SEO up to 2 days before the earnings announcement date. The results for both buybacks and SEOs are reported in Table 2.6.

Table 2.6: Returns around announcement dates of buybacks or SEO pricings dates

This table reports returns around the announcements of buybacks and SEO pricings. The analysis is conducted for firms that announce buybacks or price an equity offering up to 2 days prior to the next earnings announcement. In addition to raw returns, four-factor (Fama-French Carhart) abnormal returns are reported. The t statistics are reported in parentheses below each estimate. N shows the number of observations. See Table 2.3 for the methodology used for calculating abnormal returns.

Day 0: Announcement date for buybacks or SEO pricings				
	Buybacks (Up to 2 days before earnings)		SEOs (Up to 2 days before earnings)	
Window	Four-factor	Raw	Four-factor	Raw
(-1,+1)	0.020	0.020	−0.020	−0.014
	(15.591)	(14.497)	(−21.154)	(−14.653)
(0,+1)	0.023	0.022	−0.013	−0.009
	(21.341)	(20.411)	(−15.079)	(−10.141)
(-1,+3)	0.025	0.025	−0.019	−0.010
	(17.476)	(16.337)	(−17.575)	(−9.355)
(-1,+5)	0.026	0.028	−0.020	−0.008
	(16.888)	(17.202)	(−17.265)	(−6.825)
(-1,+30)	0.042	0.065	−0.045	0.011
	(13.098)	(19.856)	(−21.051)	(5.487)
(+2,+15)	0.011	0.022	−0.008	0.015
	(6.736)	(12.628)	(−6.542)	(12.459)
(+2,+30)	0.022	0.046	−0.025	0.025
	(7.389)	(14.939)	(−13.733)	(14.689)
N	4,737	4,737	8,846	8,846

The first two columns show the raw returns and four-factor abnormal returns around announcements of buybacks for various time intervals. Consistent with previous studies (Vermaelen, 1981; Chan et al., 2004; Peyer and Vermaelen, 2009), we find a positive market reaction to these announcements. For example, we find positive and statistically significant abnormal returns in the -1 to +1 window (2.0%, t=15.591) for firms that announced their buybacks up to 2 days before earnings announcements. The abnormal return increases to 2.6% (t=16.888) when the window is expanded to a (-1,+5) day period. The raw returns exhibit similar results confirming the findings of previous studies.

The right panel of Table 2.6 contains results for the issuing firms. Consistent with previous studies (Spiess and Affleck-Graves, 1995; Loughran and Ritter, 1995; Denis and Sarin, 2001), we find a negative market reaction to these announcements: the abnormal return in the -1 to +1 day period is a statistically significant -2.0% (t=-21.154) when equity issues are priced up to 2 days prior to earnings. The abnormal return continues to be negative: -2.0% (t=-17.265) in the (-1,+5) window. The raw returns show similar results. Overall, our sample is consistent with those used in previous studies demonstrating positive market reaction to buyback announcements and negative market reaction to equity offerings.

2.5 Returns and post earnings announcement drift

In this section, we provide evidence that abnormal returns around earnings following a buyback or an equity offering are not a manifestation of the well-documented post earnings announcement drift (PEAD); the tendency for a stock to drift in the direction of an earnings surprise for several weeks following the earnings announcement. Based on the PEAD anomaly, estimated cumulative abnormal returns continue to drift up for good news firms and down for bad news firms even after earnings are announced. In contrast, we show that in our framework, stocks continue to drift up for earnings following buybacks regardless of whether earnings contain good news or bad news and continue to drift down for earnings following equity offerings regardless of the nature of the news contained in earnings. We begin our analysis by classifying stocks into deciles based on the observed raw returns around earnings over the (-1,+1) window and calculate the cross-sectional mean of raw and four-factor abnormal returns over (+2,+15) and (+2,+30) windows for each decile.

The results for the buybacks sample are in Table 2.7. The first row contains the decile of stocks with the lowest returns in the (-1,+1) window, with higher returns in subsequent rows. Looking at the (+2,+15) window after the earnings announcement, we note that raw returns and four-factor returns are similar across different deciles (from one decile to the next) irrespective of initial returns, and the difference between returns in the highest and lowest deciles is statistically insignificant as reported in the last row of Panel A. The results for the longer window, (+2,+30), are similar and the difference between returns in the highest and lowest deciles is statistically insignificant. The last column shows that firms in different deciles do not differ significantly in size, though the market-to-book ratio is much higher for the highest return decile.

As an additional test, in Panel B of Table 2.7, we classify stocks into two categories based on whether earnings following buybacks contain positive or negative surprises and calculate cross-sectional mean of raw and four-factor abnormal returns over (+2,+15) and (+2,+30) windows for each group.

Earnings surprises are defined as the difference between the actual quarterly earnings per share and the median of all the latest outstanding forecasts (Bartov et al., 2002; Akbas, 2016). We also report the cross-sectional mean of market-to-book and size for each group. Similar to the results in Panel A, the returns after earnings, calculated over (+2,+15) and (+2,+30) windows, are not statistically different across positive and negative earnings surprise portfolios. Table 2.8 reports the results for SEOs sample. Similar to the results of previous analysis, we do not observe significant differences between returns after earnings across return decile portfolios or earnings surprise portfolios. Overall, the results in Tables 2.7 and 2.8 confirm that the drift in our sample is unrelated to the initial market reaction, and different from the nature of post-earnings announcement drift.

2.6 Regression analysis

In this section, we examine firm characteristics that may explain the returns around earnings announcements documented above. Because information asymmetry may cause mispricing, the primary focus of this inquiry is on variables that measure information asymmetry.

2.6.1 Measures of information asymmetry

We use several factors that may contribute to a delay in market reaction to announcement of buybacks and equity issues. In particular, we consider the level of information asymmetry between managers and outside investors and construct three proxies to capture information asymmetry. The proxies include the bid-ask spread, analysts' forecast error, and the standard deviation of analysts' forecasts. The bid-ask spread is obtained from CRSP and the other proxies are obtained from IBES.

We select these proxies for information asymmetry based on prior research. Venkatesh and Chiang (1986) show that dealers increase bid-ask spreads with an increased degree of information asymmetry. They also find that the spreads significantly wider prior to earnings announcements. Given this finding, we calculate the bid-ask spread over 5 to 30 day before earnings announcement dates and use the average of the values as one of our measures of information asymmetry ($BidAskSpread$). Following Corwin and Schultz (2012), we estimate bid-ask spreads from daily high and low prices. They show that this measure outperforms the covariance spread estimator of Roll (1984) and the estimator of Lesmond et al. (1999). Elton et al. (1984) provide evidence on the use of errors in analysts' forecasts of earnings and the standard deviation of analysts' forecasts as measures of information asymmetry, that is, firms with higher levels of information asymmetry between managers and outside investors are expected to have higher forecast errors and higher standard deviation of the forecasts submitted by analysts.

For the accuracy of analysts' forecasts of earnings per share ($ForecastError$) and the dispersion among analysts' forecasts ($StdForecast$) as proxies for information asymmetry, we follow

Table 2.7: Return deciles: Buybacks sample

Return deciles based on earnings announcement returns are formed and reported in Panel A for different windows. The last two columns report the average of market-to-book ratio and the average size of firms in each portfolio. Panel B reports the same values as Panel A for portfolios formed based on whether earnings following buybacks contain positive or negative surprises. Earnings surprises are defined in Section 2.5. The analysis is done for the firms that announce buybacks up to 2 days before their earnings release date. The t statistics are reported in parentheses below each estimate. N shows the number of observations. See Table 2.3 for the methodology used for calculating abnormal returns.

	Window: (-1,+1)		Window: (+2,+15)		Window: (+2,+30)			
	Raw	Four-factor	Raw	Four-factor	Raw	Four-factor	M/B	Size
Panel A: Return deciles								
Decile 1	−0.121	−0.108	0.031	0.020	0.047	0.029	2.432	5916.485
	(−31.515)	(−24.733)	(4.433)	(3.165)	(5.311)	(3.188)	(15.979)	(4.023)
Decile 2	−0.044	−0.040	0.007	0.002	0.025	0.009	2.323	11727.717
	(−91.254)	(−24.717)	(1.238)	(0.347)	(3.287)	(1.273)	(16.646)	(4.766)
Decile 3	−0.023	−0.022	0.025	0.018	0.032	0.020	2.275	10173.356
	(−91.444)	(−17.960)	(5.096)	(4.116)	(4.678)	(3.095)	(15.728)	(4.297)
Decile 4	−0.009	−0.010	0.008	0.005	0.012	0.003	2.507	14483.143
	(−45.238)	(−7.705)	(1.933)	(1.220)	(1.787)	(0.465)	(13.096)	(4.205)
Decile 5	0.000	0.000	0.019	0.013	0.030	0.016	2.257	7968.353
	(−0.366)	(−0.016)	(3.354)	(2.194)	(3.804)	(1.967)	(12.773)	(2.825)
Decile 6	0.009	0.005	0.021	0.011	0.029	0.008	2.345	8653.240
	(44.294)	(4.834)	(4.605)	(2.530)	(4.473)	(1.170)	(15.136)	(4.610)
Decile 7	0.021	0.016	0.022	0.012	0.030	0.012	2.451	9204.068
	(97.171)	(15.034)	(5.722)	(3.149)	(4.776)	(1.864)	(17.166)	(4.875)
Decile 8	0.035	0.029	0.022	0.014	0.044	0.021	2.438	11627.586
	(122.431)	(20.110)	(4.569)	(3.031)	(5.954)	(2.823)	(16.374)	(4.571)
Decile 9	0.061	0.051	0.028	0.017	0.046	0.024	2.928	12678.662
	(101.334)	(34.135)	(5.448)	(3.356)	(5.828)	(2.905)	(15.788)	(3.955)
Decile 10	0.147	0.127	0.042	0.019	0.058	0.024	3.316	3395.852
	(35.621)	(28.363)	(5.754)	(2.915)	(5.446)	(2.406)	(14.968)	(4.323)
10-1	0.268	0.235	0.011	−0.001	0.011	−0.005	0.884	−2520.632
	(47.547)	(37.567)	(1.132)	(−0.106)	(0.760)	(−0.350)	(3.289)	(−1.512)
Panel B: Earnings surprise portfolios								
Negative (33%)	−0.009	−0.009	0.023	0.016	0.033	0.024	2.202	5340.703
	(−3.637)	(−3.888)	(7.728)	(5.810)	(8.301)	(5.606)	(26.920)	(6.474)
Positive (67%)	0.015	0.011	0.023	0.012	0.037	0.014	2.706	11571.203
	(8.814)	(6.665)	(10.545)	(5.909)	(11.739)	(4.544)	(39.508)	(11.202)
Pos-Neg	0.024	0.020	0.000	−0.004	0.004	−0.010	0.504	6230.499
	(8.136)	(7.052)	(0.117)	(−1.276)	(0.757)	(−1.854)	(4.720)	(4.713)
N	4,737	4,737						

Table 2.8: Return deciles: SEOs sample

Return deciles based on earnings announcement returns are formed and reported in Panel A for different windows. The last two columns report the average of market-to-book ratio and the average size of firms in each portfolio. Panel B reports the same values as Panel A for portfolios formed based on whether earnings following buybacks contain positive or negative surprises. Earnings surprises are defined in Section 2.5. The analysis is done for the firms that price an equity offering up to 2 days before their earnings release date. The t statistics are reported in parentheses below each estimate. N shows the number of observations. See Table 2.3 for the methodology used for calculating abnormal returns.

	Window: (-1,+1)		Window: (+2,+15)		Window: (+2,+30)			
	Raw	Four-factor	Raw	Four-factor	Raw	Four-factor	M/B	Size
Panel A: Return deciles								
Decile 1	−0.121	−0.107	0.004	−0.033	0.006	−0.071	4.237	1683.804
	(−36.552)	(−30.120)	(0.626)	(−5.378)	(0.595)	(−6.774)	(16.350)	(4.273)
Decile 2	−0.045	−0.043	−0.003	−0.026	−0.007	−0.056	3.615	2632.007
	(−108.358)	(−32.417)	(−0.590)	(−5.224)	(−0.902)	(−6.986)	(16.393)	(4.630)
Decile 3	−0.024	−0.025	0.005	−0.021	0.007	−0.043	3.110	2072.810
	(−111.878)	(−20.540)	(0.822)	(−3.558)	(0.846)	(−4.782)	(16.580)	(8.945)
Decile 4	−0.011	−0.013	0.003	−0.018	0.009	−0.034	3.107	2438.642
	(−64.169)	(−10.698)	(0.658)	(−3.639)	(1.247)	(−4.632)	(14.803)	(6.377)
Decile 5	−0.002	−0.007	−0.001	−0.017	0.011	−0.031	2.601	2799.720
	(−13.714)	(−5.926)	(−0.100)	(−3.612)	(1.795)	(−4.350)	(16.538)	(4.523)
Decile 6	0.005	0.000	0.008	−0.014	0.017	−0.027	2.550	4352.678
	(35.572)	(0.067)	(2.050)	(−3.299)	(2.608)	(−3.739)	(19.804)	(3.290)
Decile 7	0.016	0.008	0.013	−0.009	0.021	−0.034	3.510	1936.442
	(92.356)	(7.419)	(2.613)	(−1.917)	(2.924)	(−4.517)	(16.091)	(7.808)
Decile 8	0.029	0.019	0.000	−0.027	0.010	−0.044	3.539	2473.909
	(119.727)	(18.034)	(−0.070)	(−5.512)	(1.448)	(−5.920)	(15.042)	(3.571)
Decile 9	0.054	0.041	0.007	−0.020	0.014	−0.050	3.837	2598.112
	(121.255)	(27.765)	(1.130)	(−3.457)	(1.578)	(−5.313)	(16.411)	(6.366)
Decile 10	0.135	0.108	0.010	−0.034	0.021	−0.066	4.870	1739.901
	(40.637)	(31.583)	(1.531)	(−4.984)	(2.141)	(−5.624)	(17.275)	(6.196)
10-1	0.256	0.215	0.006	−0.002	0.015	0.005	0.633	56.097
	(54.590)	(43.608)	(0.654)	(−0.185)	(1.078)	(0.309)	(1.654)	(0.116)
Panel B: Earnings surprise portfolios								
Negative (37%)	−0.009	−0.012	0.005	−0.017	0.009	−0.036	3.476	2237.175
	(−4.585)	(−7.161)	(1.588)	(−5.758)	(2.079)	(−7.464)	(26.457)	(7.275)
Positive (63%)	0.009	0.003	0.005	−0.026	0.011	−0.053	3.623	2512.647
	(6.159)	(1.965)	(2.142)	(−11.652)	(3.487)	(−14.996)	(41.873)	(11.857)
Pos-Neg	0.018	0.015	0.000	−0.008	0.002	−0.017	0.147	275.472
	(7.441)	(6.814)	(−0.059)	(−2.294)	(0.322)	(−2.875)	(0.932)	(0.738)
N	8,846	8,846						

Krishnaswami and Subramaniam (1999) and define them as:

$$ForecastError = \left| \frac{E_{i,q} - \overline{E}_{i,q}}{P_{i,q}} \right| \tag{2.1}$$

$$StdForecast = \left| \frac{Std_{i,q}}{P_{i,q}} \right| \tag{2.2}$$

where $E_{i,q}$ is the actual quarterly earnings per share for firm i in quarter q, $\overline{E}_{i,q}$ is the average of all the latest outstanding forecasts (among those less than 90 days old), $Std_{i,q}$ is the standard deviation of all the latest outstanding earnings forecasts and $P_{i,q}$ is the share price at the beginning of the quarter.

2.6.2 Control variables

Besides firm size, market-to-book ratio, prior month firm return, and prior month market return, we control for the frequency of buybacks and equity issues. Jagannathan and Stephens (2003) define an "infrequent" buyback or SEO as the first announcement in a five-year period, a moderate buyback or SEO as the second announcement in a five-year period, and a "frequent" buyback or SEO as the third or higher announcement in a five-year period. We include this proxy in our specification as a dummy variable which takes a value of 1 for moderate and frequent announcements. We control for the frequency of buybacks and equity issues because prior studies (e.g., Dittmar and Field, 2015) show that frequent and infrequent repurchasers (issuers) may experience different market reactions following the announcement of corporate actions. Table 2.9 reports descriptive statistics of the regressors.

An examination of Panel A reveals that forecast error for the repurchasing firms, on average, is 0.57% of their stock price and the standard deviation of the forecasts is 0.21% of their stock price. Panel A also shows that 32% of the repurchasing firms are moderate or frequent repurchasers and they are, on average, large firms (average size of $6.844 billion). Panel B, on the other hand, shows that forecast error for the issuing firms, on average, is 5.48% of their stock price and the standard deviation of the forecasts is 1.60% of their stock price. Panel B also shows that 42% of the issuing firms are moderate or frequent issuers and they are smaller than the repurchasing firms (average size of $2.014 billion). The difference in firm size is not unexpected because larger firms are usually mature and may generate excess cash for distribution whereas smaller firms need equity to grow. Repurchasing firms have a mean return of -4.24% in the month prior to the buyback announcement pointing to a possible undervaluation at the time of the announcement. Similarly, equity issues are priced after the stock price has gone up by 1.58% in the previous month pointing to a possible overvaluation at the time that the equity issue is priced.

Table 2.9: Descriptive statistics for control variables

Summary statistics of the main variables used in constructing the regression models are reported below. Panel A presents summary statistics of various firm characteristics for repurchasing sample. BidAskSpread is the average bid-ask spread from 5 to 30 days before earnings announcement dates. Bid-ask spreads are estimated from daily high and low prices using the methodology in Corwin and Schultz (2012). ForecastError is the absolute difference between the actual quarterly earnings per share and the average of all the latest outstanding forecasts scaled by the share price at the beginning of the quarter. StdForecast is the standard deviation of all the latest outstanding forecasts scaled by the share price at the beginning of the quarter. Size is the market capitalization (in millions). FirmRet is the firm's return over a 1-month period before the buyback announcement while MktRet is the market return over the same period. M/B is the ratio of the market value to the book value of equity and FrequentDum is a dummy variable which takes a value of 1 for moderately or frequently repurchasing (issuing) firms. Panel B presents summary statistics of several control variables for SEOs sample where variables have the same definitions as above. To mitigate the effect of outliers, variables ForecastError, StdForecast, and M/B are winsorized at the 1% and 99% of their empirical distribution. The sample includes firms that announce buybacks or equity pricings up to 2 days before their earnings release date. For each variable, the number of non missing observations (N), the first quartile (Q1), mean, median, and the third quartile (Q3) are reported.

Panel A: Buybacks					
Variable	N	Q1	Mean	Median	Q3
BidAskSpread×100	4,569	0.582	1.340	0.972	1.636
ForecastError×100	3,444	0.025	0.573	0.095	0.291
StdForecast×100	2,911	0.026	0.212	0.063	0.150
Size ($Millions)	4,672	88.921	6844.239	350.985	2025.452
FirmRet (%)	4,734	−10.386	−4.240	−2.065	3.448
MktRet (%)	4,737	−3.238	−0.524	0.522	2.953
M/B	4,015	1.044	2.251	1.555	2.471
FreqentDum	4,737	0.000	0.323	0.000	1.000
Panel B: SEOs					
BidAskSpread×100	7,354	0.560	1.323	0.941	1.626
ForecastError×100	5,102	0.043	5.489	0.162	0.637
StdForecast×100	4,148	0.037	1.604	0.105	0.335
Size ($Millions)	8,835	157.151	2014.303	487.275	1511.176
FirmRet (%)	8,842	−5.934	1.578	0.385	7.091
MktRet (%)	8,844	−1.312	0.995	1.200	3.530
M/B	6,968	1.137	3.023	1.827	3.350
FreqentDum	8,844	0.000	0.420	0.000	1.000

2.6.3 Regression models

To analyze the relation between returns around earnings and firm characteristics, we estimate the following cross-sectional regression for repurchasing and issuing firms separately:

$$\begin{aligned} R_i(\tau_1, \tau_2) = \beta_0 + \beta_1 AsymProxy_i + \beta_2 Log(Size)_i + \beta_3 FirmRet_i \\ + \beta_4 MktRet + \beta_5 (M/B)_i + \beta_6 FrequentDum_i + \epsilon_i \end{aligned} \tag{2.3}$$

where $R_i(\tau_1, \tau_2)$ is the return for firm i from time τ_1 to τ_2 around earnings announcements and $AsymProxy_i$ represents our proxy for information asymmetry between firm i's managers and investors. The proxies include $BidAskSpread_i$, $Log(1{+}ForecastError)_i$, and $Log(1{+}StdForecast)_i$ which we include both individually and collectively in our baseline regression. $Log(Size)_i$ is the logarithm of market capitalization for firm i, $FirmRet_i$ is the cumulative return over a 1-month period before the buyback announcement or SEO pricing for firm i, $MktRet$ is the cumulative market return over the same period, M/B_i is the ratio of the market value to the book value of equity for firm i, and $FrequentDum_i$ is a dummy variable which takes a value of 1 for moderate and frequent buybacks or SEOs. To mitigate the effect of outliers, $ForecastError$, $StdForecast$ and M/B are winsorized at the 1% and 99% of their empirical distribution.

We choose four-factor abnormal returns R_i(+2,+15) and R_i(+2,+30) as dependent variables in this setup and run the regression for firms that make their buyback announcements or SEO pricings up to 2 days before their closest quarterly earnings. We add size to control for any differences in market reaction to earnings surprises of large firms versus earnings surprises of small firms. We add firm and market returns to the model to control for prior price movements in the market and the firm. In addition, we control for market-to-book ratio to detect differences in market reaction to the earnings of growth firms versus value firms. The estimates for repurchasing firms are in Table 2.10 and for issuing firms are in Table 2.11.

Models 1 to 4 in Table 2.10 contain the regression estimates for Equation (2.3) if a buyback announcement occurs up to 2 days before the earnings announcement and four-factor abnormal return R_i(+2,+15) is used as the dependent variable. In the first specification, we use the bid-ask spread as a proxy for information asymmetry while for the second and third specifications we use analysts' forecast error and the standard deviation of analysts' forecasts as the proxies of information asymmetry. In the fourth specification, we include all the information asymmetry proxies in our baseline model. The coefficients on the bid-ask spread in Models 1 and 4 are significantly and positively related to earnings abnormal returns. Assuming that dealers widen the bid-ask spread due to greater information asymmetry prior to earnings announcements that usually convey new information (Venkatesh and Chiang, 1986), the positive coefficient suggests that the abnormal returns are higher when information asymmetry is higher.

The other proxies for information asymmetry are statistically insignificant. Average past firm returns ($FirmRet$) are negatively related to returns after earnings announcements implying that

Table 2.10: Determinants of returns: Buybacks sample

This table reports the estimates from regressing returns around earnings announcements on different sets of control variables. The dependent variable is the four-factor abnormal returns over the (+2,+15) and (+2,+30) windows. The analysis is done for the firms that announce a buyback program before their earnings release date. BidAskSpread is the average bid-ask spread from 5 to 30 days before earnings announcement dates. Bid-ask spreads are estimated from daily high and low prices using the methodology in Corwin and Schultz (2012). ForecastError is the absolute difference between the actual quarterly earnings per share and the average of all the latest outstanding forecasts scaled by the share price at the beginning of the quarter. StdForecast is the standard deviation of all the latest outstanding forecasts scaled by the share price at the beginning of the quarter. Size is the market capitalization (in millions). FirmRet is the firm's return over a 1-month period before the buyback announcement while MktRet is the market return over the same period. M/B is the ratio of the market value to the book value of equity and FrequentDum is a dummy variable which takes a value of 1 for moderately or frequently repurchasing firms. To mitigate the effect of outliers, ForecastError, StdForecast, and M/B are winsorized at the 1% and 99% of their empirical distribution. The analysis is conducted for firms that announce buybacks or price an equity offering up to 2 days prior to the next earnings announcement. Standard errors are reported below the coefficient estimates in parentheses. N shows the number of observations. Symbols $***$, $**$, and $*$ indicate significance at the 1%, 5%, and 10% levels, respectively.

	Four-factor: (+2,+15)				Four-factor: (+2,+30)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.005	0.022***	0.026***	0.010	−0.011	0.027***	0.033***	0.004
	(0.007)	(0.006)	(0.008)	(0.010)	(0.010)	(0.010)	(0.012)	(0.015)
BidAskSpread	0.403**			0.681**	0.706***			1.325***
	(0.164)			(0.272)	(0.229)			(0.416)
Log(1+ForecastError)		0.140		0.570***		0.272*		0.544*
		(0.106)		(0.204)		(0.160)		(0.312)
Log(1+StdForecast)			1.067***	0.105			2.116***	1.296
			(0.391)	(0.556)			(0.598)	(0.852)
Log(Size)	−0.000	−0.002**	−0.003***	−0.001	0.001	−0.003**	−0.004***	−0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
FirmRet	−0.026**	−0.052***	−0.052***	−0.038**	−0.085***	−0.098***	−0.073***	−0.055**
	(0.012)	(0.013)	(0.015)	(0.015)	(0.017)	(0.020)	(0.022)	(0.023)
MktRet	0.007	0.026	0.018	0.011	0.008	−0.012	−0.039	−0.035
	(0.033)	(0.034)	(0.038)	(0.038)	(0.046)	(0.052)	(0.057)	(0.058)
M/B	0.001	0.001	0.001	0.001	0.003***	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
FrequentDum	−0.005	−0.004	−0.002	−0.000	−0.002	−0.002	0.000	0.002
	(0.004)	(0.005)	(0.005)	(0.005)	(0.006)	(0.007)	(0.008)	(0.008)
Adjusted R^2	0.003	0.010	0.015	0.021	0.014	0.017	0.021	0.029
N	3,896	2,948	2,478	2,443	3,896	2,948	2,478	2,443

market is less surprised by earnings of the repurchasing firms that have been enjoying positive price movements before earnings announcements. Over this window, past market return, market-to-book ratio, and being a moderate or frequent repurchaser are statistically insignificant. In Models 5 to 8, we analyze the returns over a six-week (+2,+30) window. The coefficients on the bid-ask spread in Model 5 and 8 and the coefficient on the standard deviation of analysts' forecasts in Model 7 are positive and statistically significant at 1% and 5%, respectively. The remaining control variables excluding market-to-book ratio show similar patterns as in previous models. In summary, the findings of Table 2.10 provide evidence that earnings abnormal returns preceded by buyback announcements are partially caused by the level of information asymmetry when proxied by the average bid-ask spread. This suggests that market reaction to the announcement of buybacks is incomplete and the following earnings announcement continues to surprise the market.

For the SEOs sample, we implement similar models as above to investigate the relation between abnormal returns and firm characteristics. Table 2.11 contains the regression results for Equation (2.3) when the SEO is priced up to 2 days before earnings. Models 1 to 4 in Table 2.11 include the regression estimates using four-factor abnormal return $R_i(+2,+15)$ as the dependent variable. In the first three models in which the information asymmetry proxies enter the model individually, the average bid-ask spread and analysts' forecast error are negatively and significantly associated with earnings abnormal returns. In Model 4 in which all the information asymmetry proxies are included, the average bid-ask spread continues to be statistically significant with the expected sign. Recall that abnormal returns around earnings following equity pricings are negative. Hence, the negative estimate on the information asymmetry proxies suggests that abnormal returns around earnings are more negative when the level of information asymmetry is higher. Over the (+2,+15) window, past market performance and market-to-book ratio are statistically insignificant and have no sizable impact on abnormal returns. The results also show that market is less surprised by earnings of moderately or frequently issuing firms. Analyzing the returns over a six-week (+2,+30) window also leads to the same conclusions: higher information asymmetry between managers and outside investors leads to higher abnormal returns around and after earnings announcements. In summary, the findings of Table 2.11 provide evidence that market reaction to SEO pricings is incomplete which in turn causes predictability in earnings that immediately follow these SEOs.

2.7 Earnings predictability and conclusions

2.7.1 Earnings predictability

Assuming no predictability, the average market reaction to a large sample of earnings announcements should not be significantly different from zero. However, as reported above, the market reaction to earnings following buybacks is positive and statistically significant: the (-1,+1) day raw return is 0.8%, and the abnormal return is 0.5%. If the window is expanded to a longer period, the returns become larger: raw returns of 4.1% and 3.3% and abnormal returns of 1.7% and 1.3% over (-1,+30)

Table 2.11: Determinants of returns: SEOs sample

This table reports the estimates from regressing returns around earnings announcements on different sets of control variables. The dependent variable is the four-factor abnormal returns over the (+2,+15) and (+2,+30) windows. The analysis is done for the firms that price an equity offering before their earnings release date. BidAskSpread is the average bid-ask spread from 5 to 30 days before earnings announcement dates. Bid-ask spreads are estimated from daily high and low prices using the methodology in Corwin and Schultz (2012). ForecastError is the absolute difference between the actual quarterly earnings per share and the average of all the latest outstanding forecasts scaled by the share price at the beginning of the quarter. StdForecast is the standard deviation of all the latest outstanding forecasts scaled by the share price at the beginning of the quarter. Size is the market capitalization (in millions). FirmRet is the firm's return over a 1-month period before the equity offering while MktRet is the market return over the same period. M/B is the ratio of the market value to the book value of equity and FrequentDum is a dummy variable which takes a value of 1 for moderately or frequently issuing firms. To mitigate the effect of outliers, ForecastError, StdForecast, and M/B are winsorized at the 1% and 99% of their empirical distribution. The analysis is conducted for firms that announce buybacks or price an equity offering up to 2 days prior to the next earnings announcement. Standard errors are reported below the coefficient estimates in parentheses. N shows the number of observations. Symbols $***$, $**$, and $*$ indicate significance at the 1%, 5%, and 10% levels, respectively.

	Four-factor: (+2,+15)				Four-factor: (+2,+30)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	−0.002	−0.014	−0.020**	0.008	−0.010	−0.031**	−0.047***	0.016
	(0.007)	(0.009)	(0.010)	(0.013)	(0.011)	(0.014)	(0.016)	(0.021)
BidAskSpread	−0.353***			−1.431***	−0.652***			−3.073***
	(0.104)			(0.327)	(0.160)			(0.531)
Log(1+ForecastError)		−0.020		0.006		−0.046*		−0.081*
		(0.015)		(0.030)		(0.024)		(0.049)
Log(1+StdForecast)			−0.015	−0.001			−0.012	0.159*
			(0.036)	(0.058)			(0.059)	(0.094)
Log(Size)	−0.003**	−0.002	−0.000	−0.003*	−0.004**	−0.003	0.000	−0.005*
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
FirmRet	−0.034***	−0.046***	−0.024*	−0.026**	−0.063***	−0.070***	−0.048**	−0.056***
	(0.010)	(0.011)	(0.012)	(0.013)	(0.015)	(0.018)	(0.020)	(0.021)
MktRet	0.005	0.064	0.042	0.031	0.017	0.076	0.041	−0.012
	(0.040)	(0.047)	(0.049)	(0.059)	(0.062)	(0.076)	(0.081)	(0.095)
M/B	0.000	0.000	−0.000	0.000	−0.000	0.000	−0.001	0.000
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
FrequentDum	0.018***	0.014***	0.011**	0.013*	0.027***	0.022***	0.019**	0.019
	(0.004)	(0.005)	(0.005)	(0.007)	(0.006)	(0.008)	(0.009)	(0.011)
Adjusted R^2	0.007	0.005	0.001	0.007	0.009	0.005	0.002	0.014
N	5,772	4,029	3,306	2,777	5,772	4,029	3,306	2,777

and (+2,+30) windows, respectively, are observed. On the other hand, the market reaction to earnings after equity pricings is slightly weaker. The raw return over a (-1,+1) window is 0.4% and the abnormal return is -0.2% and statistically significant. As we expand the window, the returns become larger: raw returns of 1.9% and 1.6% and abnormal returns of -3.4% and -3.2% over (-1,+30) and (+2,+30) windows, respectively, with all returns being statistically significant. If we consider the longest observation window reported, (-1,+30), the market reaction to earnings announcements following buyback announcements is 2.2% greater than the reaction to earnings announcements following equity pricings when raw returns are considered, and 5.1% when abnormal returns are considered. Both returns are statistically and economically significant. From the difference in market reactions, we can conclude that market adjustment to corporate actions is incomplete, and can result in predictability of earnings announcements.

2.7.2 Conclusion

Consistent with prior work, we find that stock issues are accompanied by a negative market reaction while buyback announcements are accompanied by a positive market reaction. While these corporate actions reduce information asymmetry, we find that the market reaction to these signals is incomplete which leads to predictable returns around earnings announcements such that stock returns around the next earnings announcement are systematically greater following buyback announcements than following equity pricings. As mentioned above, these returns are statistically and economically significant. We show that the excess returns are not directly related to post-earnings announcement drift as that drift is conditioned on an extreme reaction to an earnings announcement, whereas the results in this paper point to predictability of that reaction prior to announcement of earnings. We also show that our results hold over periods of time in which there is no evidence of earnings management from repurchasing and issuing firms.

Given the high frequency of buybacks and equity issues, there should not be any residual predictability. We examine reasons for incomplete market reaction to corporate actions and find that the results are not driven by small, illiquid firms as the results are not materially affected when firms with a market cap below $100 million are excluded nor are they driven by any other known subset of stocks that may cause such predictability. However, we find that earnings predictability documented in this study is partially related to information asymmetry. Nonetheless, a significant portion of predictability can be attributed to the inability of market participants to fully incorporate information contained in prior corporate actions.

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