Institutional Investors and Corporate Decision-Making

An investigation of the relationship between institutional ownership and R&D investments

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Abstract

In this paper we investigate the impact of institutional ownership on long-term corporate decision-making by analysing the relationship between institutional investment horizon and research and development (R&D) investments. Some critics argue that institutional investors put pressure on corporate boards to meet short-term objectives and therefore contribute to managerial myopia and obstruct long-term investments, which could be crucial for sustainable value creation. In contrast, other research supports the idea that institutional investors can be characterized by long-term sophistication and that they take a monitoring role as large shareholders to ensure managerial long-term orientation. We conduct a quantitative study and examine these competing perspectives by differentiating institutional investors by their investment horizons and by using R&D as a proxy for long-term investment decisions. This is tested using a method of multivariate ordinary least squares (OLS) to estimate R&D investments in a linear regression model. Our results indicate a positive relationship between institutional investment horizon and R&D investments, which implies that short-term oriented institutional investors increase managerial myopia while long-term oriented institutional investors support long-term decisions through monitoring. Moreover, we find support for a positive relationship between institutional ownership concentration and R&D investments.

Keywords: R&D, Institutional Investors, Investment Horizon, Myopia, Monitoring

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1. Introduction

For decades an increasing number of international public voices have demanded a shift from short-term oriented “quarterly capitalism” to genuine long-term based management of companies. Not only does short-termism undermine companies’ capabilities to invest to create value, but also results in more profound societal consequences such as negative impact on GDP growth, unemployment rate and return on investments of savers (Barton, 2011). Despite the outcry against focusing on short-term profits, studies show that myopic management behaviour seems to increase. A McKinsey Quarterly survey from 2013 with more than 1,000 international board members and executives shows that a majority of business leaders felt an increasing pressure to generate strong immediate results. However, the same majority is convinced that a longer time horizon is important for the strategy and would contribute positively in terms of value creation to their companies (Barton and Wiseman, 2014).

How come there is a difference between knowing the right thing to do and doing the right thing?

Some argue that one driver of short-term oriented management is the pressure by investors to generate immediate results. Popular literature and research have attributed extensive focus on creating short-term earnings at the cost of innovation to large institutional investors (Jacobs, 1991; Porter, 1992; Laverty, 1996). But there are also contrary voices that suggest a potential positive contribution of certain institutional investors on long-term oriented corporate decisions, for instance that long-term oriented institutional investors support investments in innovation (Francis and Smith, 1995; Aghion et al., 2013).

The nature and impact of institutional investors seem particularly relevant in this context for two reasons. First, institutional ownership has increased significantly on a global level during the last decades. For instance, ownership by physical persons in public equity in the US has decreased from 84% in the mid-1960s to 40% in 2011 (Celik and Isaksson, 2013). Other economies have experienced similar trends of increasing importance of institutional investors, e.g. in 2011 in Japan and UK, public equity owned by physical persons constituted only 18% and 11% respectively (Celik and Isaksson, 2013).

Second, some of the world's largest institutional investors are pension funds, insurance firms and sovereign wealth funds or include capital provided by those types of institutions. They invest and manage contributions of savers, taxpayers and other long-term investors with fiduciary responsibilities which often last over generations. Hence, the objectives of these institutions include securing capital in the long run, which in consequence should be reflected in their investment horizons (Barton and Wiseman, 2014).

The concept of "institutional investor" is rather broadly defined and thus it is most likely that different institutional investors have different objectives. The emergence of institutional investors has created an interest to study how increasing institutional ownership impact the performance and the governance of companies. Several studies have focused on the relationship between institutional ownership and long-term investments in terms of research & development (R&D) expenditures as a measure of investments that potentially payoff in the long run. Previous research show rather mixed results and many studies argue that "patient" or long-term institutional investors are associated with a positive relationship to R&D investments and that "impatient" or short-term institutional investors have a negative influence on R&D investments, thus indicating myopic behaviour (Bushee, 1998; Brossard et al., 2013). R&D seems to be a suitable proxy to measure long-term orientation because of its risky characteristic where potential return on investments can only be realized far in the future and due to accounting requirements, which in most cases demand immediate expense of R&D which directly affect short-term earnings. Moreover, this research area offers more potential for further development since many studies seem to be very focused on specific countries, do not differentiate between industries and are based on old data.

1.1 Purpose and Structure

The main purpose is to study how institutional investors affect long-term corporate decision-making. In specific, we are interested in how corporate R&D investments vary across firms with different types of institutional owners. Do managers increase or decrease their strategic horizon accordingly to the investment horizons of institutional investors? To measure long-term orientation, we consider R&D investments as a suitable proxy because of its risky nature and the extensive period required for potential payoffs. This study contributes to the existing literature by considering a recent as well as transnational data set.

This paper is organized as follows: In chapter 2 we briefly introduce generic theory related to managerial myopia and monitoring in the context of institutional ownership and investment decisions and later contrast previous research on the relationship between institutional investors and R&D expenditures. Chapter 3 describes our methodology, including descriptions and decisions about our research design, data sample and model. Next, chapter 4 presents some descriptive statistics, a correlation matrix and other empirical results. Finally, chapter 5 concludes our study.

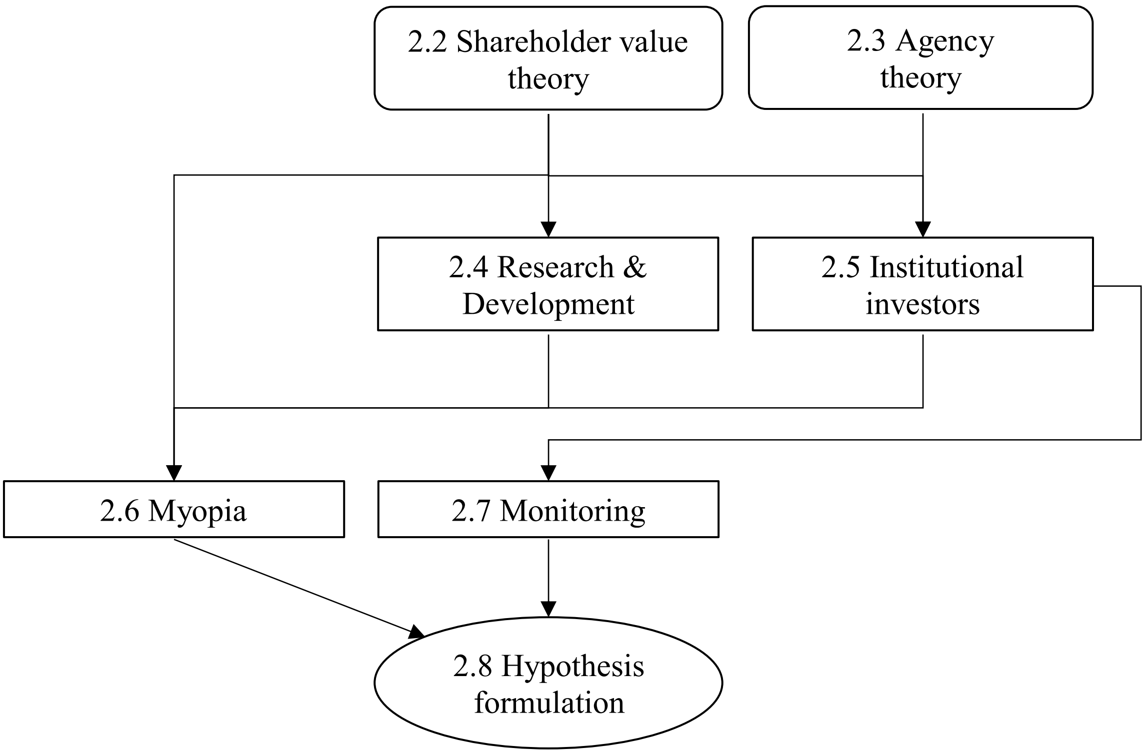
2. Theory

2.1 A Model of Ownership and R&D Investments

To study the relationship between institutional ownership and long-term corporate decision-making, we will begin with reflections on shareholder value theory in section 2.2 and agency theory in section 2.3 to understand how general economic theory explains the shortcomings in corporate perspectives on long-term investments regarding innovation in a rather limited way. Both generic theories have great implications on managerial behaviour, investment horizons and alignment between shareholders, which in this context are the institutions, and managers.

In section 2.4, we will highlight the importance of R&D as risky, value-creating, long-term projects and elaborate on managerial considerations driven by shareholder value and agency theory, that result can result in myopia. This will be followed by an introduction into the construct of institutional investors, how they act as principals with the potential of strengthening the collective power of shareholders and their characteristics with different implications on long-term orientation in section 2.5. It is important to understand how institutional investors' behaviour relate to shareholder value and agency theory, but also to underline characteristics which can deviate between institutions and lead to contradicting consequences.

Figure 1 – Theoretical Model



Building on these general perspectives, section 2.6, managerial myopia, and 2.7, institutional monitoring, will present two competing but also complementing views on the relationship between institutional ownership and R&D investments. Considering the discussion from generic theory to various specific research, section 2.8 will present the development of our hypotheses.

2.2 Shareholder Value Theory

Since the 1980s, general economic theory suggests that the main objective of companies is to maximize value for shareholders (Rappaport, 1998; Lazonick, 2007). From a corporate perspective, this translates to a corporate desire to only invest in projects with positive net present values using the cost of capital as the discount rate (Jensen, 1986). Put differently, shareholder value theory claims that managers should invest in projects that create or maintain the value of shareholders' assets. If projects like that cannot be located, the capital should flow back to the shareholders and be invested in more efficient alternatives (Lazonick and O'Sullivan, 2000).

However, calculating the net present value (NPV) of R&D projects – setting the relevant cost of capital and predicting future cash flow – is challenging and requires future assumptions while the innovation process remains unknown (Lazonick, 2007). Hence, innovative projects are characterized by difficult cash flow predictions and bear significant risks to fail to generate positive returns. They require both high capital intensity and a long-term investment horizon and are likely to fail the requirement of delivering positive NPV or seem initially rather unattractive from a shareholder value perspective (Porter, 1992). For this reason, Lazonick (2007) argues that the perspective on innovation is missing in the shareholder value theory.

Due to the importance of innovation and the difficulties to account for the innovation process in a project, this study aims to investigate if the ownership structure affects investments in R&D projects. Before further investigating these implications, we develop on the relationship and potential conflicts between shareholders and managers using agency theory as a starting point for the discussion.

2.3 Agency Theory

Agency theory addresses the situation of different interests, attitudes towards risks and objectives between principals and agents (Jensen and Meckling, 1976). Managers act as agents on behalf of their principals, the investors, but due to different involvement into the business, e.g. having deeper insights into the business and taking risks without being accountable with own capital, managers can be motivated to act in their own self-interest rather than the interest of the shareholders. Jensen and Meckling (1976) further describe how agency problems create agency costs related to monitoring of manager actions.

In the context of this thesis, we consider institutional investors as the principals, although institutions are also guided by managers and have their own investors as principals. The rationale behind this is that we intend to analyse the impact of institutions on long-term firm decisions made by the management and not the relationship between the management of the institutions and their investors.

It has been argued by David et al. (1996) that long-term investments in R&D may cause agency problems due to different levels of diversification between shareholders and managers. For instance, institutional investors face legal regulations affecting the distribution of their capital and therefore hold diversified portfolios. Furthermore, some institutions manage such large amount of funds that one asset or even one asset class cannot cover the size of the entire funds. In contrast, managers usually work for a single company and face no diversifications in their employment. In that way, managers may prefer a strategy of lower risk to avoid managerial turnover whereas institutional investors can manage the risk of failed projects due to their diversified portfolios (David et al., 1996; Aghion et al., 2013).

Eng and Shackell (2001) argue that information asymmetry between shareholders and managers is another driver of agency problems. There is a need for managers to inform shareholders about the value of innovative projects and the potential long-term effects on value creation as well as secure funding for new innovative projects (Eng and Shackell, 2001). However, presenting too much information could potentially unveil business secrets and ultimately affect the firm's competitive edge which makes it hard for managers to always convey their idea in a proper way (Brossard et al., 2013). In other words, managers have an information advantage towards investors regarding the company strategy and operations. Consequently, managers could use this information advantage to cut R&D to increase short-term profits, but also might struggle to explain the importance of R&D projects to shareholders and get their support.

In a situation when different kinds of shareholders have different levels of risk, for instance regarding the level of diversification, and/or their investment objectives differ in terms of strategies for long-term versus short-term investments, agency problems can also exist between large and small shareholders (Shleifer and Vishny, 1986). However, in this study, focus lays on institutional investors and their impact on the level of long-term investing set by the management. Thus, agency problems between shareholders and managers appear to be more relevant and will be further discussed in relation to long-term investments.

2.4 The Concept of R&D

R&D is one form of long-term investments that drives innovation. The risky nature of R&D can be related to the uncertainty of the expenditures. Investments are visible directly, but the potential benefit is generated over time (Aghion et al., 2013). Furthermore, since R&D expenditures are, unless certain criteria related to the development cost are met (see IAS 38 in the International Financial Reporting Standards), expensed immediately, they can be viewed as natural short-term disincentives for managers concerned with meeting consensus estimates and the subsequent effect on the share price (Eng and Shackell, 2001).

R&D projects are often capital intensive, require a long investment horizon and are difficult to predict regarding their future value (Chen et al., 2014; Rong et al., 2017). Hence, it is likely that R&D projects are rather selected based on the certainty of success and their NPV according to shareholder value theory. In consequence, long-term R&D projects could be neglected and their strategic importance might be considered as secondary. Also, the accounting treatment of R&D induce agency problems as management may be rewarded on meeting short-term estimates – thus cutting R&D – while shareholders require R&D investments to enhance long-term value creation. Evidence of short-termism caused by managerial behaviour was found by Graham et al. (2005). They studied the driving forces behind reported earnings and disclosure decision and found that managers many times actively engage in earnings smoothening by reducing the level of R&D expenditures. Also, their study show that managers wish to preserve predictably in earnings and to deliver on consensus estimate. In that way, R&D is treated as a function to smoothen earnings rather than enlightening the potential innovation process. However, this short-term behaviour could also be driven by investors as managers smoothen earnings to satisfy investors with short time horizons rather than aiming for instant rewards for themselves. (Graham et al., 2005).

Laverty (1996) discusses the intertemporal-choice problem - *"the course of action that is best in the short term is not the same course of action that is best over the long run"*[3] - and enlighten the difficulties in finding the optimal trade-off between short-term and long-term decisions. Since returns from R&D investments naturally take long time to generate and lower current earnings, thus negatively affecting short-term managerial goals, shareholders and managers may develop an agency problem (Laverty, 1996).

2.5 Institutional Investors and Corporate Decision-Making

To study the ownership structure and due to the difficulties of foreseeing the innovation process in R&D projects, this paper focuses on institutional ownership. Since the capital managed by institutional investors has increased substantially over the last decades, they serve as an interesting research area (Celik and Isaksson, 2013). In particularly, the increasing size of institutional ownership and its implications on corporate decision-making offer further research potential from the perspectives of agency and shareholder value theory.

The term "institutional investor" is loosely defined as it only implies that it is not a physical but rather a legal investment entity and unrelated to the type as well as the extent of ownership. Although institutional investors can be classified into different categories generally associated to differences in engagement, there are also differences in ownership engagement within these categories. Çelik and Isaksson (2013) emphasized that it is rather specific features and choices than generic categorizations of institutional investors which define the business models of these entities and thereby determine their interest as well as degree of ownership engagement. Further, they point out that ownership engagement should reflect the self-interest of investors to collect as much information as possible to ensure future prosperity, i.e. value-enhancing information as discussed by Huang and Petkevich (2016).

Considering the increasing importance of institutional investors and the possibility to differentiate between them, considerable research focus on institutional investor influence on corporate decisions (Bushee, 1998; Jagannathan et al., 2000; Eng and Shackell, 2001). Thereby, several studies dealt with the impact of institutional investors on corporate governance and corporate decision-making; sometimes with contradicting findings. For instance, regarding corporate governance, El-Gazzar (1998) found a positive relationship between institutional ownership and voluntary disclosure, while Schadewitz and Blevins (1998) argue that the

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relationship is inverse. Other studies in this context examine the impact of institutional investors on accounting conservatism, e.g. Ramalingegowda and Yu (2012) provide findings that higher ownership by institutional investors, which are associated to higher degree of management monitoring, induce conservative financial reporting.

Parallel, significant research has been conducted about the impact of institutional investors on corporate operations, such as payout policy, R&D and merger and acquisitions (M&A) activities. For instance, Jagannathan et al. (2000) provide evidence that higher institutional ownership in companies lead to a looser payout policy. In many cases R&D has become a popular research variable with very different empirical outcomes. Graves (1988) provides empirical evidence that R&D investments are lower when institutional ownership is higher, while other studies imply that holdings by institutional investors are positively related to R&D investments (Bushee,1998; Eng and Shackell, 2001).

2.6 Managerial Myopia

Myopia is an area in the literature which focuses on short-termism that encourages managers to neglect long-term investments and value creation to lift current earnings, meet short-term goals and focus on fluctuations in the stock price (Porter, 1992). Naturally, cutting R&D can be one way to illustrate managerial myopia.

There are different explanations for myopia. Lazonick and O'Sullivan (2000) highlight how the amount of capital managed by institutional investors has grown over time and thereby strengthened the collective power of such shareholders to influence corporate decision-making. In that way, institutional investors may put further pressure on management to align their interests with that of the shareholders. Some argue that the trend of large institutional ownership increases pressure on managers to shorten the investment horizon and to focus on short-term results (Graves, 1988; Porter, 1992). Moreover, this behaviour may be explained by the way institutional investors are evaluated and the construction of their portfolios. Institutional investors are usually assessed on a short-term basis and they hold diversified portfolios with relatively short holding periods. Therefore, they have restricted access to company-specific information which limits the ability to understand long-term objectives, thus forcing management to focus on short-term profits (Graves, 1988; Porter, 1992).

Besides external shareholder pressure, research further suggests that it can also be based on managerial interests which are in conflict with shareholder interest. Hence, managerial myopia would mainly be triggered by the reluctance to make difficult, risky decisions due to "laziness" (Aghion et al., 2013) and the fear of being fired or experiencing a negative impact on own compensation for not meeting short-term profit goals (Dechow and Skinner, 2000; Cheng, 2004). Rong et al. (2017) describe those two sides as the "rent-seeking view", which argues that managers tend to seek a quiet life towards retirement, and the "career concern view", which is driven by incentive contracts and short-term objectives. Although these two perspectives alone cannot fully explain managerial myopia, we acknowledge that they cover significant aspects of the myopic theory.

In line with these two perspectives, managerial myopia results in underinvestment in long-term, intangible projects such as R&D (Porter, 1992; Bushee, 1998) and leads to the tendency to cut R&D investments to meet short-term earnings goals (Dechow and Sloan, 1991). When managers are encouraged to neglect long-term investments, innovation projects are likely to be disregarded and firms risk losing their competitiveness over time. As illustrated by Porter (1992), the decline of US competitiveness in the 1980s can partly be explained by myopic investors focusing mainly on instant results and thus neglecting innovative projects. Some research show that higher ownership concentration, e.g. larger holdings, lowers the possibility of owners to hold a diversified portfolio and they are therefore more likely to avoid uncertain and risky investments and implement a more conservative strategy (David et al., 1996; Cebula and Rossi, 2015). This naturally increases the risk of myopic behaviour as uncertain innovative projects are neglected in favour of more certain investments.

2.7 Institutional Monitoring

Although the literature considers shareholder value focused on institutional investors to be one reason for managerial myopia (Graves, 1988), other research also reveals that certain characteristics of institutional investors lead to a focus on long-term value creation (Eng and Shackell, 2001). In that way, institutional investors occupy a monitoring as well as mitigating function against myopic corporate management (Bushee, 1998; Eng and Shackell, 2001).

The growing size and power of institutional investors could increase monitoring by affecting corporate governance or corporate decision-making of portfolio companies. This would allow institutional investors to monitor managers and confirm that they make long-term investments into innovative projects instead of meeting short-term earnings. In other words, the monitoring role could reduce managerial short-term incentives. Still, a potential problem of free-riding between large institutional investors, that have obtained costly and value-enhancing information, and other investors, may arise (Huang and Petkevich, 2016). By analysing company specific data and changing governance activities, monitoring behaviour may produce value-enhancing information that can be used to affect business decisions and create long-term value (Bushee, 1998; Huang and Petkevich, 2016). But, because monitoring is costly, ownership concentration affects the incentives to engage in monitoring. The ownership stake needs to be enough to influence the management and the potential return big enough to cover the cost of monitoring (Holmström and Tirole, 1993). Also, the investment horizon of the institutional investor needs to be long enough to capitalise on risky long-term projects as R&D investments take time to generate return (Bushee, 1998).

Francis and Smith (1995) argue that concentrated ownership and monitoring reduce the high agency and contracting costs related to innovation as their study show a positive relation between R&D and ownership concentration. Furthermore, Aghion et al. (2013) show that institutional ownership has a positive but small effect on R&D while the impact of R&D productivity (i.e. patents per R&D dollar) is positive and strong. In contrast, Cebula and Rossi (2015) found contradicting evidence of a negative relationship between ownership concentration and R&D investments. However, their study further supports the positive relationship between R&D investments and the presence of institutional investors. Like David et al. (1996), they argue that higher ownership concentration (i.e. larger holdings), reduces the possibility of owners to hold a diversified portfolio and they are thus more likely to avoid uncertain and risky investments and implement more conservative strategies.

It is also suggested that institutional monitoring and sophistication about long-term investments can have a mitigating effect on the short-term pressure that managers are exposed to, and hence allow managers to focus on long-term projects. Several studies support the idea of a positive relationship between institutional ownership and R&D investments, provided that institutional investors are long-term oriented themselves (Bushee, 1998; Wahal and McConnell, 2000; Eng and Shackell, 2001). Long-term orientation though is a characteristic which is difficult to determine as this is highly dependent on the business model rather than the type of the institutional investor. Bushee (1998) differentiated between short-term oriented and long-term oriented indirectly by measuring the past investment behaviour of institutional investors and other studies follow this approach (Eng and Shackell, 2001; Cebula and Rossi, 2015). Like Bushee (1998), Brossard et al. (2013) simplify this approach and mainly focus on the portfolio turnover for institutional investors to differentiate between them. In other cases, the legal type, e.g. pension fund or hedge fund, is used to distinguish between institutional investors (Brossard et al., 2013; Chen, 2007).

2.8 Hypothesis Formulation

In this context, literature about determining factors of R&D investments can be divided into two perspectives. One deals with the managerial myopia – either driven by institutional ownership or by managers themselves – which leads to underinvestment into R&D (Baber et al, 1991; Porter, 1992) or reduction of R&D investments as a trade-off to meet short-term earning objectives (Bushee, 1998; Cheng, 2004). The other examines monitoring implications of investors, particularly family ownership (Anderson et al., 2003; Block, 2012) and institutional ownership (Bushee, 1998; Wahal and McConnell, 2000; Eng and Shackell, 2001) on R&D investments.

Considering both perspectives – the managerial myopia and the institutional monitoring on R&D investments – research shows how different and contradicting the findings about the role of institutional investors for long-term investments can be. While there is relevant research which does assign a negative relationship between institutional ownership and long-term investments (Graves, 1988; Porter, 1992), complementing and following research differentiate stronger between different characteristics of institutional investors and their implications on R&D investments (Bushee, 1998; Eng and Shackell, 2001).

Even though many studies show a positive association between institutional ownership and R&D investments, most of them used data from the US market between 1980 and 2000 (Bushee, 1998; Eng and Shackell, 2001; Aghion et al., 2013): A period when there was tremendous stock market volatility and large M&A activities which could influence findings (Lazonick, 2007). However, Brossard et al. (2013) employ data on the most innovative European companies based on the *EU Industrial R&D Investments Scorecard* between 2002 and 2009 and find a positive relation between institutional ownership and R&D investments.

Hence, the findings in the literature about the relationship between institutional investors and R&D investments are not consistent or cannot be considered as universal due to these limitations. Based on this discussion and since we see further potential to examine this relationship and that empirics mainly show a positive relationship between institutional investment horizon and R&D investments, we propose the following hypothesis:

H1: *Ceteris paribus*, institutional investment horizon is positively associated with R&D investments

Further, we notice that some studies suggest that higher institutional ownership concentration is positively associated with R&D investments (Cebula and Rossi, 2015; David et al.,1996) while others support a negative relationship in that regard (Francis and Smith, 1995; Bushee, 1998). Cebula and Rossi (2015) argue that higher ownership concentration reduces the possibility of owners to hold diversified portfolios and are thus more probable to neglect uncertain investments as well as implement a more conservative strategy. On the other hand, Bushee (1998) and Brossard et al. (2013) relate the positive relationship to the idea that increased influence through higher ownership concentration encourages investors to serve a monitoring role. Due to these conflicting findings, we see potential to further investigate this relationship and derive the following hypothesis based on the support for the monitoring theory:

H2: *Ceteris paribus*, institutional ownership concentration is positively associated with R&D investments

3. Methodology

This chapter starts with a brief description of the research design for this study. This is followed by an operationalization of institutional investors through various methods to determine their investment horizons and ownership concentration. Further, the measurement of the dependent variable R&D investments is defined. Moreover, controlling variables on a firm level will be presented and discussed. Next, the sample used in this research will be further scrutinized together with some descriptive data. Finally, the model will be presented and later used to test the hypotheses.

3.1 General Research Design

To test the hypotheses formulated in section 2.8, this paper follows a quantitative and deductive approach by investigating the association between different variables. Given the rather extensive research of prior literature regarding R&D investments and corporate decision-making as discussed in chapter 2, this field of research can be viewed as relatively mature. In that way, quantitative data and formal hypothesis testing to add specificity or new limitations to existing theories is a methodological fit (Edmondson and McManus, 2007).

Following the purpose of this paper, the relationship between institutional investors and long-term corporate decision-making will be tested using a method of multivariate ordinary least squares (OLS) to estimate R&D investments in a linear regression model. The hypotheses are tested on an unbalanced panel of European companies between 2005 and 2017. Data is collected from the database of Thomson Reuters EIKON. Further, we operationalize institutional ownership by linking it to investment horizons and ownership concentration. The relationship between institutional investment horizon and long-term decision-making (equation 1) as well as institutional ownership concentration and long-term decision-making (equation 2) are illustrated in the following generic models:

$$\text{R\&D investments} = \text{Institutional investment horizon} + \text{control variables} \tag{1}$$

$$\text{R\&D investments} = \text{Institutional ownership concentration} + \text{control variables} \tag{2}$$

3.2 Institutional Investment Horizon and Ownership Concentration

As described in the theory section, institutional investors have historically been classified in different ways for the purpose of analysing corporate decision-making. A potential method, that has been used in some studies, is to classify institutional investors by legal type (Chen, 2007; Brossard et al., 2013). The advantage of this method is that information about legal types of institutions are often available in data bases, while a major disadvantage is that institutions are not homogenous and there can be differences between institutional investors of the same legal type regarding investment horizons (Bushee, 2004). Hence, classifying institutions based on legal type might not be suitable because a type classification does not necessarily reflect investment horizons. Other studies classify institutions and their investment horizons through historic investment behaviour, particularly portfolio turnover (Bushee, 1998; Huang and Petkevich, 2016; Harford et al., 2017). Portfolio turnover is specifically used because it is based on the expectations that short-term investors trade stocks more frequently, while long-term investors' positions should be characterised by unchanged stock holdings for a longer period.

We partly draw inspiration by studies such as Bushee (1998) and Huang and Petkevich (2016) which operationalize institutional characteristics through several different variables and specifically incorporated the idea of capturing investment horizons by using trading turnover as a proxy. Our initial and main classification is based on portfolio turnover, which we determine first through "churn rates", and second through a simplified "portfolio turnover" method. In addition, we use institutional investors' "stability of holdings" as an alternative variable related to investment horizons. We use "churn rates" as our main model to determine investment horizon because this method is most accurate in capturing trading behaviour, while the other two models are easier in their application and used as alternatives in different studies, but also incorporate shortcomings. We argue for the usage of the main model and two complementing models to capture investment horizons because of the difficulties to capture it and intend to further strengthen potential findings with this attempt. By doing so, we cover institutional investment horizons through three measures by using a more complex method, one which is widely used and one which is simpler in its idea to test for the first hypothesis.

Because several studies (Eng and Shackell, 2001; Brossard et al., 2013) support institutional ownership concentration as a potential influential factor on corporate decisions, we use "combined influential institutional holdings" as another independent variable to test for the second hypothesis.

As we operationalize institutions from a firm perspective by investment horizons from short- to long-term, it is possible that institutional investors are considered long-term oriented with certain investment holdings while defined as short-term oriented with other investment holdings. The idea here is that institutions can apply different investment horizons for different investments. Moreover, this perspective is in line with the methods of Yan and Zhang (2009) as well as Huang and Petkevich (2016), to which we also refer to with our different classification methods.

3.2.1 Churn Rates

Investment horizons can be measured by using ownership turnover as a proxy, which implies that short-term oriented investors buy and sell frequently, whereas investors with long-term horizons less frequently change their ownership position. To capture the ownership turnover using churn rates, we follow procedures described by Yan and Zhang (2009) and Huang and Petkevich (2016), in which the churn rate for institutional investor i with respective investment in a firm is calculated as in equation 3.

$$CR_{i,t} = \frac{\sum |N_{j,i,t}P_{j,t} - N_{j,i,t-1}P_{j,t-1} - N_{j,i,t}\Delta P_{j,t}|}{\sum \frac{N_{j,i,t}P_{j,t} + N_{j,i,t-1}P_{j,t-1}}{2}} \tag{3}$$

$P_{j,t}$ and $N_{j,i,t}$ represent the price and number of shares held in stock j by investor i at quarter t. Basically, churn rates describe the rate of investors of a stock who change their respective investment through buying or selling within a given time period. Hereby, the value can range from 0 to 2 with 0 illustrating no change in investment holdings and 2 representing total divestment or buying shares for the first time. To aggregate the turnover from an investor's perspective to a firm level and measure the turnover for each stock, we use the weighted average churn rate of institutional investors holding in respective firms (equation 4).

$$Turnover\ of\ firm\ j = \sum_{i \in S} w_{j,i,t} \left(\frac{1}{8}\sum_{r=1}^{8} CR_{i,t-r+1}\right) \tag{4}$$

S represents the set of institutional investors within our sample, $w_{j,i,t}$ the weight of institutional investor i in quarter t in stock j as ownership in percentage of all institutional investors is considered. In each quarter, the investor turnover of each stock is measured as the weighted average of the total investor churn rates over the previous eight quarters. Unlike Huang and Petkevich (2016), we double the observed time period to eight quarters to capture the, presumably lengthier R&D investment horizon, more accurately. Based on these quarterly churn rates on firm level, we determine the annual churn rates as an average of the quarterly data. The use of churn rates to classify investment horizons is one of many widely accepted methods in academic literature and we consider churn rates as our main model due to the complexity as well as accuracy of the model and the support from previous research (Yan and Zhang, 2009; Huang and Petkevich, 2016). However, since the investment horizons of investors are difficult to define, and we see a variety of methods to determine this variable, two additional methods are complementary used to determine investment horizons.

3.2.2 Portfolio Turnover

As an alternative method to determine institutional investment horizons, we use a simplified method of portfolio turnover as defined by Bushee (1998) and as illustrated in equation 5. We first calculate, from an investor perspective, the sum of the absolute difference in portfolio weight – shares held times stock price – at quarter t and at the previous quarter t-1. Further, we add the portfolio weight investors are holding at quarter t and t-1 and sum these values on a quarterly basis. The quotient of all changes in investor portfolio weight and the total sum of portfolio weights of considered and previous quarter constitute the portfolio turnover per quarter on firm level.

$$\frac{\sum\left|\Delta w_{j,t}\right|}{\sum(w_{j,t} + \sum w_{j,t-1})} \tag{5}$$

The annual portfolio is calculated by taking the average of four quarters. This method also attributes to the idea that investment horizons can be determined through trading. The method is similar to that of churn rates but portfolio turnover represents a simpler alternative with a major difference of including changes in portfolio weights through changes in stock prices. Further, unlike churn rates, this variable is not weighted by investment size.

3.2.3 Stability of Holdings

Following Bushee (1998), we also use stability of holdings as a proxy for investment horizons and start by determining a variable on a quarterly basis that represents long-term (LT) holdings as presented in equation 6. Accordingly, LT = 1 if the institutional investor held stocks in firm j continuously for the prior eight quarters and LT= 0 otherwise. We multiply each investor's portfolio weight with this LT variable per quarter, compute the sum and divide it by the sum of each investor's portfolio weight in the quarter.

$$\frac{(\sum w_{j,t} LT_{j,t})}{\sum w_{j,t}} \tag{6}$$

Like previous approaches, we use the average of four quarters to determine the annual stability of holdings for firms. We considered this method a suitable alternative because it differs strongly to previous two methods by its strict classification of LT measured by continues investments. While the previous two methods care about trading frequency in its nuances, stability of holding reflects a much simpler perspective by solely focusing on being invested in the firm.

3.2.4 Combined Influential Institutional Holdings

Beyond these three applied methods which aim to capture investment horizons and reflect the focus of this thesis, we also include a measure of institutional ownership concentration to test the second hypothesis. Several studies, such as Bushee (1998), Brossard et al. (2013) and Aghion et al. (2013), support the perspective that institutional investor concentration enhances monitoring and influence on firms to become more innovative.

We measure institutional ownership concentration through "Combined Influential Institutional Holdings", which represents accumulated voting power of relevant institutional investors. Thereby, we consider the top 20 investors, excluding single investors with a voting power of less than 3%. Investors with voting power of less than 3% are excluded to be consistent with the sample we have set in general and used for the other classification methods as well. Also, by setting a minimum cut-off at 3%, this study focuses on influential investors.

3.3 R&D Investments

In this study, R&D investments do not include amortization of R&D since this is related to capitalized R&D, which rarely is organic and if so needs to meet strict criteria (see IAS 38 in the International Financial Reporting Standards for details). Instead, amortization of R&D might in many cases be a consequence of acquired and later capitalized R&D through M&A activities.

Some studies measure R&D through R&D productivity (i.e. patents per R&D dollar) as the dependent variable (Francis and Smith, 1995; Aghion et al., 2013). Although this approach could be relevant in this study because of the industry focus, we decide not to use output-based measures, such as patents, and only focus on R&D expenditures as input-based variables since patent regulations and assessments of quality may differ among countries. Hence, to measure R&D investments, we define our dependent variable as the R&D expenditure scaled with a variable that accounts for firm size. Since sales is often used as the scalable variable in literature (Berger, 1993; Bushee, 1998; Eng and Shackell, 2001), we use R&D intensity – R&D in relation to sales – as the dependent variable. For robustness reasons, and as suggested by Brossard et al. (2013), we also run tests in which R&D is set in relation to total assets. One reason for scaling R&D to assets rather than sales is that sales are often more volatile than assets (Brossard et al., 2013). In that sense, the dependent variable is likely to be more stable and not as affected by short-term fluctuations in sales when using R&D to assets as the dependent variable.

Although we have considered industry differences in R&D by focusing on a specific industry and aim to control the findings by running regressions on a sub-industry basis, it is possible to corroborate the results by computing average levels of R&D per sub-industry and year. This allows us to measure the abnormal level of R&D. Therefore, we test for the relationship between our independent variables and abnormal R&D as a third dependent variable. Abnormal R&D is defined by equation 7.

$$\text{ABNORMALR\&D} = (\text{R\&D/sales for firm}) - (\text{average R\&D/sales for sub-industry}) \qquad (7)$$

We use the term R&D investments when describing the dependent variables R&D to sales, R&D to assets or abnormal R&D.

R&D decisions are normally budgeted with some lead time in advance and hence, it could potentially take time for owners to influence corporate decision-making with long-term character. Further, changes in investments might be associated with adjustment costs, e.g. through additional administration or restructuring, which could cause hesitance for decision-makers. This is particularly the case for R&D projects due to the large amount of time required to generate returns (Himmelberg and Petersen, 1994; Hall, 2002; Brossard et al., 2013). Therefore, we test the dependent variable R&D investments with a time lag of one year and without any time lag. Like Brossard et al. (2013) and Cebula and Rossi (2015), we consider the use of a time lag of one year as our main model.

3.4 Control Variables

This paper uses a multivariate OLS method to incorporate potential effects of other variables. In addition to the different methods to classify investment horizons as described above, we include several control variables as listed below.

Financial Leverage

To control for the influence of financial leverage, we use debt to assets as a control variable. The capital structure of the firm is likely to influence the possibility of making long-term investments. A high debt burden may induce an attempt to service debt instead of making R&D investments. On the other hand, debt could be one way to finance the R&D expenditures. However, previous research show that firms with large long-term institutional owners usually use funds that are generated internally (Huang and Petkevich, 2016). Due to the potential restrictions of resources associated with a high leverage ratio, the coefficient is expected to be negative.

Profitability

The use of EBIT (Earnings before interest and taxes) to assets serves as a proxy to capture the influence of profitability on long-term decision-making. This control variable shows the availability of internally generated funds. Since internally generated funds are usually the preferred way of financing as described by Huang and Petkevich (2016), EBIT to assets can be expected to have a positive relationship with the dependent variable.

Growth Opportunities

Tobin's Q is included to control for expectations of growth. A high value implies growth opportunities and therefore more valuable R&D investments with a higher cost of cutting R&D expenditures for myopic reasons (Bushee, 1998). We assume that the book value of debt is equal to the market value of debt. The coefficient is expected to be positive.

Historical Growth Rate

We use sales growth as another proxy for firm growth. Unlike Tobin's Q that captures the implied growth rate, sales growth captures the historical growth rate. Sales growth also to some extent show availability of internally generated funds. However, a current high sales growth could imply that the management focus on short-term investments instead of considering long-term R&D investments.

Company Size

The number of employees serves as a measure of company size. Since we use sales and assets to scale R&D expenditures, those variables are not appropriate to be used as control variables for size (Brossard et al., 2013). Furthermore, a larger firm is more likely to enjoy the benefits of economies-of-scale and synergies. In that way, we expect large companies to invest relatively less in R&D and thus the coefficient to be negative. We use the natural logarithm for number of employees to reduce skewness.

Fixed effects

We introduce a dummy variable for year since the dependent variable may experience trends over the estimation period. Also, even though the companies included in this sample are required to use the same accounting standards, a transnational data set may induce differences on a country level that can affect the outcome. Therefore, we introduce a control variable on a country level to capture these potential differences. Finally, to capture differences among the sub-industries, a dummy variable determined by sub-industry is also included in the model.

3.5 Data Sample

The data sample consists of listed companies within the European Union (EU) that use the International Financial Reporting Standards (IFRS) and operate in the industrial goods industry during the years 2005 to 2017. For comparative reasons, the study begins in 2005, when the EU adapted IAS regulations so that IFRS became mandatory for listed companies. The initial idea for the sample selection was to select an industry within the EU which is mature and offers an adequate sample size. Also, R&D should be an essential component of the business within this industry. For instance, it appears to be less attractive to look extensively into general services or financial industries because the R&D investment level is relatively low compared to other industries.

Furthermore, we decided that industries in which firms are extensively dependent on R&D should not be considered. In many cases these expenses cannot easily been cut since the business is mainly based on the success of these R&D projects. Given the above discussion, we have decided that industrial goods with its sub-industries would be a suitable industry for the sample selection. Moreover, dividing the industrial goods industry into sub-industries allows us to cluster companies into groups with comparable peers and run regressions within these groups and thus reduce noise. To select the companies, we use the Thomson Reuters Business Classification (TRBC) of the industrial goods industry and consider the following classified sub-industries: Electrical Components & Equipment, Industrial Machinery & Equipment and Commercial Services & Supply.

The data sample only considers companies with a market cap of more than 10 M EUR by the time of selection (March 2018). This is a reasonable cut-off because it partly excludes young growth companies but does not necessarily neglect established small companies.

At the investor level, this paper focuses on the top 20 investors of each company. This ensures that only investors which can exercise influence on the management are considered. Moreover, we manually exclude non-institutional investors (such as individuals, corporations and family funds) from the analysis. Also, we exclude institutional investors with ownership of less than 3% to further ensure that the studied institutional investors are able to influence R&D investment decisions.

After this pre-selection, the data sample still included companies with abnormal R&D investments of double or even triple digits. As this degree of R&D investments is not sustainable, we further set the prerequisite of only covering companies with R&D investments at any point in the time series of at least 1% (similar to Bushee, 1998 and Chen, 2007) and a maximum of 8%. We consider this to be a range of reasonable R&D investment level for established companies within these sub-industries. Also, the R&D cut-offs resulted in a significant reduction of skewness without losing too many data points. Because of these restrictions, our final data set includes 107 companies with a total of 875 firm-year observations between 2005 and 2017. Table 1 displays a country distribution of the firm-year observations.

Table 1 – Country Distribution

Country	Firm-year observations
Austria	13
Belgium	11
Denmark	17
Finland	72
France	84
Germany	276
Greece	6
Italy	56
Luxembourg	4
Netherlands	17
Sweden	107
United Kingdom	212
Final sample	**875**

Based on this data, we make a pooled sample and conduct a cross-sectional analysis. Furthermore, the study uses an unbalanced panel of data. Since laws and regulations differ within the EU, all countries within the EU do not necessarily demand the publication of R&D information in quarterly or even annual reports (see IAS 34 in IFRS for more details), this paper uses annual R&D data to refer to a large and consistent sample. Data on control variables, ownership and R&D expenditures is collected from Thomson Reuters EIKON. However, since R&D expenditures are not always specified in the income statement and therefore sometimes missing in the database, we complement it manually with data points from annual reports. Furthermore, a cluster of selected data points provided by the databases has manually been checked against reported figures to enhance the validity of this study.

Since the EU adopted the IFRS framework as of 2005, and as the current form of IAS 38 was revised in March 2004 to include all intangible assets acquired in business combinations, the year of 2005 can be considered as a natural starting point for this study. Similar accounting requirements in the EU enhance and standardize disclosure quality, which allow us to collect data from a larger number of countries and include more data points.

By focusing on European companies, a specific industry and set a minimum of 10 companies within each sub-industry, this study uses a sufficient data sample size. Table 2 presents the selection criteria as well as the number of firms and firm-year observations used in this study.

Table 2 – Selection Criteria

Sample adjustments

Criteria	Firm-years	Firms
Initial sample with R&D data, 2005-2017	1760	187
Excluded:		
R&D/sales less than 1%	-564	-51
R&D/sales more than 8%	-139	-4
Missing independent variables	-163	-20
Fewer than 10 firms in the sub-industry	-19	-5
Final sample	**875**	**107**

3.6 The Model

To consider both time series and cross-sectional differences, this paper uses a multivariate analysis. To test the hypotheses, we use several models with different independent variables for institutional investors and change the dependent variable. We use four different measures of institutional investors, three that are related to investment horizon (churn rates, portfolio turnover and stability of holdings) and one related to ownership concentration (combined influential institutional holdings). Furthermore, the first three measurements are used to test our first hypothesis whereas the fourth measurement relates to the second hypothesis. The following general regression model (equation 8) will be used to test the association between R&D investments and institutional investors.

$$
\begin{aligned}
\text{R\&D Invest.} = \alpha &+ \beta_1 \text{Institutional Investors}_{j,t} + \beta_2 \text{Financial Leverage}_{\mathrm{j,t}} \\
&+ \beta_3 \text{Profitability}_{j,t} + \beta_4 \text{Expected Growth}_{j,t} \\
&+ \beta_5 \text{Historical Growth}_{j,t} + \beta_6 \mathit{Company\ Size}_{j,t} + \beta_7 \text{Year} \\
&+ \beta_8 \text{Country} + \beta_9 \text{Subindustry} + \varepsilon
\end{aligned} \tag{8}
$$

Variable Descriptions

R&D Investments	
$R\&DSALES_{j,t}$ $R\&DSALES_{j,t+1}$	= R&D in relation to sales
$R\&DASSETS_{j,t}$ $R\&DASSETS_{j,t+1}$	= R&D in relation to total assets
$ABNORMALR\&D_{t}$ $ABNORMALR\&D_{t+1}$	= Abnormal R&D

Institutional Investors	
$CHURN_{j,t}$	= Churn rates
$PT_{j,t}$	= Portfolio turnover
$STABILITY_{j,t}$	= Stability of holdings
$CIIH_{j,t}$	= Combined influential institutional holding is the sum of institutional investor ownership with at least 3% ownership stake during the estimation period

Control variable		
Financial $Leverage_{j,t}$	FINLEV	= Debt in relation to assets
$Profitability_{j,t}$	PROFIT	= EBIT in relation to assets
Expected $Growth_{j,t}$	EXPGROW	= (Market value equity + market value debt)/ total assets
Historical $Growth_{j,t}$	HISTGROW	= Change in sales from previous year
Company $Size_{j,t}$	SIZE	= Natural logarithm of number of employees in company
Year	YEAR	= Fixed year effects
Country	COUNTRY	= Fixed country effects
Sub-industry	SUBIND	= Fixed sub-industry effect

Other	
β	= Regression coefficient
α	= Regression intercept
ε	= Error term
j	= firm
t	= year of observation

4. Empirical Results and Analysis

In this chapter we address our hypotheses – the relationships between i) institutional investment horizon and R&D investments and ii) institutional ownership concentration and R&D investments – by presenting our empirical findings. We start by displaying descriptive statistics and providing background through a correlation matrix. This is followed by a presentation of our multivariate regression output. Additionally, we present some robustness tests to strengthen our statistical model and test for specific conditions.

4.1 Descriptive Statistics

Table 3 displays some descriptive statistics for the three dependent variables and all the independent variables. The mean for R&D to Sales (R&DSALES), R&D to Assets (R&DASSETS) and abnormal R&D (ABNORMALR&D) are 3%, 3.4% and 1% respectively. Despite setting specific cut-offs for the dependent variables, the data table shows rather low standard deviations of the dependent variables, ranging from 0.017 to 0.023. This could potentially indicate that the industry carries narrow R&D requirements despite the presence of several sub-industries.

Considering our main measurement of investment horizons, churn rates (CHURN), which can range from 0 to 2, the mean is in the lower end of the range, more specifically at 0.311. This indicates that institutional investors on average have not changed their investment holdings to a large extent. Based on our simplified portfolio turnover measurement (PT), we observe that institutions, on average, turn over 10.6 % of their portfolio. This value also appears to be rather low and therefore in line with the indications we observe from churn rates. According to the stability of holdings method (STABILITY), the data shows that, on average, 65.1% of the institutional investors hold their investments for at least two years. Although this measure does not capture the trading frequency, it further provides support that institutions tend to show long-term commitment.

With regards to the fourth measurement for institutional investors, combined influential institutional holdings (*CIIH*), the empirics display that influential institutions on average constitute 26.5% ownership. Given that the institutional investors have similar objectives and time horizons, this concentration of institutional ownership could potentially influence long-term corporate decisions, such as R&D investments.

Reflecting upon the control variables, the data sample includes companies with large deviations in terms of financial leverage, profitability, expected growth, historical growth and size. For instance, financial leverage (FINLEV) varies from 0% to 78.4% while profitability (PROFIT) ranges from -75% to 34.8%. In that way, the data sample includes companies with both high and non-existent debt burden and companies that are highly profitable and nonprofitable. Furthermore, the mean company has a financial leverage of 19.3%, profitability of 8% and a positive historical growth (HISTGROW) of 6.2%. A mean of 1.171 for expected growth (EXPGROW) imply further expectations of growth.

Table 3 – Descriptive Statistics

Dependent variable	Obs.	Mean	Std. Dev.	Min.	Max.
R&DSALES	875	0.030	0.017	0.010	0.080
R&DASSETS	875	0.034	0.023	0.004	0.192
ABNORMALR&D	875	0.010	0.017	-0.022	0.049
Institutional Investment Horizon					
CHURN	875	0.311	0.257	0.000	1.459
PT	875	0.106	0.073	0.003	0.518
STABILITY	875	0.651	0.331	0.000	1.000
CIIH	875	0.265	0.212	0.013	0.950
Control variable					
FINLEV	875	0.193	0.130	0.000	0.784
PROFIT	875	0.080	0.095	-0.750	0.348
EXPGROW	875	1.171	0.762	0.000	6.184
HISTGROW	875	0.062	0.193	-0.747	1.592
SIZE	875	8.061	1.638	2.708	12.133

The second column shows the number of firm-year observations for the data sample. Following that column, the table presents mean, standard deviation, minimum and maximum value for each variable.

Table 4 presents a correlation matrix that displays both the independent and the dependent variables. As expected, the dependent variables, R&DSALES and R&DASSETS, are highly correlated. Also, R&DASSETS is highly correlated with ABNORMALR&D. Further, we observe a significant positive relationship between CHURN and PT at the 1%-level. This is also in line with expectations as both variables capture trading frequency. Moreover, the table shows a significant negative correlation between both STABILITY and CHURN as well as between STABILITY and PT. This also seems highly probable as a higher trading frequency should translate into less stable portfolio holdings.

Combined influential institutions holdings (CIIH) is significantly positive correlated with the dependent variables R&DSALES and R&DASSETS. Further, this variable is significantly negative correlated with CHURN, indicating that trading frequency is lower when the level of institutional ownership is higher. Concerning PROFIT, one can observe a significant negative correlation of this variable to both R&DSALES and R&DASSETS, which we consider counter-intuitive. One would expect managers to be able to invest more into R&D as a high level of profitability indicate greater availability of internally generated funds. However, due to the lack of information about causality, it may be the case that high levels of R&D investments reduce profitability and not the other way around.

Regarding company size (SIZE), the variable shows a significant negative correlation to R&DSALES and R&DASSETS but a significant positive correlation to ABNORMALR&D. As previously explained, lower R&D investments could potentially be driven by economies-of-scales and synergies that firms gain with increasing size. Thus, smaller companies need to invest more heavily into R&D to take market shares while larger companies enjoy monopolistic advantages (Brossard et. al, 2013).

As some of the control variables are significantly correlated, the data sample may be suffering from multicollinearity. Hence, we will test the variance inflation factor (VIF) as part of our robustness tests. Furthermore, we will also test for autocorrelation using a Durbin-Watson test.

Table 4 – Correlation Matrix

	1.	2.	3.	4.	5.	6	7.	8.	9.	10.	11.	12.
1. R&DSALES$_t$	1											
2. R&DASSETS$_t$	0.714*	1										
3. ABNORMALR&D$_t$	-0.083	0.417*	1									
4. CHURN$_t$	-0.023	0.006	-0.029	1								
5. PT$_t$	0.028	0.050	0.034	0.333*	1							
6. STABILITY$_t$	0.007	-0.018	0.029	-0.816*	-0.304*	1						
7. CIIH$_t$	0.153*	0.167*	-0.006	-0.131*	-0.065	0.037	1					
8. FINLEV$_t$	0.048	0.014	0.036	0.005	0.111*	0.031	0.037	1				
9. PROFIT$_t$	-0.121*	-0.089*	-0.0622	-0.061	-0.148*	0.049	0.156*	-0.240*	1			
10. EXPGROW$_t$	-0.021	-0.041	-0.038	-0.015	-0.064	0.004	0,393*	-0.062	0.335*	1		
11. HISTGROW$_t$	-0.054	0.006	0.017	0.043	0.004	-0.112*	-0.025	-0.031	0.242*	0.078	1	
12. SIZE$_t$	-0.124*	-0.291*	0.200*	-0.031	-0.041	0.051	0.074	0.120*	0.185*	0.005	0.008	1

* <0.01

4.2 Relationship between R&D Investments and Institutional Ownership

Since a correlation matrix does not fully reflect on industry effects, collinearity between the variables and time dimensions, observed relationships need to be further scrutinized. Also, because many independent variables are correlated with each other, we conduct multiple regression analyses.

As previously mentioned, various studies suggest a positive relationship between institutional investment horizons and R&D investments and a positive relationship between institutional ownership concentration and R&D investments. We present our regression models by first setting R&D to sales as the dependent variable and run the regression with different time lags (t and t+1) for the different measurements of institutional investors. The usage of a one-year time lag is highlighted as it represents our main model. Next, we run the same regressions with R&D to assets as the dependent variable and then abnormal R&D as the dependent variable. Furthermore, we use four different measures of institutional investors, three that are related to investment horizon (churn rates, portfolio turnover and stability of holdings) and one only related to ownership concentration (combined influential institutional holdings) and present the regression output for each of these measurements as we notice significant correlation between these independent variables. The first three measurements help us investigate the first hypothesis and the fourth measurement is related to the second hypothesis.

4.2.1 Churn Rates

The results of our regression models that test the relationship between institutional investment horizon, measured through churn rates, and R&D investments, are shown in table 5. It reveals a highly significant (at the 1%-level) relationship between CHURN and R&DSALES with a time lag of one year with a negative coefficient of -0.060. With regard to the relationship between CHURN and R&DASSETS only the regression without time lag shows significant results, which are highly significant at the 1% level and suggest a negative relationship with a coefficient of -0.007. Finally, for the relationship between CHURN and ABNORMALR&D, we find high significance at the 1%-level without and with time lag. In both cases, a negative relationship is supported with coefficients of -0.072 and -0.061 respectively. Overall, our different regressions support a positive relationship between institutional investment horizons, captured by CHURN, and R&D investments, captured by R&DSALES, R&DASSETS and ABNORMALR&D, in four out of six cases. Among the significant relationships, the signs are similar, but the magnitude of the coefficient differs stronger in case of the relationship between

CHURN and R&DASSETS (without time lag) compared to the other cases. Despite this, we believe that the regression output generally support and confirm the first hypothesis. In other words, institutional investors that trade less frequently tend to hold companies that are associated with higher levels of R&D investments.[4] This is in line with expectations and support our hypothesis of a positive relationship between institutional investment horizon and R&D investments.

Table 5 – Regression with Churn Rates

	R&DSALES		R&DASSETS		ABNORMALR&D	
	No lag	1-year lag	No lag	1-year lag	No lag	1-year lag
Test variable	t	t+1	t	t+1	t	t+1
$CHURN_t$	-0.002	-0.060***	-0.007***	-0.005	-0.072***	-0.061***
	(0.002)	(0.018)	(0.002)	(0.003)	(0.023)	(0.018)
$FINLEV_t$	0.010**	-0.085	-0.006	0.015*	-0.132**	-0.084
	(0.004)	(0.048)	(0.005)	(0.007)	(0.057)	(0.048)
$PROFIT_t$	-0.012**	0.128*	0.026***	0.025***	0.179**	0.130*
	(0.005)	(0.058)	(0.007)	(0.008)	(0.069)	(0.058)
$EXPGROW_t$	0.000§	-0.023**	-0.001	-0.001	-0.034***	-0.023***
	(0.001)	(0.008)	(0.001)	(0.001)	(0.009)	(0.008)
$HISTGROW_t$	-0.006***	0.005	-0.001	0.003	0.005	0.005
	(0.002)	(0.019)	(0.002)	(0.003)	(0.024)	(0.019)
$SIZE_t$	0.000§	-0.042***	-0.006***	-0.005***	-0.056***	-0.042***
	(0.001)	(0.007)	(0.001)	(0.001)	(0.007)	(0.007)
CONSTANT	0.029***	0.436***	0.080***	0.058***	0.549***	0.407***
	(0.006)	(0.059)	(0.008)	(0.010)	(0.065)	(0.059)
Number of firms	107	104	107	104	107	104
Firm-years	875	819	875	819	875	819
Adjusted R^2	0.066	0.030	0.153	0.176	0.047	0.030
Fixed effects+	YES	YES	YES	YES	YES	YES
VIF_{MAX}	1.410	1.420	1.410	1.420	1.390	1.400
DW test	1.910	1.833	1.898	1.859	1.593[a]	1.278[b]

* <0.10, ** <0.05, *** <0.01 (two-tailed test). VIF = Variance Inflation Factor. DW=Durbin-Watson
( ) = Standard error. a = inconclusive. b = significant autocorrelation
+ = Dummy-variables for year, country and sub-industry included in regression model
§ = Coefficient for the variable is a non-zero value

Considering the control variables, particularly PROFIT appears to be very relevant since the empirical results show significance at different levels for the dependent variables in all six

[4] The higher the churn rates, the shorter the institutional investment horizon. Since CHURN shows a high significance to R&D investments in most cases and the regression output suggest negative coefficients, we interpret a positive association between institutional horizon and R&D investment

regressions. With exception to the case of PROFIT and R&DSALES without time lag, all coefficients have a positive sign. This could potentially be explained by the lack of information regarding causality. High profitability imply greater availability of internally generated funds while high levels of R&D investments reduce profitability. Another control variable, that bears particular relevance, is SIZE, which is highly significant at the 1%-level in five of six regressions for the dependent variables. The coefficient signs suggest a negative relationship between company size and the measurements we use to capture R&D investments. This could potentially be explained by stronger cost synergy effects that a firm gains with increased company size. Moreover, increased firm size indicate that companies might be established and not operating in a growth phase anymore. Hence, the urgency to innovate might be perceived by the management as lower than before.

The coefficients for FINLEV are significantly positive in two cases (R&DSALES without time lag and R&DASSETS with time lag) and significantly negative in one case (ABNORMALR&D without time lag). The positive coefficients may be due to the fact that firms finance R&D investments with debt while the negative coefficient may be explained by the company trying to service debt instead of making R&D investments. The regression output also shows that the coefficient for EXPGROW is negatively significant at the 5%-level with a one-year time lag and using R&DSALES as the dependent variable. Further, the regression output shows that EXPGROW is also negatively significant at the 1% level without and with time lag in case of ABNORMALR&D. This finding is surprising as it indicates that firms with lower expected growth tend to have higher levels of R&D investments. A potential explanation could be that, since lower expected growth expresses lower confidence in a firms' future, managers feel pressured to increase investments in R&D. An alternative explanation could be that the the time period required to generate return on such long-term investments is not fully captured by the varible.

4.2.2 Portfolio Turnover

Testing for institutional investment horizons measured by portfolio turnover (PT), the regression output (table 6) shows that this independent variable is in none of the six regressions significant. The regression models cannot confirm any association between institutional investment horizons and R&D investments. Although the usage of churn rates represents our main method to capture investment horizons and the portfolio turnover method is only used as a complementation, this can be interpreted as weakening the findings in the previous regression output.

Table 6 – Regression with Portfolio Turnover

	R&DSALES		R&DASSETS		ABNORMALR&D	
	No lag	1-year lag	No lag	1-year lag	No lag	1-year lag
Test variable	t	t+1	t	t+1	t	t+1
PT_t	-0.003	0.031	-0.001	-0.005	0.026	0.030
	(0.005)	(0.056)	(0.006)	(0.008)	(0.069)	(0.056)
$FINLEV_t$	0.010**	-0.092	-0.007	0.014*	-0.140**	-0.092
	(0.004)	(0.049)	(0.006)	(0.007)	(0.057)	(0.049)
$PROFIT_t$	-0.011**	0.134**	0.027***	0.025***	0.189**	0.136**
	(0.005)	(0.058)	(0.007)	(0.008)	(0.070)	(0.058)
$EXPGROW_t$	0.000§	-0.024***	-0.001	-0.001	-0.036***	-0.024***
	(0.001)	(0.008)	(0.001)	(0.001)	(0.009)	(0.008)
$HISTGROW_t$	-0.006***	0.005	-0.001	0.003	0.005	0.006
	(0.002)	(0.020)	(0.002)	(0.003)	(0.024)	(0.020)
$SIZE_t$	0.000§	-0.041***	-0.006***	-0.005***	-0.055***	-0.041***
	(0.001)	(0.007)	(0.001)	(0.001)	(0.007)	(0.007)
CONSTANT	0.028***	0.414***	0.078***	0.058***	0.524***	0.385***
	(0.006)	(0.059)	(0.008)	(0.010)	(0.065)	(0.059)
Number of firms	107	104	107	104	107	104
Firm-years	875	819	875	819	875	819
Adjusted R^2	0.062	0.029	0.148	0.172	0.048	0.029
Fixed effects+	YES	YES	YES	YES	YES	YES
VIF_{MAX}	1.410	1.420	1.410	1.420	1.410	1.420
DW test	1.910	1.833	1.898	1.859	1.593[a]	1.280[b]

* <0.10, ** <0.05, *** <0.01 (two-tailed test). VIF = Variance Inflation Factor. DW=Durbin-Watson
( ) = Standard error. a = inconclusive. b = significant autocorrelation
+ = Dummy-variables for year, country and sub-industry included in regression model
§ = Coefficient for the variable is a non-zero value

The control variables show similar output as in table 5. Among the control variables, PROFIT and SIZE show the most significant and strongest effects. For instance, looking at PROFIT the empirical analysis supports our expectations stated in section 3.4 with positive and significant coefficients in five of six regressions. However, we also observe a significant relationship with a negative coefficient of PROFIT in case of R&DSALES without any time lag. The negative coefficients in the table could be attributed to second-order effects.

4.2.3 Stability of Holdings

Table 7 presents a table when the third measurement for institutional investors is used in the regression model. Applying the stability of holdings (STABILITY) as a variable yield no significance when setting R&DSALES or ABNORMALR&D as the dependent variable. However, using R&DASSETS as the dependent variable, the coefficient for STABILITY is 0.004 at the 5% significance-level with no time lag. Like PT, the lack of further significance indicates that STABILITY cannot sufficiently explain the dependent variable. As in the regression outputs displayed above, the control variables show similar patterns.

Table 7 – Regression with Stability of Holdings

	R&DSALES		R&DASSETS		ABNORMALR&D	
	No lag	1-year lag	No lag	1-year lag	No lag	1-year lag
Test variable	t	t+1	t	t+1	t	t+1
$STABILITY_t$	0.001	0.026	0.004**	0.002	0.034	0.026
	(0.001)	(0.015)	(0.002)	(0.002)	(0.018)	(0.015)
$FINLEV_t$	0.010**	-0.089	-0.007	0.014*	-0.137**	-0.088
	(0.004)	(0.049)	(0.005)	(0.007)	(0.057)	(0.047)
$PROFIT_t$	-0.012**	0.129*	0.026***	0.025***	0.181**	0.131*
	(0.005)	(0.058)	(0.007)	(0.008)	(0.069)	(0.058)
$EXPGROW_t$	0.000§	-0.023***	-0.001	-0.001	-0.035***	-0.023***
	(0.001)	(0.008)	(0.001)	(0.001)	(0.009)	(0.008)
$HISTGROW_t$	-0.006***	0.007	-0.001	0.003	0.009	0.008
	(0.002)	(0.020)	(0.002)	(0.003)	(0.024)	(0.020)
$SIZE_t$	0.000§	-0.042***	-0.006***	-0.005***	-0.056***	-0.042***
	(0.001)	(0.007)	(0.001)	(0.001)	(0.007)	(0.007)
CONSTANT	0.027***	0.401***	0.075***	0.056***	0.505***	0.372***
	(0.006)	(0.059)	(0.008)	(0.010)	(0.065)	(0.059)
Number of firms	107	104	107	104	107	104
Firm-years	875	819	875	819	875	819
Adjusted R^2	0.063	0.029	0.151	0.173	0.048	0.029
Fixed effects+	YES	YES	YES	YES	YES	YES
VIF_{MAX}	1.400	1.410	1.400	1.410	1.400	1.410
DW test	1.908	1.833	1.898	1.859	1.594[a]	1.280[b]

* <0.10, ** <0.05, *** <0.01 (two-tailed test). VIF = Variance Inflation Factor. DW=Durbin-Watson
( ) = Standard error. a = inconclusive. b = significant autocorrelation
+ = Dummy-variables for year, country and sub-industry included in regression model
§ = Coefficient for the variable is a non-zero value

4.2.4 Combined Influential Institutional Holdings

To test the second hypothesis, we continue to run regressions with the fourth measurement of institutional investors to highlight ownership concentration. According to table 8, the measure for combined influential institutional holdings (CIIH) is highly significant with R&DSALES as the dependent variable without any time lag and highly significant with R&DASSETS as the dependent variable with and without time lag. In all three cases the coefficient is positive and very small: For the relationship between CIIH and R&DSALES without time lag, the coefficient is 0.0001, while for the relationship between CIIH and R&DASSETS without and with time lag the coefficient is 0.0001 and 0.0002 respectively. In contrast, the empirical results show neither with nor without time lag significance in the relationship between CIIH and ABNORMALR&D. Overall, three out of six tests confirm high significance between CIIH and the dependent variables. The positive coefficients close to zero indicate a positive but very limited influence by CIIH on the dependent variables. In that sense, the influence by concentration of influential institutional investors on the level of R&D investments seems to be of strong statistical significance but a lower economic significance and needs to be interpreted carefully. This could potentially be explained by the presence of both long-term and short-term institutional investors that act as counterbalance.

Table 8 – Regression with Combined Influential Institutional Holdings

	R&DSALES		R&DASSETS		ABNORMALR&D	
	No lag	1-year lag	No lag	1-year lag	No lag	1-year lag
Test variable	t	t+1	t	t+1	t	t+1
$CIIH_t$	0.000***§	0.000§	0.000***§	0.000***§	0.001	0.000§
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$FINLEV_t$	0.010**	-0.090	-0.006	0.015*	-0.138**	-0.090
	(0.004)	(0.049)	(0.005)	(0.007)	(0.057)	(0.049)
$PROFIT_t$	-0.011*	0.135**	0.028***	0.027***	0.188**	0.137**
	(0.005)	(0.058)	(0.007)	(0.008)	(0.069)	(0.058)
$EXPGROW_t$	0.000§	-0.023***	-0.001	-0.001	-0.036***	-0.024***
	(0.001)	(0.008)	(0.001)	(0.001)	(0.009)	(0.008)
$HISTGROW_t$	-0.005***	0.007	-0.001	0.004	0.008	0.008
	(0.002)	(0.020)	(0.002)	(0.003)	(0.024)	(0.020)
$SIZE_t$	0.000§	-0.042***	-0.006***	-0.005***	-0.056***	-0.042***
	(0.001)	(0.007)	(0.001)	(0.001)	(0.007)	(0.007)
CONSTANT	0.025***	0.406***	0.074***	0.051***	0.513***	0.378***
	(0.006)	(0.059)	(0.008)	(0.010)	(0.065)	(0.059)
Number of firms	107	104	107	104	107	104
Firm-years	875	819	875	819	875	819
Adjusted R^2	0.087	0.031	0.184	0.230	0.050	0.031
Fixed effects+	YES	YES	YES	YES	YES	YES
VIF_{MAX}	1.400	1.400	1.400	1.400	1.520	1.520
DW test	1.836	1.797	1.831	1.827	1.597[a]	1.262[b]

* <0.10, ** <0.05, *** <0.01 (two-tailed test). VIF = Variance Inflation Factor. DW=Durbin-Watson
( ) = Standard error. a = inconclusive. b = significant autocorrelation
+ = Dummy-variables for year, country and sub-industry included in regression model
§ = Coefficient for the variable is a non-zero value, full figure is mentioned in the text when significant

4.3 Hypothesis Testing

Summarizing the first three regression outputs, we notice some interesting findings. When we use churn rate to capture institutional investment horizon, we find confirmation to a high degree that institutional investment horizon is positively related to R&D investments due to high significance we find in four out of six regression outputs. We see our interpretation limited by a lack of significance for CHURN in two regressions. Nevertheless, we believe that the overall findings here strongly support our first hypothesis. In contrast, we do not find any significance to R&D investments when we capture investment horizons with the portfolio turnover-method (zero out of six) or only very little significance in case of the stability of holding-method (one out of six). The lack of significance we observe when using the other two methods might weaken the relevant findings of the churn rate-method. We declared the churn rate-method as our main model to capture institutional investment horizon with the argument that it is in our view the most accurate method as unlike the portfolio turnover method it does not recognize the effects of changing stock prices and unlike the stability of holding-method it does capture nuances of trading behaviour. For this reason, we still believe that the regression output we receive when using churn rates are most relevant and support our first hypothesis of a positive relationship between institutional investment horizon and R&D investment to a certain extent, even though the limitations we see through our other two methods need to be highlighted here. Moreover, the lack of pattern of significant values over the use of different time lags is surprising as the time to influence corporate decision-making was expected to be similar despite the use of different independent variables for institutional investors. Furthermore, the presence of both significantly positive and negative coefficients for the same control variable over the different time lags is difficult to interpret as they also differ when using different measurements for investment horizons.

As the measurement of institutional ownership concentration – combined influential institutional holdings – is statistically significant in three out of six regressions, the second hypothesis of a positive relationship between institutional ownership and R&D investments is confirmed.

4.4 Robustness Test

As the tables presented in the empirical analysis shows, the data suffers from autocorrelation when using a one-year time lag and setting the abnormal R&D as the dependent variable as the test statistic for the Durbin-Watson test (DW test) is below the lower value of the critical range according to the Durbin-Watson table. Furthermore, the test statistic is inconclusive when we run the regression without any time lag and using abnormal R&D as the dependent variable. In all regression displayed in this paper, the variance inflation factor (VIF_{MAX}) is never above two. Since previous research has used a variety of critical levels of VIF, differing from 4 to 10 (O'Brien, 2007), this data set does not suffer from significant multicollinearity. Furthermore, we try to make the model more robust by i) including three dependent variables ii) running regressions with and without time lags and iii) measure institutional investment horizon in three different ways. In that way, we believe that the regression output presented in the empirical analysis is rather robust.

5. Conclusion, Implications and Outlook

In the following section we conclude our study by interpreting our findings and connect the empirics to the literature. Further, we elaborate on improvement potential for our study. Beyond this, we reflect on the contributions for this study area and make suggestion for future research.

5.1 Is there a Relationship between Institutional Ownership and R&D Investments?

In this paper we investigate the relationship between institutional investors and long-term corporate decision-making. For this purpose, we examine institutional ownership and link it to R&D investments as a proxy for long-term investment decisions. Further, we operationalize institutions by differentiating them according to investment horizons through three different independent variables (churn rates, portfolio turnover and stability of holdings). Complementary to this, we study the impact of combined influential institutional holdings on R&D to understand the general influence of ownership concentration on corporate decisions as a fourth independent variable of institutional investors. Even though previous research found somewhat conflicting results about the relationship between R&D investments and institutional ownership, most studies support the idea that i) institutional investment horizon is positively related to R&D investments and ii) institutional ownership concentration is positively related to R&D investments. Based on this, we derived our hypotheses and expected to find similar results with altered conditions.

This study is based on a transnational dataset of 107 publicly listed firms of the industrial goods industry in EU countries with 875 firm-year observations between 2005 and 2017. We investigate these potential relationships by conducting several multivariate and cross-sectional regressions with fixed effects. Further, we conducted robustness tests to strengthen our study by investigating abnormal R&D levels in addition to the other dependent variables that are commonly used in previous research. However, we must acknowledge that the data in some cases suffer from autocorrelation.

Based on the empirical analysis, we draw three conclusions; First, there is a positive relationship between institutional investment horizon and R&D investments. The results support the expectations derived from previous literature (Bushee, 1998; Eng and Shackell, 2001; Aghion et al., 2013) and thus confirm hypothesis H1. In that regard, long-term oriented institutions appear to take a monitoring role and support long-term strategies, while short-term oriented institutions might further pressure management to achieve short-term objectives. In case of myopic behaviour, institutions that are assessed on a short-term basis might put pressure on management to align their interests and hence discouraging long-term investments (Graves, 1988). In contrast, other institutional owners with long-term perspectives might occupy a monitoring role, e.g. through the board of directors, and ensure disciplinary focus on long-term objectives and investments (Eng and Shackell, 2001).

Second, the empirical analysis shows significance for the relationship between combined influential institutional holdings and the depend variables. Since the coefficients for CIIH are close to zero irrespective of the dependent variable and usage of time lags, the empirical analysis indicates that the combined size of the influential institutional ownership has a limited impact on R&D investments. Still, we see confirmation for the second hypothesis, H2, of a positive relationship between institutional ownership concentration and R&D investments which is in line with the study of Bushee (1998) who found a positive relationship and opposes Cebula and Rossi (2015) who saw a negative relationship. However, this paper uses a unique definition of influential institutions which may explain the deviation from previous studies. Nevertheless, we also acknowledge that the positive coefficient is very small and hence indicates a limited influence by concentration of institutional ownership on R&D investments. A potential explanation could be that long-term and short-term oriented institutional investors outbalance each other so that a combined impact turns out to be very small. Put differently, influential institutional investors with diverse investment horizons have very limited effect on R&D investments while institutions with similar investment horizons significantly affect the level of R&D investments. This further complements the study by Shleifer and Vishny (1986) who argued that ownership structure, more specifically ownership concentration, influence agency costs and affect corporate decision-making as the preference of the investors also matter according to our research.

Third, the empirics indicate a general time lag between initiating influence by institutional owners and execution of the decision by the management. However, the observed time lags differ depending on the independent variable used for institutional investor ownership. We derive the implication that owners are slow in conveying their objectives, management is hesitant in their execution or that the R&D decision-process is slow. The general time lag could be explained by potential adjustment costs which create persistence (Brossard et al, 2013). For instance, institutional investors or management might avoid changing R&D investments in the light of high additional costs generated by adjustments. Differing time lags may be, from a technical perspective, a result of using different classification methods and different dependent variables. Further, this could potentially also be explained by different company specific features, such as the length of the budgeting process or the dynamics of the business. For example, a more dynamic business may require shorter lead times of R&D decisions.

5.2 Contribution and Limitations

We contribute to this research area by using a transnational dataset, which based on our literature research, can only be found in a study by Brossard et al. (2013). Numerous studies only refer to US data and cover a later period, while we differ by investigating European data in recent times. Regarding R&D lead times, previous researchers have used different time lags, but have not reported their results for varying time lags to the same extent. By including time lags, we capture the lead time of R&D decisions and expect similar patterns when using different time lags when running regressions with varying independent variables and dependent variables. However, the empirics show different time patterns for different regression set ups, i.e. we see significant values over all time lags, indicating a challenge to capture this time component. Beyond this, previous studies mainly scaled R&D in relation to size variables such as sales or assets, but do not relate them to a mean level of peer group R&D. We strengthened our model by also using abnormal R&D to sales, which to the best of our knowledge has not been applied in similar studies before.

Moreover, our study differentiates from others by focusing on a specific industry as R&D requirements may differ among industries. We aimed to obtain reliable and comparable data by selecting a narrow sector and only include three sub-industries. Interestingly, we find similar results as many previous studies, even though these other studies did not have the same narrow industry-focus. Hence, we contribute to this research area by strengthening the idea of a positive relationship between institutional investment horizons and R&D investments.

A major challenge of strengthening our models is to determine investment horizons since this is not directly observable and can only be approximated by capturing this through proxy variables. The lack of a technical definition for investment horizons is also confirmed by the large variety of methods applied in previous studies. Similarly, there are numerous ways to control for size, for instance in relation to sales or assets, and time (years of time lag) when it comes to R&D. Inspired by previous research, we also determined several cut-offs to balance our data sample.

Our study is limited in that way that it does not provide any statement about the quality of R&D, innovation and its potential value creation. We can only support the idea that institutional investment horizon has a positive relationship to R&D investments. Higher quantity of R&D as form of innovative input does not necessarily lead to higher innovation. Further, impulses and temptations to invest into R&D could also lead to overinvestments in R&D. In this context, our study does not provide any statement about neither how institutions impact R&D productivity nor how institutions contribute to a reduction of wasteful R&D investments. Another limitation of our model is that regressions only capture relationships between variables, not their causality. In our study, we assume that institutional investment horizons determine R&D investments. However, it could be the case that different R&D levels attract institutions with different investment horizons, i.e. firms that invest significantly into R&D attract long-term oriented institutions while firms that decrease R&D investments are appealing to short-term oriented institutions.

Regarding the challenge of capturing time horizons, we tackle this issue by applying different methods. Nevertheless, this could be improved by seeking and complementing our model with even more variables that attempt to measure the investment horizon. A qualitative approach by interviewing institutions to measure their investment horizon could have been an alternative. In terms of R&D, the model could have been extended by more variables and time lags. But our findings of significant values for the independent variables both with and without time lags provide some indications that the model, at least to some extent, captures the lead time in R&D. One way to further add creditability to our findings would be to complement our model with a regression that is based on changes in variables rather than using the level of each variable.

5.3 Future Research

Previous literature and the findings of our study offer many directions for further research. One potential area of interest is to investigate institutional ownership on corporate decision-making by using other proxies. Institutional investors can be operationalized differently, for instance by the representation in the board of directors or through public active engagement that can range from voting behaviour on the annual meeting to activist shareholder campaigns. We believe that the usage of a case study would be more suitable for such examinations. In contrast, this study area could be extended by using alternative measures of long-term corporate decision-making, e.g. investment decision about long-term assets such as property, plant and equipment (PPE). Investments in PPE might be more driven by daily operations than investments in R&D and potentially do not impact the income statement in the same way as R&D since PPE are capitalized. Nevertheless, such an investigation could provide complementary knowledge to which extent institutional influence even impact more operations-related decisions. It would also be interesting to analyse how institutions prioritize their influence on corporate decisions. Moreover, this study area could be extended by comparing regional differences regarding institutional influence on corporate decision-making and further distinguish between foreign and domestic institutional institutions. To conclude, this research area offers various opportunities for further investigations to understand the influential characteristics of institutional investors in a better way.

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