

**The Impact of Post-IPO Private Equity Ownership on Long-Term Company  
Performance**

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*Honors Thesis submitted in partial fulfillment of the requirements for Graduation with  
Distinction in Economics in Trinity College of Duke University.*

Duke University  
Durham, North Carolina  
2019

## **Acknowledgments**

We are very grateful to Professors Michelle Connolly and David Robinson. Their advice and guidance has been invaluable in the thesis writing process. We truly appreciate the time they have spent helping us and their insightful comments that have shaped our work from the very first day. We would like to thank all our peers in the honors seminar whose perspectives, comments and comradery have been integral in the journey to this final product. We would also like to acknowledge our incredible friends for their support and encouragement, in particular Brandon Foreman for his contributions during the initial stages of this thesis.

## **Abstract**

This thesis contributes to existing knowledge of private equity (PE) by analyzing the impact of PE ownership post-IPO upon the long-term performance of companies. It considers whether companies perform better when PE funds maintain their ownership stakes post-IPO and whether this performance is also impacted by the degree of ownership that is maintained after IPO. This study uses stock performance (measured by cumulative excess stock returns) as a proxy for long-run company performance. The paper constructs and analyzes a sample of 487 companies that underwent an IPO between 2004 and 2012 to determine the implications of the maintenance and level of PE ownership by analyzing the performance of these companies for six years post-IPO. Results suggest that PE ownership post-IPO positively impacts long-term stock performance of companies. Duration and degree of PE ownership post-IPO are also important determinants of long-run performance likely due to the positive signal that continued PE ownership sends to outside investors about the quality of the company, the information asymmetry that exists between public and private markets and that PE firms are experienced managers that add value to companies.

JEL Codes: G11, G14, G24

Keywords: private equity, IPO, ownership, stock performance, signaling effect, information asymmetry

## Introduction

The initial public offering (IPO) is a milestone in a company's lifetime through which it transitions from a private to a public company by selling shares of stocks to outside investors. Public companies have the hallmark of liquidity, meaning that shares are easily bought and sold, unlike when companies are private. One of the most important functions of an IPO is to raise capital which can help fund further investment and expansion of the company. It can also serve as a strong indicator to investors, employees and customers that the company is focused on the future and long-run success. The shareholder base of a private company typically consists of founders and financial sponsors. Financial sponsors are usually private equity (PE) funds, which encompass large buyout funds and early investors such as venture capital (VC) funds. In an IPO, these often-longstanding shareholders are provided instant liquidity whereby they are allowed to sell their shares on a large scale. While focused on maximizing returns, PE firms have been shown to provide additional value to a company, and throughout their ownership period, they may play an active role in financial and organizational decisions. For both early- and late-stage investors, the IPO is a mechanism in which they realize the return on their investment, and many investors choose to sell their stakes fully in the IPO however, many do not, electing to continue holding a stake in the now-public company. This thesis investigates this little-studied circumstance and seeks to answer the question: **Does the maintenance of PE backing once public, impact a company's long-term performance?**

PE is an asset class consisting of several types of funds, all characterized by ownership of private companies, through which firms seek to combine business and financial expertise to produce returns. On one end of the spectrum, there are seed investors, which finance companies at a very early stage; on the other end are buyout funds, which raise money to purchase either

private or public companies – if public, they delist the company from its exchange and operate it out of the public eye. In between are VC and growth-equity funds, which are classified by the size, age and growth of the company at the time of investment. These various funds generally have different investment motivations and expectations of returns.

PE funds typically hold their investments for a multi-year period during which they may actively work with management teams to improve the company. When purchasing a business, PE funds often purchase a majority stake (more than 50%). This makes the fund the controlling shareholder, where, unlike a minority stake, the PE firm has more power over operations and potential transactions. However, in recent years there has been a trend towards minority investments (Schneider & Henrik, 2015), which has been very minorly explored in the academic literature. This paper also analyzes whether the level of PE backing maintained post-IPO effects a company's long-term performance.

PE firms raise funds from institutional investors such as pension funds and other asset managers, who are referred to as limited partners in the collective fund. The PE firms earn money based on management fees (a fixed percentage based on the size of the fund, unaffected by performance) and performance fees (a percentage of the profits from any investment). PE funds make investments that are constructed to last for a period close to five to seven years, as this is the timeframe in which limited partners traditionally demand results. The fund's divestment allows it to realize returns, which are distributed back to the limited partners and the PE manager.

In order to realize gains that can be returned to investors, the firms must exit the company via either an IPO or a sale to another company or investor group (private placement). After an IPO, PE funds may be subject to an IPO lock-up period; a contractually agreed upon period of

time after an IPO in which large investors who obtained stocks prior to the IPO are not allowed to sell their shares. The purpose of the lock-up period is to prevent large investors from suddenly liquidating their shares and bringing the price of the stock down. While the duration of the lock-up period varies from case to case, it is generally between 90-180 days in the US. Yet, many firms choose to hold their stakes even when possessing the ability to sell on the public market i.e. beyond the lock-up period, a decision that may signal that the company is of high quality with a promising future. Maintaining a stake delays the realization of cash flows and reduces a fund's internal rate of return (IRR), the metric PE funds use to calculate their performance. Such a decision would lead one to believe that, it stems from the conviction that the company will perform strongly in the short and long-term. The main objective of this paper is to address this hypothesis and to determine whether this investment decision also influences a company's long-run performance.

The PE industry is known to be illiquid, meaning shares are not easily bought and sold. By scouring the private markets for potential investments, PE firms operate in less regulated environments and deal with companies whose shareholders are illiquid. This illiquidity has several implications, one of which is information asymmetry. When a PE fund sources potential investments by looking at private companies, it may be given more information as a potential buyer of this private company than it would have when purchasing equity of a public company, as all investors in public companies must be on a level playing field, and management teams of public companies are hesitant to reveal too much information for competitive purposes. When PE funds ultimately decide to invest in a private company, it is likely that they have been given extra information from management that has convinced them that the company is a good purchase. Thus, PE firms may choose to maintain ownership post-IPO simply on the basis of

private information they have as a result of this information asymmetry, which leads them to believe the company is a great investment from which they can expect to earn high returns in the future.

Additionally, since public companies face far more regulation than private companies do, they are required to provide much more information to outside investors and the markets. The decision to maintain PE ownership post-IPO gives outside investors access to more information on how PE investments impact the operations of a now public company than they would have had while the company was still private. Thus, a PE firm's decision regarding how and when to exit an investment also creates information asymmetry regarding how PE firms function and interact with their portfolio companies.

Further, it is believed that PE funds produce returns by creating value during the period in which they operate their portfolio companies. It is often argued that PE managers possess operational and financial expertise which facilitate an increase in efficiency of companies they invest in. This perceived value creation has been widely studied in previous literature related to PE. Since PE firms invest and manage private companies which are subject to less regulation than public companies, they are able to make changes in companies without having to answer to outside investors, allowing private companies to make aggressive business decisions more easily than their public counterparts. This thesis, however, aims to test the relatively unexplored question of whether PE managers are still able to create value for companies by maintaining investment in them post-IPO and whether the level of investment maintained (which impacts the decision-making power PE firms have) impacts long-term company performance.

As mentioned earlier, PE funds realize their returns when they exit their investments. We analyze the impact that PE firms have on company performance after they undergo an IPO and

how this changes based on the level of ownership that the PE fund maintains post-IPO. Limiting our study to publicly-traded companies is beneficial because public companies are required to report financial information and have recorded instantaneously calculable share prices. We use stock price movement against the market to analyze company performance.

The following section discusses prior literature about PE and the opportunity we see to contribute to the conversation regarding the maintenance and degree of ownership. The empirical specification section outlines the development of the model employed in this paper and the theoretical reasoning behind this model. The data section presents how the dataset for this thesis was created. Lastly, we present our results and provide possible economic interpretations and implications of the study and how this topic may be further explored.

## **Literature Review**

There are three sets of relevant literature. The first set discusses whether and how PE funds add value to companies, the second looks into the financial performance of PE backed companies post-IPO and the third studies PE ownership of companies post-IPO. Relatively few academic papers, however, examine the effect that continued PE ownership post-IPO and the degree of ownership maintained has on a company's long-term performance.

Several papers in the academic literature related to PE look into the different ways in which PE funds increase value of their portfolio companies. Jensen (1986, 1989), writes that PE firms add value by creating operational efficiencies through centralizing decision-making processes and better aligning management incentives within their portfolio companies. Wright et al. (2000) arrive at a similar conclusion and state that PE buyouts lead to more efficient decision-making not only through better management incentives but also through a shift from a managerial to an entrepreneurial mindset. Additionally, other changes such as lowering the



number of board members (Cornelli, 2008) and linking manager compensation plans to the firm's performance through stock options have also been linked to improving company performance under PE ownership. Lastly, some studies identify leverage as the principal value driver in PE deals because it considerably reduces a company's cost of capital (Shivdasani and Zak, 2007; Acharya et al., 2010; Levis, 2011). Mainly, consensus across academic literature is that PE funds are drivers of value for their portfolio companies. This premise indicates that PE funds should continue to add value to companies in which they maintain ownership post-IPO.

Furthermore, some papers consider the long-run post-IPO performance of PE-backed companies in comparison to non-PE backed companies. Lin (1996) finds that the presence of a PE sponsor lowers the total cost of going public for a firm and reduces underpricing of the stock. More recently, Bergstrom et al. (2006) and Katz (2009) analyzed the impact that PE ownership has on a company's long-term performance post-IPO. Looking at a sample of IPOs in the U.K. and France, Bergstrom et al. (2006) find that in the long-run (defined as the 5 years post-IPO), stocks of PE-backed IPOs outperformed non-PE-backed IPOs. Correspondingly, Katz (2009) finds that PE-backed firms (defined as firms in which the PE fund had a majority stake pre-IPO) usually have better earnings quality (financial performance) than non-PE-backed companies and that firms with majority ownership by PE sponsors tend to have superior long-run stock performance.

Other relevant studies that have examined the long-run post-IPO performance of companies have focused mainly on earlier-stage investors such as venture capital (VC) firms rather than all PE firms. Similar to findings regarding PE-backed companies, Brav and Gompers (1997) find that stocks of VC-backed companies outperformed non-VC-backed companies when looking at equal-weighted returns five years after their IPO. They argue that VC backing brings

better management expertise and corporate governance structures, which contribute to better long-term performance post-IPO. Relatedly, Krishnan et al. (2011), build upon Brav and Gompers' findings, reporting that VC reputation has a significant positive correlation with a company's long-run performance post-IPO.

A few studies have looked into the length of PE ownership maintained in companies after IPO, and the drivers behind retaining PE ownership. Concerning the length of PE ownership post IPO, Barry et al. (1990) find that not all PE firms sell their entire ownership stake in a company at the IPO and Furth and Rauch (2014) find that on average, sponsors stay involved in a company for 2.81 years after its IPO. Furthermore, and related to the determinants of maintained PE ownership post IPO, Matanova (2015) finds evidence that voluntary holdings of PE firms after IPO are consistent with the commitment hypotheses, which states that PE ownership post-IPO is used to alleviate other shareholders' concerns of misuse of private resources by management. She argues that by maintaining ownership after the lockup period post-IPO, sponsors show commitment in monitoring the company, and its management, and alleviate outside investors concerns on moral hazard and information asymmetry issues. Leland and Pyle (1977) refer to the signaling hypothesis in the context of entrepreneurs, as the message that is sent to the market by the willingness of owners (PE firms, for example) to invest and retain ownership in their company. If owners choose to invest or remain invested in their company, then this sends a positive signal to outsiders about the quality of the company. They use a theoretical model to affirm that the value of a firm (which is directly related to its stock price when public) increases as the share of insider ownership increases. Courteau (1995) builds on their findings and states that the length of the lock-up period (time in which pre- IPO investors agree to maintain ownership after IPO) also serves as a positive signaling mechanism to the

market. Overall, most research related to voluntary PE ownership of companies post-IPO finds that not all PE funds immediately divest at the time of IPO (or after the lock-up period) and is consistent with our hypothesis that ownership retention is probably driven by higher expected returns on holdings.

While there are multiple studies that look into the value that PE funds bring to portfolio companies, the long-term performance of PE backed companies in comparison to their non-PE-backed counterparts and the length and drivers behind voluntary PE ownership post-IPO, existing literature does not address the impact that continued PE ownership post-IPO has on company performance. This impact, however, can be highly relevant for determining both investment and exit strategies across different companies. Our thesis, hence, intends to bridge the gap in the literature and illuminate the effects of maintaining PE ownership post-IPO and how varying degrees of this ownership impact companies' performances through the analysis of stock performance as outlined in the empirical specification below.

### **Empirical Specification**

This thesis uses multivariable regressions to examine the relationship between the duration and nature of continued PE ownership in the initial three-year period post-IPO and the company's long-run performance from year four to year six post-IPO. We considered analyzing the company's performance separately over the initial three-year period post-IPO during which PE ownership is also observed and from years four to six after the IPO. However, there exists endogeneity when considering company performance in the first three years post-IPO and PE ownership maintained during the contemporaneous period. This endogeneity due to simultaneity arises because company performance and ownership are expected to be jointly determined. While the initial decision to maintain PE ownership post-IPO is likely to be determined by

expectations of company performance in the future, the actual duration of PE ownership maintained post-IPO is impacted by company performance during that time period. Further, company performance may also be affected by PE ownership during the same period. Accordingly, we use two distinct time periods as we study the impact of PE ownership during the first three years post-IPO on the long-run company performance in the following three years (from year four to six) post-IPO. As discussed earlier, this paper extends on literature that analyzes whether PE-sponsored companies outperform non-PE-sponsored companies. Our aim is to determine if continued PE ownership post-IPO, as opposed to a complete exit upon the IPO, improves companies' long-run performance.

The earliest available post-IPO PE ownership data starts from 2004 and thus we limit our analysis to a six-year period post-IPO and in turn to IPOs before 2012 so as to yield a large enough company sample size while also studying a long enough time period in which we can sufficiently observe both PE ownership maintained post-IPO and long-run company performance after IPO in distinct time periods.

We build up our analysis on the impact of continued PE ownership post-IPO by first using a benchmark model that includes a single variable to capture continued PE ownership post-IPO. We then use two alternative specifications in which we include more specific variables to account for continued PE ownership in order to parse out the impact of these more targeted variables while keeping all the other control variables used in our benchmark model. The empirical models employed in the regressions are specified below:

- 1)  $R_{4,6} = \beta_0 + \beta_1 \text{ownmaintaineddummy}_i + \beta_2 \text{age}_i + \beta_3 \log(\text{IPOsize})_i + \vec{\beta}.(\text{Industry Fixed Effects}) + \vec{\beta}.(\text{Year Fixed Effects}) + \varepsilon_i$
- 2)  $R_{4,6} = \gamma_0 + \gamma_1 \text{avgownmaintained}_i + \gamma_2 \text{avgownmaintained}_i^2 + \gamma_3 \text{age}_i + \gamma_4 \log(\text{IPOsize})_i + \vec{\gamma}.(\text{Industry Fixed Effects}) + \vec{\gamma}.(\text{Year Fixed Effects}) + \mu_i$
- 3)  $R_{4,6} = \delta_0 + \delta_1 \text{ownquarters}_i + \delta_2 \text{ownquarters}_i^2 + \delta_3 \text{age}_i + \delta_4 \log(\text{IPOsize})_i + \vec{\delta}.(\text{Industry Fixed Effects}) + \vec{\delta}.(\text{Year Fixed Effects}) + \varphi_i$

Where  $R_{4,6}$  represents the cumulative excess return for company  $i$ , from year 4 to year 6 post-IPO.  $\text{ownmaintaineddummy}_i$  is the dummy variable for whether PE ownership is maintained post-IPO, while  $\text{avgownmaintained}_i$  denotes the average PE ownership percentage maintained from year one to year three post-IPO and  $\text{avgownmaintained}_i^2$  represents the square of the average PE ownership percentage maintained during the first three years after IPO.  $\text{ownquarters}_i$  is the number of quarters PE ownership is maintained from year one to year three post-IPO and  $\text{ownquarters}_i^2$  represents the square of the number of quarters PE ownership is maintained during the first three years after IPO.  $\text{Age}_i$  represents the age of the firm and  $\log(\text{IPOsize})_i$  is the logarithm of the size of the IPO.

There is no single metric that holistically analyzes performance. Hence, we use stock performance, a well-established indicator of a company's present value and growth potential in literature, as a proxy in our study. Assuming the Efficient Market Hypothesis holds, then a company's share price reflects all public information. Under this assumption, a company's stock, once public, trades based on all public information, including its ownership structure prior to its IPO – implying that prior PE ownership is taken into account. We measure stock performance through the excess return of the stock over the market from years four to six following the

company's IPO. The S&P 500 index is chosen as the benchmark to control for general economic conditions that impact the entire equity market. The three-year excess returns from years four to six post-IPO are obtained by calculating daily excess returns (the convention of 252 trading days in a year is assumed).

$$R_{4,6} = [(1 + r_{1,4})(1 + r_{2,4}) \dots (1 + r_{755,4})(1 + r_{756,4})] - 1$$

where  $R_{4,6}$  represents the cumulative excess return from year 4 to year 6, and

$r_{j,4}$  represents the daily excess return  $j$  days after start of year 4

#### Continued PE Ownership Post-IPO Variables

PE ownership post-IPO is first analyzed using a dummy variable which takes the value of 1 if any PE ownership is maintained post-IPO and 0 if the PE firm exits the investment completely at the IPO. We expect there to be a positive relationship between whether PE ownership is maintained in the first three years post-IPO and price return in years four to six after-IPO due to the signaling effect generated by a PE's decision not to fully divest from an investment.

In the alternative specifications, continued PE ownership post-IPO can be studied using different methods. The aim is to capture both the duration of PE ownership maintained during the first three years after IPO and the intensity of the PE ownership maintained. The intensity of PE ownership is important because the degree of PE ownership maintained such as majority stakes (at least 50%) or minority stakes (less than 50%) determines the level of control the PE firm has on the operations of the company. We use two methods to analyze PE ownership post-IPO. One method of analyzing continued PE ownership post-IPO is to use the number of quarters in which greater than a 5% stake is maintained by a PE fund in the first three years post-IPO. We use 5% as the minimum threshold for our analysis because stakes of more than 5% in a public

company must be reported with the Securities and Exchange Commission (SEC). This model allows us to analyze the impact of the duration of PE ownership on cumulative excess returns. The second method to study continued PE ownership post-IPO is to use the average percentage of ownership maintained during the first three years post-IPO. This is calculated by adding up the percentage of PE ownership maintained in each quarter of the 12 quarters from year one to year three after IPO and then dividing this sum by the total number of quarters i.e. 12 quarters. While this measure does treat shorter periods of higher level ownership similar to longer periods of lower level ownership (for example, if a PE firm maintains 60% ownership in each quarter for three quarters post-IPO and another PE firm maintains 20% ownership in each quarter for nine quarters after IPO, both of these investment structures will be treated equally by the average percentage of PE ownership maintained post-IPO variable), we believe it is a concise and adequate gauge of both length and level of PE ownership maintained post-IPO as PE funds generally decrease their ownership percentage in a company gradually over time as they exit an investment. Thus, companies that maintain higher levels of investment immediately after IPO will generally maintain ownership for longer durations after IPO and will have a higher average percentage of PE ownership maintained post-IPO. This is supported by the fact that there is a strong correlation between the level of PE ownership in quarter one and the duration of PE ownership maintained after IPO in our dataset. Finally, we also expect a non-linear relationship between cumulative excess returns from year four to year six and the average percentage and duration of PE ownership during the first three years after IPO. Thus, we add quadratic terms for the average percentage of PE ownership maintained from year one to year three post-IPO and number of quarters of PE ownership during the first three years post-IPO in the respective models.

One limitation is that some of the companies observed may still have PE ownership beyond the initial 3-year period post-IPO during which we follow ownership structure and thus cumulative excess returns in the long-run (from year four to year six) may be impacted by continued ownership in that period as well. However, using the average percentage of PE ownership maintained from year one to year three post-IPO variable to capture continued PE-ownership may in part control for PE ownership maintained after the initial three-year period after IPO as higher levels of average percentage of PE ownership maintained may indicate continued ownership in years four to six. This is further supported by the high positive correlation between average percentage of PE ownership maintained during the first three years after IPO and whether there is any PE ownership present during quarter 12 i.e. at the end of year three post-IPO.

#### Control Variables

In the regression model, we control for the year of IPO, size of IPO, age of firm and industry of firm. The year of IPO variable is a time fixed effect. Although using excess returns over the markets does account for some variation in stock price returns over different economic cycles and time periods, we add a time fixed effect to our model as it allows us to study trends and changes in the PE industry over time. The size of IPO is calculated by multiplying the offer price per share by the number of shares offered at IPO. We use the logarithm of IPO size to create a normal distribution for the variable. The logarithm of the size of an IPO can affect stock performance, since higher initial valuations may signal greater potential and growth opportunities. Thus, company performance is expected to increase as the size of an IPO increases.



We also include the age of a company in our model because it can impact the operational efficiency of the company as a result of management experience and an established reputation. However, older companies often have reduced growth expectations and opportunities. A firm's age is calculated in years from when the company was founded to its IPO. While we do control for market trends by calculating excess returns over the S&P 500 index and including time fixed effects in our model, stock performance can vary significantly across industries independent of the overall market such as how changes in oil prices highly influence stock prices in the Energy sector. Thus, we include an industry fixed effect to control for the impact of industry-specific trends on long-run performance.

## **Data and Methodology**

The transactions used for the purpose of this study are a subset of all prior PE-backed IPOs (encompassing all types of PE funds) that were listed on major U.S. stock exchanges (mainly the NASDAQ and NYSE) between 2004 and 2012 and had a gross offering amount of over \$50 million. Data on all prior-PE backed IPOs, gross offering amounts of IPOs and PE ownership is collected from Capital IQ. Capital IQ is a market intelligence platform designed by Standard & Poor's which provides research and analysis on both public and private companies. The 2004 to 2012 timeline was selected for two reasons. First, the earliest that Capital IQ provides PE ownership data for companies post-IPO is 2004. Second, since our analysis focuses on long-run performance and we follow companies for six years post-IPO, the latest transactions we can study were those that occurred in 2012. To construct this portion of the dataset, we first collected all PE-backed IPOs from 2004 to 2012 on a quarterly basis. We then compiled PE ownership over the first 12 quarters (first 3 years) post-IPO individually for each company. This process provided observations for a total of 837 companies.

We exclude two kinds of companies from this sample based on inconsistencies in PE ownership over time. These inconsistencies may arise if another PE firm different from the PE firm that was originally invested in the company immediately prior to the IPO also invests in the company post-IPO. First, we observed that some companies in our dataset display no PE ownership during the quarter in which the IPO occurred (quarter 0) or the following quarter (quarter 1), but have PE ownership in later quarters (after quarter 1). Including these companies would bias our results, as no PE ownership during quarter 0 and 1 but some PE ownership after (quarter 2 and onward) indicates that another PE investment different from the one immediately prior to the IPO has occurred. We thus remove these companies to better explore the effect of continued PE ownership post-IPO by the original PE firm. This causes us to drop 19 observations. Second, we discovered that some companies exhibit some level of PE ownership during quarter 0 and quarter 1, but then show no ownership until several periods thereafter. Similar to our reasoning above, since these companies do not show continued PE ownership during the periods' post-IPO, we eliminate them from our sample to avoid biasing our results. 31 companies are removed from the sample due to this condition. After applying the aforementioned criteria, we are left with a sample of 787 companies.

As mentioned previously, some PE funds may be subject to lock-up periods preventing them from liquidating their shares for a period of around 90-180 days after IPO. Since the primary purpose of this thesis is to study the effects of voluntary continued ownership post-IPO, we treat companies that have PE ownership only during the quarter of IPO (i.e. quarter 0) but not in the quarters after, as having no PE ownership post-IPO in our regressions to account for lock-up periods.

To create the rest of the dataset, we use Bloomberg to obtain stock price, industry and founding date information for this sample of companies. Bloomberg, similar to Capital IQ, is a provider of financial news and information including historical price and financial data. In order to compute cumulative excess stock price returns over the market we gathered daily stock and S&P 500 prices over the six-year period post IPO for each company in our sample. There are on average 252 trading days in a year and ideally for a company to have complete stock price data, we need 756 observations in each of the two-time periods (first three years post-IPO and years four to six after IPO) for that company. Due to inconsistencies in the number of daily stock price data points available for each company through Bloomberg, we define a complete stock price dataset for a company as at least 725 daily stock price observations in each of the three-year time periods. As cumulative excess return over the market is calculated with daily observations over three years, the absence of the up to 30 observations won't change the value of cumulative excess return over the three-year period significantly. In these cases, while we lose some information, the formula for cumulative excess returns accounts for the fewer observations and thus missing observations do not bias returns downward.

Several companies in this sample either did not stay public for six years post-IPO or were acquired by another company during the six-year period post-IPO. Due to this, some companies may not have complete stock price data available for the entire six-year period post-IPO. 298 observations were excluded due to this, leaving 489 companies in our sample. These eliminations may bias our results as the companies that do not stay public for the six-year period after IPO may be inherently different from the rest of the companies in our sample.

Finally, in our sample, 460 out of the 489 companies have cumulative excess returns from year four to year six post-IPO between -200% and 200%. One company (ticker: 0977894D)

has excess returns of -2938% during this period. We thus exclude this outlier from the regressions as we believe it may overly impact our results. Additionally, 456 out of the 489 companies have cumulative excess returns for the first three years after IPO between -200% and 200%. Only one company in this sample has cumulative excess returns for the first three years after IPO greater than 800%. This company (ticker: VIPS) has cumulative excess returns of 2775%. While we do not include cumulative excess returns for the first three years after IPO in our models due to endogeneity, we remove this company from our sample because it may also overly effect our results as this company may be inherently different from the rest of our sample. After these two exclusions, we are left with 487 companies in the dataset.

Figure 1: Distribution of PE-Backed IPOs over Time in the Sample

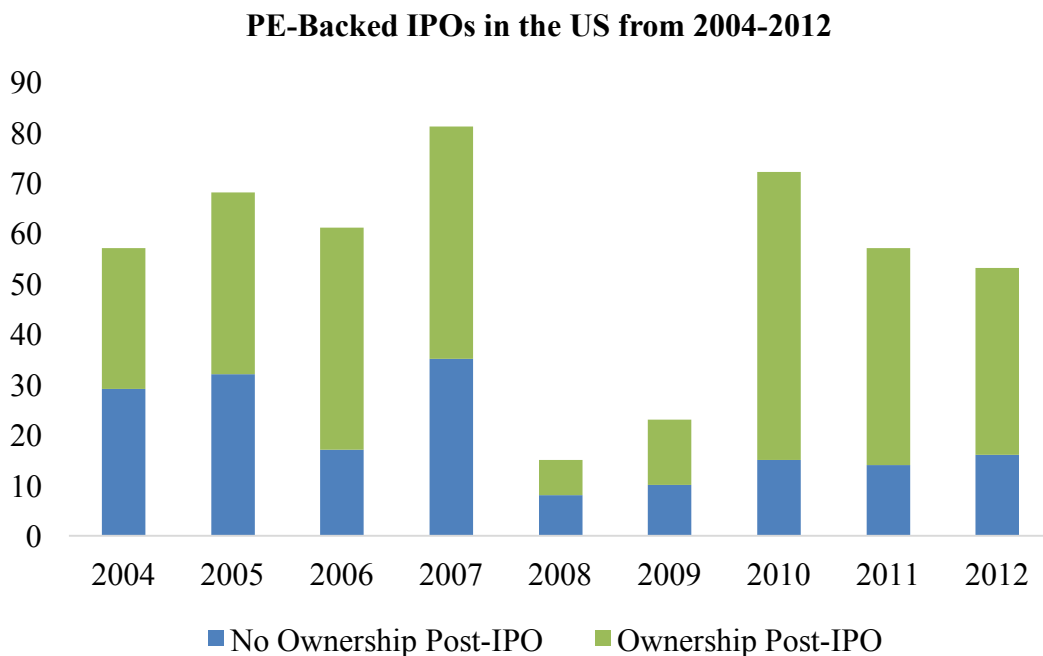
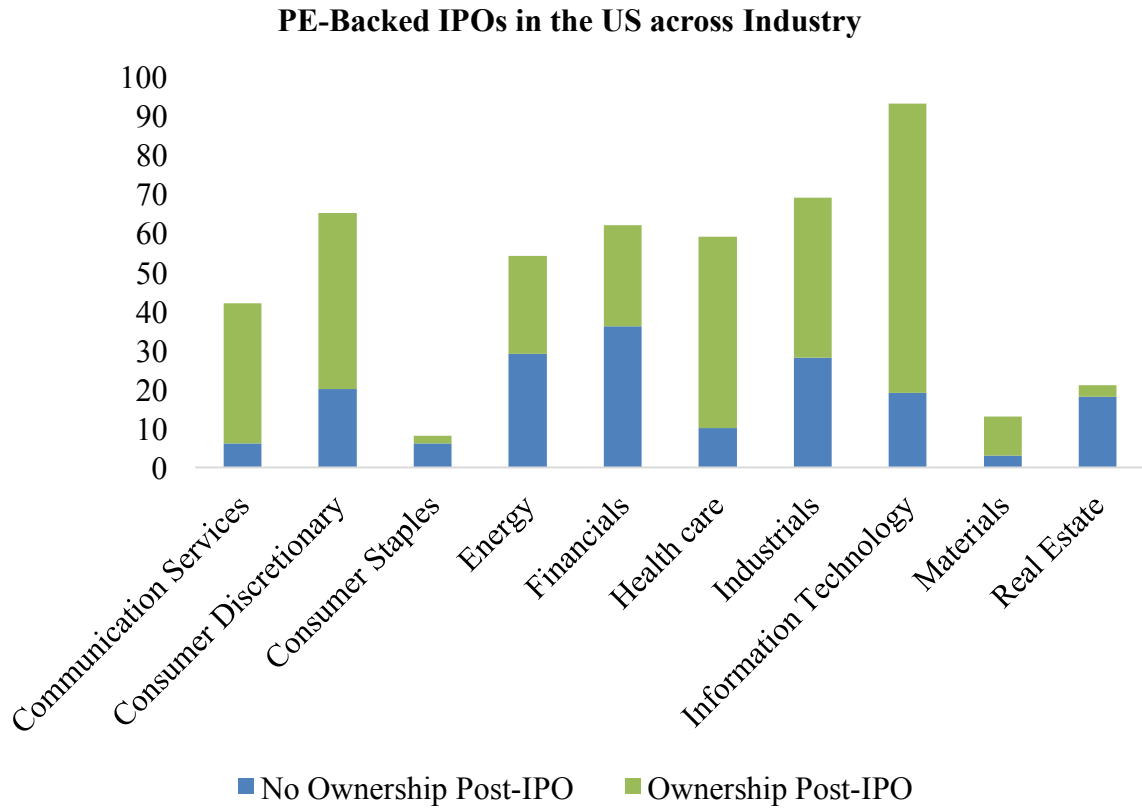


Figure 2: Distribution of PE-Backed IPOs across Industries in the Sample



The sample is separated into two main groups of companies. The first group contains companies with PE ownership of greater than 5% in the quarter after the IPO occurred (quarter 1). The second group is composed of companies with PE ownership only in quarter 0 (quarter in which IPO occurred) or less than 5% PE ownership during quarter 1. We use this set of companies as our control group. We consolidate companies with PE ownership of less than 5% with those with no ownership because in both cases, PE firms have negligible influence on a company’s decisions. This is consistent with Section 12 of the *Securities Exchange Act of 1934*, which requires companies to only disclose shareholders with over 5% ownership in their filings, hence, grouping shareholders with 0-5% ownership stakes in the same category. Summary statistics of the relevant variables are displayed in Table 1 below.

Table 1: Summary Statistics of the Sample

Variable	No. of Obs	Mean	Std. Dev.	Min	Max
Cumulative excess returns for years 4-6 post-IPO	487	0.0618	0.9533	-1.0294	7.060
Average percentage of ownership maintained during first three years post-IPO	487	0.1513	0.1764	0	0.7387
No. of quarters PE ownership is maintained during first three years post IPO	487	5.9445	5.3701	0	12
Age of firm (years)	487	11.02	11.5172	6	113.38
Size of IPO (\$ mm)	487	300.29	1122.49	43.97	15670.18

## Results

In order to estimate the relationship between long-run company performance and PE ownership post-IPO, we run a series of OLS regressions. The first regression is run using the benchmark model (equation 1) which includes only the ownership maintained post-IPO dummy variable as the measure of PE ownership post-IPO. Regression 1 evaluates the relationship between a company's cumulative excess returns during years four to six after IPO and the PE ownership maintained during first three years post-IPO dummy variable. As mentioned earlier, while we do not believe the impact of PE ownership maintained during the first three years post-IPO on cumulative excess returns in the contemporaneous period (during the first three years) can be effectively modeled due to endogeneity, we include the results of the regression (Regression 4) that estimates the effect of the PE ownership maintained post-IPO dummy variable on the company's cumulative excess return during the first three years after IPO in the appendix.

Regression 2 is run using the first alternative specification (equation 2) which uses a more comprehensive approach to capture PE ownership during years one to three post-IPO. This

regression measures PE ownership post-IPO using the average percentage of PE ownership maintained from year one to year three post-IPO and the square of this term. As previously discussed, there are several methods to create a variable that measures PE ownership maintained during years one to three post-IPO. Hence, Regression 3 is run using the second alternative specification (equation 3) in which the number of quarters during which PE ownership is maintained during the first three years post-IPO and its square are used to capture PE ownership post-IPO. The model concentrates on the impact of the duration of PE ownership after IPO. Similar to Regression 4, we also estimate the relationship between the cumulative excess returns from year one to year three and the average percentage of PE ownership maintained post-IPO in Regression 5, and the relationship between cumulative excess returns from year one to year three and the number of quarters of PE ownership maintained post-IPO in Regression 6. The results of these regressions can be found in the appendix as well. The results from Regression 1 (using the benchmark specification) and Regressions 2 and 3 (using the alternative specifications) are included in Table 2 below.

Table 2: OLS Regressions using Equation (1), Equation (2) and Equation (3) respectively

	(1)	(2)	(3)
	Cumulative Excess Returns from Year 4 to Year 6 Post-IPO	Cumulative Excess Returns from Year 4 to Year 6 Post-IPO	Cumulative Excess Returns from Year 4 to Year 6 Post-IPO
PE ownership dummy for 3 years post-IPO	0.239** (0.0978)		
Percent PE ownership from year 1 to year 3 post-IPO		0.0160** (0.00726)	
Percent PE ownership from year 1 to year 3 post-IPO squared		-0.000256* (0.000132)	
No. of quarters of PE ownership from year 1 to year 3 post-IPO			0.127*** (0.0420)
No. of quarters of PE ownership from year 1 to year 3 post-IPO squared			-0.00918*** (0.00336)
Firm age	0.0103*** (0.00374)	0.0105*** (0.00375)	0.0105*** (0.00373)
Ln IPO size	0.0377 (0.0513)	0.0389 (0.0516)	0.0449 (0.0513)
Consumer discretionary	0.461** (0.183)	0.453** (0.183)	0.431** (0.183)
Consumer staples	0.896** (0.360)	0.826** (0.358)	0.884** (0.357)
Energy	0.193 (0.193)	0.157 (0.192)	0.187 (0.192)
Financials	0.0937 (0.188)	0.0522 (0.186)	0.0840 (0.187)
Health care	0.297 (0.189)	0.274 (0.189)	0.311 (0.189)
Industrials	0.0358 (0.182)	0.00630 (0.181)	0.0259 (0.181)
Information technology	0.363** (0.172)	0.343** (0.172)	0.348** (0.171)
Materials	0.145 (0.294)	0.135 (0.295)	0.0988 (0.294)
Real Estate	0.338 (0.255)	0.275 (0.252)	0.328 (0.252)
Utilities	0.344 (0.934)	0.268 (0.935)	0.341 (0.931)
2005 dummy	0.139 (0.167)	0.142 (0.168)	0.139 (0.167)
2006 dummy	0.351** (0.173)	0.348** (0.174)	0.364** (0.173)
2007 dummy	-0.0107 (0.160)	-0.0115 (0.161)	-0.0137 (0.160)
2008 dummy	0.310 (0.268)	0.312 (0.268)	0.312 (0.267)
2009 dummy	-0.211 (0.229)	-0.225 (0.230)	-0.208 (0.229)
2010 dummy	-0.188 (0.167)	-0.173 (0.168)	-0.178 (0.167)
2011 dummy	-0.461*** (0.177)	-0.469*** (0.178)	-0.460*** (0.177)
2012 dummy	-0.0993 (0.177)	-0.0876 (0.177)	-0.127 (0.177)
Constant	-0.601* (0.337)	-0.537 (0.333)	-0.641* (0.336)
Observations	487	487	487
Adjusted R-squared	0.0803	0.0764	0.0867

Standard errors in parentheses; \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1



The results of the benchmark model, support the expected relationships between cumulative excess price returns (proxy for company performance) and PE ownership post-IPO and the characteristics of the firm. The correlation between cumulative excess returns in the long-run and PE ownership during the first three years post-IPO is positive and significant at the 0.05 confidence level. This coefficient indicates that if PE ownership is maintained in a company post-IPO, then cumulative excess return for the period from year four to year six (proxy for long-run company performance) increases by 23.9%.

For the time fixed effects, a positive coefficient indicates that companies that executed their IPO in that year perform better than companies that IPOed in 2004. Similarly, a negative coefficient demonstrates that companies that went public that year performed worse than companies that executed their IPO in 2004. The value of these coefficients can be interpreted as the increase or decrease in performance during the three-year time period being studied for companies that IPOed that year in relation to those that went public in 2004. For instance, the coefficient for 2006 dummy expresses that companies that went public in 2006 increased cumulative excess returns in years four to six post-IPO by 35.1% in comparison to companies that went public in 2004. This is significant at the 0.05 confidence level. Similar to the time fixed effect coefficients, the coefficients for the industry fixed effects indicate how companies in industries other than Communication Services perform relative to companies in the Communication Services industry. For example, a company in the Consumer Discretionary industry is expected to perform better than a company in the Communication Services industry by 46.1% in the long-run. This result is significant at the 0.05 confidence level.

The coefficients related to the characteristics of the firm such as age can be interpreted as the change in percentage of cumulative excess returns in the three-year period being studied

brought about by a unit increase in given characteristic, for instance an increase in firm age by one year results in an increase in cumulative excess returns from year four to year six by 1.03%. This is significant at the 0.01 confidence level.

The results of the alternative specifications extend on the findings of the first regression. Regression 2 indicates there is a positive but diminishing relationship between the average percentage of PE ownership post-IPO that is maintained from years one to three and the stock price performance of a company in years four to six after IPO. The results suggest that the coefficient for the average percentage of PE ownership post-IPO is positive and significant at the 0.05 confidence level. The coefficient for the variable measuring the square of the average percent of PE ownership post-IPO is negative and significant at the 0.1 confidence level. Further, the F-test to determine the combined effect of the linear and quadratic terms indicates that the total effect of the two variables together is significantly different from zero. The results of the F-test can be found in the appendix.

The results of Regression 3 are very similar to those of Regression 2. Regression 3 also indicates a positive but diminishing relationship between the number of quarters of PE ownership post-IPO and cumulative excess returns from year four to year six post-IPO. The coefficients capturing this non-linear relationship are both significant at the 0.01 confidence level.

All other variables in the alternative specifications (Regressions 2 and 3), including the time fixed effect, industry fixed effect, IPO size and firm age can be interpreted as they are in Regression 1.

## Discussion

In our benchmark model (Regression 1), we see a positive and significant relationship for PE ownership during the first three years post-IPO and price returns from years four to six after IPO. Leland and Pyle (1977), find that ownership retention post-IPO serves as a key signal to investors regarding the quality of the underlying business; large amounts of insider selling might signal the firm is overvalued while large degrees of ownership retention might signal a superior quality business. This idea, consistent with the signaling hypothesis, may partially explain the positive relationship between continued PE ownership post-IPO and excess returns in our regressions. Moreover, the positive relation between ownership and excess returns is also consistent with Ritter's (1984) findings that insiders (PE firms, for example) are only willing to hold shares in IPOs if they believe it will allow them to realize higher returns in the future. By delaying their divestment, PE funds expose themselves to significant costs including negative impacts to their IRR, the possibility of a bear market, and to idiosyncratic firm risk. Hence, it only makes sense for PE firms to hold on to investments if they expect them to perform well in the future. This expectation may be due to an opinion that the PE firm has added value to the company during the investment period or due to private information the PE firm has access to because of the information asymmetry that exists between public and private markets.

Further, Welch (1989) notes that the period in which insider ownership is maintained post-IPO allows for previously private information held by insiders to become more readily available. This theory suggests that PE ownership maintained post-IPO may allow outside investors to become more familiar with how PE impacts a company's operations as opposed to when PE firms completely exit at time of IPO (or immediately after the lockup period). Hence, this information asymmetry regarding how companies and PE firms interact may also explain the

positive relationship between PE ownership maintained during the first three years post-IPO and stock price performance in the long-run (from years four to six). However, as noted earlier, a limitation of the paper is that we do not follow PE ownership past the first three years post-IPO, and the time and level of PE ownership maintained in years four to six could also affect a company's stock price in that period. Hence, using a more complete history of PE ownership post-IPO could be an avenue for further research on this topic.

In the first alternative specification, we use the average percent PE ownership maintained during the first three years after IPO as the main independent variable. Average percent PE ownership from year one to year three post-IPO captures both intensity and duration of PE ownership maintained. As mentioned previously, there is a high correlation (0.81) between the average percent PE ownership maintained post-IPO and the duration of PE ownership post-IPO (number of quarters in which PE ownership is maintained). Similarly, there is a strong positive correlation (0.78) between the average percent PE ownership maintained post-IPO and the number of quarters during which majority ownership (greater than 50%) is maintained. These relationships are explored further in the appendix and the results of regressions using average percent PE ownership, duration of all PE ownership and duration of majority PE ownership can be found in Table 7 (in the appendix).

In Regression 2, we notice that the average percent PE ownership maintained has a positive but diminishing impact on cumulative excess returns. This can be inferred from the fact that the coefficient of the average percent PE ownership maintained variable is positive and significant while the coefficient of the quadratic term (square of average percent PE ownership maintained during the first three years post-IPO) is negative and significant. Further, in Regression 3, the number of quarters during which PE ownership is maintained post-IPO also

has a positive but diminishing effect on cumulative excess returns in the long-run. Generally, PE firms hold investments over a five to seven-year time horizon in order to maximize returns. Since any ownership maintained post-IPO is in addition to the time a PE firm was invested in the company before the IPO, too long of a holding period likely indicates that the PE firm has not found a suitable time to exit the company and achieve returns they had initially targeted. This long investment period potentially acts as a signal to outside investors that the company is a weak investment choice, further depressing the stock price. Similar to the duration of PE ownership maintained post-IPO and in line with Leland and Pyle (1977), maintaining higher degrees of ownership initially after IPO may act as a positive signal for outside investors indicating a superior company likely to rise in value. However, if large investment stakes are maintained for too long, it may indicate two things. First that the PE firm believes that it needs to continue to maintain high degrees of ownership in order to have control over decision making and improve the company and extract returns. But if this period is extended too long, it may call into question whether the PE firm can actually better the quality of the company. Second, it may indicate that they have not been able to divest at a high enough multiple (or price) in order to realize targeted returns. Either indication may act as a negative signal to outside investors and thus negatively impact cumulative excess returns in the long-run.

There seem to be three factors working in different directions (positive signaling if ownership is maintained after IPO, information asymmetry and negative signaling as duration and intensity of PE ownership post-IPO increases) that affect stock price performance. The relationships in the alternative specifications suggest that there are diminishing marginal returns to the average percent PE ownership maintained and the duration of PE ownership maintained during the first three years post-IPO. Further research could be conducted to confirm this

hypothesis and determine the optimum duration and degree of PE ownership that should be maintained post-IPO to maximize cumulative excess returns in the long-run.

All three regressions yield interesting results regarding the relationship between companies in specific industries and their long-term performance against the market. Consumer Discretionary, Consumer Staples and Information Technology (IT) industry dummy variables yield positive and statistically significant coefficients at the 0.05 confidence level. Companies belonging to the aforementioned industries had better cumulative excess returns over the market than companies in all other industries in the four to six-year period following their IPOs. These results are consistent with the performance of indices that track these industries. The S&P indices tracking IT, Consumer Staples and Consumer Discretionary industries have outperformed the Communication Services index by 15.93%, 5.83% and 15.19% respectively, over the past ten years.

The outperformance of IT companies relative to other industries' companies may be explained by the difference in business models between companies in these two sectors. IT companies commonly operate under a software as a service (SaaS) business model which allows them to primarily have cycle resistant recurring revenues. This type of business model is attractive to PE investors because it allows for easily predictable cash flows which help PE firms better predict a company's pay-down capacity before an LBO transaction. As such, the superior performance of IT companies compared to those in Communication Services in our sample may be explained by the better alignment of IT companies with the PE business model, which allows PE funds to implement their practices and create value easily. The compatibility of IT companies and PE is also supported by the number of IT specific funds that have been created over the past several years. Historically, PE firms have rarely focused on a specific sector. Recently, however,

IT-focused PE firms such as Silver Lake, Vista and Insight Ventures have emerged. Consistent with this, a growing proportion of IT deals have captured the PE buyout space since 2015. While only 15% of buyout deals in 2015 were of IT companies, the total number of buyout deals of IT companies increased to 23% by March 2018 (Preqin, 2018).

The reasons for outperformance of PE-backed Consumer Discretionary companies may be similar to those of IT companies. First, consumer-focused companies have business models that are well suited for PE ownership. Consumer companies usually have simple business models in which PE managers can quickly implement their expertise to lower costs, grow revenues and hence increase firm value. Well known PE deals such as the acquisition of Kraft Heinz by 3G capital show how PE firms are able to create value in consumer-focused companies. Secondly, and consistent with the trend towards specialization in the PE industry, a new wave of consumer-focused PE funds such as L'Catterton and Centerview Partners, have emerged over the past decade. The increasing emergence of consumer-focused PE firms makes Consumer Discretionary companies natural targets for PE funds to acquire and implement their practices to. The relative simplicity and well alignment of consumer companies' business models with PE firms' business models as well as increased PE specialization in the consumer space may explain the outperformance of Consumer Discretionary companies.

Finally, when discussing the statistical significance of the Consumer Staples dummy coefficient, it is important to note that our sample only contains eight companies in the Consumer Staples industry and that this number is not sufficiently large to measure and generalize the post-IPO performance of companies in that sector. That said, the over performance of the eight companies in the sample can likely be explained by the same reasons as those mentioned for the performance of Consumer Discretionary companies. Future research

could focus on the impact of both pre-and post-IPO PE ownership on companies specifically in the Consumer Staples, Consumer Discretionary and Information Technology sectors.

Additionally, in all three models, the coefficients associated with the 2006 and 2011 dummy variables are significant. Companies that IPOed in 2006 had better excess returns in years four to six after IPO in comparison to the returns of companies that IPOed in 2004. This is likely due to the financial crisis of 2008. The four to six-year period post-IPO for companies that underwent IPOs in 2004 (from 2007 to 2009) coincided with the financial crisis. The S&P 500 market index lost approximately 50% of its value during the financial crisis, dropping 38.49% during 2008 alone. The long-run time period (four to six years after IPO) for companies that IPOed in 2006 (from 2009 to 2011), however, corresponded with the resurgence of the financial markets following the recession. Hence, companies that underwent IPOs in 2006 performed better in the long-run period than companies that IPOed in 2004. In our sample, the average cumulative excess returns of companies whose IPOs occurred in 2006 is much higher than the average cumulative excess returns of companies that underwent IPOs in 2004 (approximately 49% higher). The coefficient associated with the 2011 dummy variable is negative and significant at the 0.01 confidence level in all three regressions in Table 2. Thus, companies who underwent IPOs in 2011 underperformed companies that IPOed in 2004. This could be explained by the 2015-16 stock market selloff in response to the slowdown in growth of the GDP of China, fall in petroleum prices, the Greek debt default and the end of quantitative easing in the US. While the four to six-year period post-IPO for companies that IPOed in 2004 included the bull market that characterized most of 2007, the long-run period of companies whose IPO occurred in 2011 (from 2014-2016) coincided with a relatively bearish market. The average cumulative excess returns of these companies is about 34% less than that of companies that IPOed in 2004.



## **Study Limitations**

While limitations of this paper and opportunities for future research have been discussed in the sections above, we summarize the three main constraints to our research in this section. First, this thesis only tracks PE ownership during the first three years after IPO and not during the period in which stock performance is measured (from year four to year six after IPO). It is likely that stock performance in years four to six post-IPO (in the long-run) is impacted by PE investment decisions in that period as well. The second limitation is related to the structure of PE funds. We are unable to differentiate whether General Partners (GPs) choose to maintain ownership in a company or Limited Partners (LPs) decide to retain stocks of the company after receiving them from the GPs. Reasons for LP ownership may be different from those for GP ownership as GPs are generally considered the more sophisticated investors, and hence which partner maintains ownership in a company may impact stock prices in the long-run. Third, due to time constraints and limited availability of data, we are not able to identify the type of PE fund (buyouts funds or VC funds) that invest in each company in our sample. Although both types of funds are considered ‘smart investors’ and usually strive to add value to their portfolio companies, they have different motivations for both investing and retaining ownership of a company, especially once public. Further research could study the impact that different PE funds have on a company’s performance post-IPO.

## **Conclusion**

This paper studies the impact of continued PE ownership post-IPO on the long-term performance of a company. While existing literature addresses the performance of PE-backed companies in relation to non-PE backed companies, there is little analysis on the impact that PE involvement after IPO may have on companies. Hence, we create a dataset consisting of PE-

backed IPOs to examine if PE ownership after-IPO and the degree of this ownership affects stock price performance of the company in the long-run. This compiled dataset is a contribution to the study of the PE industry due to the relative difficulty in obtaining data about businesses and operations in this market.

The findings, in line with our hypothesis, indicate that continued PE ownership in the first three years post-IPO positively impact returns from year four to year six after IPO. Further, it seems that the level and duration of PE ownership maintained post-IPO also affects cumulative excess returns of a company in the long-run (four to six years after IPO). Beyond the initial hypothesis, the analysis suggests an interesting trend of diminishing marginal returns to the duration and level of PE ownership post-IPO which has previously not been discussed in literature. This trend is likely due to opposing signaling effects and information asymmetry and may illustrate how the perceptions of a PE investment decision are important in determining stock price movements in the long-run. In addition to future research opportunities addressed in this paper, studying long-term performance in a more holistic approach using financial and efficiency measures in addition to stock price returns might help to further illuminate the impact of continued PE ownership post-IPO.

Additionally, the results suggest that PE ownership may be more effective for companies in certain industries, in particular Information Technology, Consumer Staples and Consumer Discretionary industries. This may partially be explained by the business models of companies in these industries being more suited for PE practices aimed to create value in the companies. This could be important in determining future trends in relation to specialization and business methods in the PE industry. Finally, while we do briefly examine trends over time in our analysis, detailed studies of the PE industry over a longer period of time to determine how the

measurable impact of the industry has changed especially in light of saturation could lead to significant contributions to the discussion.

# Appendix

Table 3: OLS Regressions using Equation 1,2 and 3 on Cumulative Excess Returns from Year 1 to Year 3 Post-IPO

	(4)	(5)	(6)
	Cumulative Excess Returns from Year 1 to Year 3 Post-IPO	Cumulative Excess Returns from Year 1 to Year 3 Post-IPO	Cumulative Excess Returns from Year 1 to Year 3 Post-IPO
PE ownership dummy for 3 years post-IPO	-0.00477 (0.123)		
Percent PE ownership from year 1 to year 3 post-IPO		-0.00338 (0.00903)	
Percent PE ownership from year 1 to year 3 post-IPO squared		-7.60e-05 (0.000164)	
No. of quarters of PE ownership from year 1 to year 3 post-IPO			0.194*** (0.0517)
No. of quarters of PE ownership from year 1 to year 3 post-IPO squared			-0.0177*** (0.00414)
Firm age	0.00181 (0.00469)	0.00183 (0.00466)	0.00212 (0.00458)
Ln IPO size	0.0994 (0.0643)	0.0965 (0.0642)	0.106* (0.0631)
Consumer discretionary	0.278 (0.229)	0.233 (0.228)	0.171 (0.225)
Consumer staples	0.0248 (0.451)	-0.0588 (0.445)	0.00559 (0.439)
Energy	-0.000750 (0.242)	-0.0729 (0.239)	-0.0153 (0.236)
Financials	-0.0217 (0.236)	-0.0890 (0.232)	-0.0460 (0.229)
Health care	0.341 (0.237)	0.342 (0.236)	0.403* (0.232)
Industrials	0.190 (0.228)	0.177 (0.226)	0.166 (0.223)
Information technology	0.382* (0.215)	0.345 (0.215)	0.332 (0.211)
Materials	0.724* (0.368)	0.668* (0.367)	0.538 (0.362)
Real Estate	0.0598 (0.320)	-0.0563 (0.314)	0.0433 (0.310)
Utilities	0.729 (1.171)	0.610 (1.164)	0.721 (1.144)
2005 dummy	0.316 (0.210)	0.343 (0.209)	0.348* (0.205)
2006 dummy	-0.108 (0.217)	-0.0581 (0.216)	-0.0382 (0.212)
2007 dummy	-0.0725 (0.201)	-0.0380 (0.200)	-0.0307 (0.197)
2008 dummy	-0.325 (0.336)	-0.350 (0.334)	-0.336 (0.328)
2009 dummy	-0.258 (0.288)	-0.230 (0.286)	-0.185 (0.281)
2010 dummy	-0.347 (0.210)	-0.268 (0.209)	-0.264 (0.206)
2011 dummy	-0.432* (0.222)	-0.364 (0.222)	-0.351 (0.218)
2012 dummy	0.226 (0.222)	0.277 (0.221)	0.177 (0.218)
Constant	-0.394 (0.423)	-0.282 (0.414)	-0.641* (0.336)
Observations	487	487	487
Adjusted R-squared	0.070	0.0374	0.071

Standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 4: Relationship between Average Percent of PE Ownership and Duration and Level of PE Ownership during the First Three Years after IPO

(i) Regression Results		
	(6)	(7)
	No. of quarters of PE ownership during first three years post-IPO	No. of quarters of majority PE ownership during first three years post-IPO
Percent PE ownership from year 1 to year 3 post-IPO	0.248*** (0.00803)	0.123*** (0.00453)
Constant	2.193*** (0.187)	-0.754*** (0.105)
Observations	487	487
Adjusted R-squared	0.662	0.603

Standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

(ii) Correlation Matrix			
	Percent PE ownership from year 1 to year 3 post-IPO	No. of quarters of PE ownership during first three years post-IPO	No. of quarters of majority PE ownership during first three years post-IPO
Percent PE ownership from year 1 to year 3 post-IPO	1.00		
No. of quarters of PE ownership during first three years post-IPO	0.82	1.00	
No. of quarters of majority PE ownership during first three years post-IPO	0.78	0.40	1.00

Table 5: F-test Results

(i) *Is total effect of percent PE ownership from year 1 to year 3 post-IPO and percent PE ownership from year 1 to year 3 squared significantly different from zero*

F (1,464) = 4.86

Prob>F = 0.0279

(i) *Is total effect of number of quarters of PE ownership from year 1 to year 3 post-IPO and number of quarters of PE ownership from year 1 to year 3 squared significantly different from zero*

F (1,464) = 9.19

Prob>F = 0.0026

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