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Institutional Ownership and Firm Innovation

A Swedish Study on the Impact of Institutional Ownership on R&D Activity

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Abstract

Title	Institutional Ownership and Firm Innovation - A Swedish Study on the Impact of Institutional Ownership on R&D Activity
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Authors	Blomberg Persson Carl and Neubauer Robert
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Key words	Institutional Ownership, Firm Innovation, R&D Expenditures, Myopic Investment Behavior, Long-Term Value Creation
Purpose	The objective of this study is to investigate the relationship between institutional ownership and firm innovation in a Swedish and contemporary context.
Theoretical framework	The theoretical framework underlying this study is primarily based on the myopic institutions theory, which suggests that institutional investors have an inherent short-term focus that influences their attitude towards long-term investments such as R&D.
Methodology	This study employs multiple ordinary least squares (OLS) regressions to investigate the relationship between institutional ownership and firm innovation, measured by the proxy variable R&D-to-assets.
Empirical foundation	The complete data sample consists of 1059 firm observations from the Swedish stock index OMXSPI, covering the period from 2012 to 2021.
Conclusions	The result of this study shows that institutional ownership has a statistically significant negative impact on firm innovation. This finding aligns with anecdotal evidence and the myopic institutions theory, which suggests that institutional investors prioritize short-term gains over long-term value creation. An additional model exploring the interaction between institutional ownership and firm size confirms the negative effects of both variables on R&D. However, surprisingly, the joint effect of institutional ownership and size amplifies resource allocation towards R&D.

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1. Introduction

1.1 Background

Investments in new products, technologies, and processes, commonly referred to as research and development (‘’R&D’’), serves as an important foundation for growth and prosperity. In many ways, such investments may be viewed as a catalyst for economic expansion and an engine for growth (Aghion et al, 2013). R&D investments play a significant role in enhancing competitiveness and driving long-term value creation in companies of all sorts and sizes. On a larger and broader scale, investments in innovative projects are pivotal for creating wealth and facilitating further progress in regions, nations, and globally (Porter, 1992). For example, evidence has been found that there is a positive relationship between R&D intensity and BNP per capita (Ulku & Subramanian, 2004). In Sweden, the level of expenditures for research and development has increased steadily over the past decades and as of 2020 the country recorded the highest R&D intensity among all European countries (Eurostat, 2021).

According to Statistics Sweden (2022), one of the main characteristics of R&D investments is the inherent uncertainty that surrounds their outcomes. Moreover, these investments typically entail uncertainty related to the timing of costs and benefits, as expenses are incurred in the near-term whereas the potential payoff is realized at a later stage (David, Hitt & Gimeno, 2001). Therefore, engagement in innovative projects and activities typically require great patience and a long-term investment horizon. Financial theory suggests that all investments with a positive net present value should be undertaken regardless of the timing of costs and benefits (David, Hitt & Gimeno, 2001). However, in practice, many firms are hesitant to increase their R&D spending and activity (Scott, 2014). Consequently, the allocation of resources to research and development becomes a key financial decision for companies, as they must carefully consider the potential long-term benefits against the immediate costs and risks.

Despite the importance of innovation, uncertainty remains about the factors that influence a firm’s ability and willingness to engage in R&D activities. Porter (1992) suggested that the ownership structure of a company, including its form of ownership and the identity of its owners, may be an important component in understanding a firms’ investment behavior. More specifically, Porter argued that the goals and objectives of owners, as well as the size of their individual stakes and ability to influence management behavior, could offer further insights

into a company's likelihood of undertaking R&D investments. Previously, a lot of research has focused on the impact of financial constraints on innovation, whereas less emphasis has been put on the relationship between ownership and R&D (Brossard, Lavigne & Sakinc, 2013). However, based on Porter's propositions, the question arises of how various ownership structures influence firm innovation and R&D investment decisions.

One of the most notable categories of owners are institutional investors. This group includes, for example, pension- and mutual funds, insurance companies, investment firms, and more (Porter, 1992). These entities are all legal organizations pooling large amounts of capital with the main objective of managing these funds on behalf of their clients and investors. Since the early 1980s, European markets and companies have seen a considerable increase in the presence of these investors (Brossard, Lavigne & Sakinc, 2013). A similar trend of expanding institutional ownership has also been evident in Sweden. As of 2020, Swedish institutional investors accounted for approximately 45% of the total equity in Swedish companies (Euroclear, 2020). Simultaneously, foreign owners held around 42% of the equity, with a substantial portion expected to be institutional investors (Henrekson & Jakobson, 2011). Altogether, Sweden ranks among the top countries in Europe in terms of the proportion of institutional ownership to non-institutional ownership (Blackrock, 2020). The significant growth of institutions has come largely at the expense of more ‘’strategic’’ owners, such as individuals, families, and industrial companies (Brossard, Lavigne & Sakinc, 2013).

1.2 Problem discussion

Ever since the start of institutional investors' rapidly growing presence in the 1980s, the impact and importance of this type of ownership has been heavily debated. Largely, the interest around institutional investors revolves around the fact that these investors often hold substantial ownership stakes (Brossard, Lavigne & Sakinc, 2013). In turn, this typically renders significant influence and control over companies. One topic of discussion has been the influence of institutional ownership on firm innovation. Anecdotal evidence and critics of institutional ownership have long contended that such investors have an inherent nature of short-termism, potentially hampering innovation and reducing the resources spent on research and development (e.g., Jarrell, Lehn & Marr, 1985; Porter, 1992). These critics often draw on the hypothesis that institutional investors are *myopic*, implying a preference towards short-term returns and gains. In turn, this might inflict *managerial myopia* and a greater focus on short-

term earnings in institutionally owned companies' management teams (Bushee, 1998). If the supposition of institutions' myopic investment behavior is correct, there is an apparent risk that companies owned by institutions will underinvest in R&D and sacrifice long-term value creation (Porter, 1992).

While the relationship between institutional ownership and R&D expenditures has been previously explored, anecdotal propositions and empirical evidence seem to show somewhat mixed results. Previous research conducted in this area has predominantly focused on U.S. samples and often dates to the early 1980's, 1990's, and 2000's. For example, Porter (1992) suggested that the growing presence of institutional investors and their presumed myopic behavior could explain the decline in the competitiveness of U.S. firms in the late 1980's. Similarly, Graves (1988) found evidence that higher institutional holdings in the computer industry were associated with lower R&D activity. Furthermore, Bushee (1998) examined whether changes in earnings had implications for the change in R&D spending the subsequent year. The results were somewhat dispersed, however, indications showed that large holdings by institutions with high portfolio turnover significantly increased the probability of managers cutting back on R&D to compensate for earnings declines in the prior year.

In contrast to the aforementioned studies, a substantial body of research presents opposite findings. For example, one of the pioneering studies in this field conducted by Jarrell, Lehn and Marr (1985) found a positive relationship between institutional holdings and greater R&D activity. However, the authors argued that it was not necessarily institutions that influenced firm innovation positively, but rather institutions that seemed to favor firms with high R&D intensity. Furthermore, Baysinger, Kosnik and Turk (1991) and Hansen and Hill (1991) found similar evidence of a positive relationship. Both authors argued that one reason for this could be that institutional investors typically hold significant ownership stakes. As these might be complicated to divest, institutions are ''forced'' to embrace a long-term approach, in turn making them more open to engage in long-term value creating strategies such as R&D investments. Additionally, Baysinger, Kosnik and Turk argued that institutional investors typically have well-diversified investment portfolios. This allows them to spread the risks from R&D investments more effectively than other investors with smaller and less diversified portfolios.

1.3 Purpose and research question

Investments in research and development are important both on a firm specific as well as a national, more general, level. For firms, R&D is crucial for maintaining and enhancing competitiveness. Moreover, R&D plays a pivotal role in discovering new solutions and opportunities that can enrich society. As a result, the economic impact of this field is substantial. Furthermore, institutional investors possess significant ownership power in equity markets, typically granting them the ability to influence the strategic direction of the companies in which they invest. As the importance of such investors has increased, so has the need to understand what implications they have as shareholders. However, despite the significant importance of institutional ownership and R&D expenditures individually, no consensus has been reached on the relationship between the two.

The purpose of this paper is to investigate the relationship between institutional ownership and firm innovation in a contemporary Swedish context. The covered time period in this study will be 10 years, spanning from 2012 to 2021. As most of the existing literature is conducted on distant markets in earlier time periods, the aim of this study is to add new insight into the existing and somewhat outdated literature base. Moreover, Sweden is a well-suited location for this research due to its wide-spread institutional ownership and strong focus on firm innovation. For example, in 2020, Sweden was the European country with the highest R&D intensity (Eurostat, 2021). Additionally, Sweden is one of the countries in Europe with the greatest proportion of institutional ownership to non-institutional ownership (Blackrock, 2020). As both R&D expenditures and institutional ownership in Sweden has increased over the last decades, it is possible that the characteristics of these variables have undergone changes. Consequently, there appears to be a research gap in the existing literature in terms of both time and geographical market. To address this research gap, the following research question will be addressed:

- Does the level of institutional ownership affect R&D investments in listed Swedish companies?

1.4 Empirical findings

This study employs OLS-regression analysis to establish the relationship between institutional ownership and firm innovation, using R&D-to-assets as a proxy. To account for inherent differences between years and firms, the main model includes year controls and firm fixed effects. With a Swedish sample of 1059 observations spanning a 10-year period (2012-2021), the study finds evidence of a negative relationship between institutional ownership and R&D-to-assets. This relationship exhibits moderate statistical significance. Furthermore, to test the robustness of these findings and gain deeper insight into the relationship between institutional ownership and R&D, an additional model introduces an interaction variable between institutional ownership and size. In this additional model, institutional ownership alone still demonstrates a negative impact on R&D-to-assets. However, the positive coefficient of the interaction variable indicates that the joint effect of institutional ownership and size amplifies the allocation of resources towards R&D.

1.5 Contribution

This study contributes new insights to the existing and somewhat outdated literature base. Furthermore, Sweden makes an interesting geographical location as previous research has largely focused on distant markets, with a majority of studies conducted in the U.S. Consequently, this study offers a new and updated perspective on the relationship between institutional ownership and R&D. Additionally, as this study also considers the potential moderating effect of size on this relationship, the findings provide deeper indications on how institutional investors influence corporate decisions on R&D.

1.6 Outline

The following sections of this paper are structured as follows: Chapter 2 provides a practical and theoretical framework, along with a review of the empirical literature and prior research. Chapter 3 describes the data sample and discusses the variables used to examine the relationship between institutional ownership and R&D. Chapter 4 presents an overview of the methodology employed to address the research question. Subsequently, chapter 5 presents the study's results and provides an analysis of these. Chapter 6 displays an additional model that nuances the initial findings. Finally, chapter 7 concludes the study and discusses its implications.

2. Literature review

2.1 Practical framework

2.1.1 Conceptualization of research and development

According to Statistics Sweden (2022), R&D comprises ‘’creative and systematic work undertaken in order to increase the stock of knowledge and to devise new applications of available knowledge in all fields of science’’. An important aspect of investments within this field is that they involve a temporal trade-off between expenditures over the near-term and payoff over the long-term (David, Hitt & Gimeno, 2001). Therefore, R&D investments could have the effect of reducing short-term earnings and profitability (Eng & Shackell, 2001). Additionally, there is typically uncertainty about the costs involved and the time required to achieve anticipated outcomes (Statistics Sweden, 2022). David, Hitt and Gimeno (2001) write that fundamental financial theory suggests that investments with a positive net present value should be pursued regardless of the timing of costs and benefits. In spite of this, the authors argue that various stakeholders might have divergent temporal preferences where some could be conflicting with this proposition.

Based on this view, the temporal preferences of major stakeholders such as management and larger shareholders could play an important role in determining the R&D efforts of companies. This could be affected by the goals and the objectives of stakeholders; some are patient, long-term oriented and willing to wait for investments to pay off, whereas others are more impatient, short-term oriented and less eager to sit back and await potential benefits. Additionally, the risk attitude of stakeholders could play a part in determining their stance on R&D investments. R&D projects are inherently risky and uncertain by nature, which could cause more risk averse stakeholders to discourage such investments (Eng & Shackell, 2001). Altogether, it is likely that the temporal preferences of impactful stakeholders have an influence on corporations’ R&D investment policies and strategies. Nonetheless, disagreement appears to exist regarding the specific preferences certain stakeholders, such as institutional investors, have.

2.1.2 Conceptualization of institutional ownership

Institutional investors can be defined in different ways. In this study, however, institutions encompass banks, brokerage firms, foundations, government agencies, hedge funds, holding companies, insurance companies, investment advisors, mutual funds, pension funds, private

equity firms, sovereign wealth funds and, lastly, venture capital firms (Bloomberg, 2023). The most common trait among these entities is that they pool large amounts of capital from different sources and invest these funds on behalf of their clients, members, and partners (Chen, 2021). In turn, the managers of institutional funds are often compensated partly according to the size of the capital that they are managing (Brossard, Lavigne & Sakinc, 2013). As institutions are professional investors often managing substantial amounts of capital, they play a significant role in the financial markets. Additionally, given their substantial size, expertise and resources, institutional owners typically have the ability to exert influence over the operating companies in their portfolios.

Institutional investors may exert their influence on operating firms through various internal and external mechanisms (Brossard, Lavigne & Sakinc, 2013). Internally, large shareholdings typically grant them significant voting power, allowing them to influence board composition and decision making at annual meetings, thereby shaping corporate governance, strategy, and operations. They can also impact management composition policies to align them with their own interests. Externally, institutional investors can monitor management more closely and potentially sell their shares, thereby signaling dissatisfaction and causing a drop in stock price. Given that institutional owners typically hold a large proportion of equity, large selloffs could trigger temporary undervaluation of the firm which may be disadvantageous for managers (Bushee, 1998; Porter, 1992). Consequently, this dynamic discourages managers from deviating too much from the preferences of larger shareholders and encourages engagement and discussion between institutional owners and management (Brossard, Lavigne & Sakinc, 2013).

Importantly, there can be variations among sub-categories of institutional investors which may be influenced by factors such as their investment strategy, portfolio structure, and risk orientation (Çelik & Isaksson, 2014). These factors and choices impact the level of ownership engagement and the extent to which institutional investors exert the aforementioned influence. For instance, prevalent investment strategies encompass ‘’passive index’’ investors, ‘’passive fundamental’’ investors, and ‘’active fundamental’’ investors, each differing in their approach to company selection and investment management (Çelik & Isaksson, 2014). While passive index investors largely mimic a predefined index of shares, active fundamental investors rely more on continuous trading by buying and selling companies based on fundamental analysis. Consequently, these differences comprehend level of passivity or activity, portfolio size, and

diversification, and might in turn affect the way and degree to which institutions try to influence corporate decision makers.

Moreover, Statistics Sweden provides annual data on the shareholder structure of companies listed on Swedish marketplaces. In 2022, foreign investors held 37,8% of equity, financial corporations held 28,6%, non-financial corporations held 14,6%, households held 12,1%, non-profit organizations held 3,6%, and the general government held 3,3% (Statistics Sweden, 2023). Among financial corporations, where institutions are included, investment funds held the largest share of equity followed by insurance companies and pension funds, investment corporations, and other financial corporations. A noteworthy trend observed between 1984 and 2022 is the increase in ownership by investment funds and the decrease in ownership by insurance companies, pension funds, and investment companies. Moreover, foreign investors also hold a significant portion of total equity, with institutional investors comprising the majority of this ownership category (Henrekson & Jakobsson, 2011). Notably, foreign institutions are often characterized by a short-term focus, as they swiftly adjust their holdings based on macroeconomic conditions, currency exchange rates, and overall risk and sentiment (Kallifatides & Nachemson-Ekwall, 2016; Öqvist, 2018).

2.2 Theoretical framework

2.2.1 Myopic institutions theory

The myopic viewpoint is to a large extent the starting point in all literature on the relationship between institutional ownership and R&D spending. According to Hansen and Hill (1991), the myopic institutions theory implies that institutional fund executives face a short-term pressure to perform and display high returns. Jarrell, Lehn and Marr (1985) argue that there are two major sources of this alleged short-termism: the intense competition among capital managers (such as institutional investors), and the continuous scrutiny such actors are facing. Institutional investors have a fiduciary duty to manage the funds entrusted to them in the best interests of their clients, members, and investors. Inevitably, this dynamic creates an environment in which institutions are under continuous scrutiny and considerable pressure to perform adequate results. Accordingly, institutional investors constantly face the risk of clients withdrawing funds and reallocating their capital to other institutions if performance expectations are not met. In such scenarios, managers of institutional funds may experience potential loss of

compensation, as it is often contingent upon the size of their assets under management (Brossard, Lavigne & Sakinc, 2013).

Both Hansen and Hill (1991) and Jarrell, Lehn and Marr (1985) argue that the aforementioned dynamic leads to a short-run focus in institutional investors decision making and preferences. Alongside this, the short-term pressures and assessments may impact these investors to become more risk averse. Due to the substantial risks involved with R&D activity, where the benefits from investments materialize in the long-term rather than the short-term, the myopic viewpoint suggests that institutions influence management decisions to reduce resource allocation to R&D investments (Brossard, Lavigne & Sakinc, 2013). Thereby, the proposed myopic behavior of institutional investors in turn inflicts a myopic investment behavior in managers of their portfolio companies (Brossard, Lavigne & Sakinc, 2013). This is often referred to as ‘’managerial myopia’’. Altogether, through the lens of the myopic institutions theory, institutional investors discourage R&D investments and innovation, which causes firms to underinvest in projects that require a long-term focus and time horizon.

However, despite the widespread application of the myopic institutions theory, critics have argued that it presents an incomplete perspective (Kochhar & David, 1996). For example, some theoretical studies suggest that managers in portfolio companies, rather than institutional investors, exhibit myopic investment behavior. Supporters of this view argue that institutional investors, due to their significant ownership stakes, act as sophisticated monitors and pressure managers to engage in long-term investment decisions (Bushee, 1998). This alternative view positions corporate managers as the ones with short-term orientation, which may be caused by near-term incentives structures or the risk that executives will not be around to enjoy the benefits of long-term R&D investments (Scott, 2014). Moreover, critics highlight the diversity among institutional investors and argue against treating them as a homogenous group. They contend that the myopic institutions theory may only apply to certain subsets of institutional investors. Thus, while the myopic institutions theory serves as a common starting point in the literature on institutional ownership and innovation, it is important to acknowledge that it is not the definitive perspective but rather one viewpoint among others.

2.3 Empirical research

2.3.1 Impact of institutional ownership on R&D activity

Although anecdotal and theoretical propositions tend to favor the perception that institutional ownership has a damaging effect on R&D spending, the empirical evidence on its true impact show conflicting results. As previously mentioned in the first section of this paper, Graves (1988) found evidence supporting the myopic viewpoint and the prediction of a negative relationship between institutional ownership and R&D. Graves examined 22 firms and 112 observations in the American computer industry throughout the time span of 1976-1985. The results from his OLS-regression analyses suggested a significant negative relationship between institutional ownership and firm innovation when controlling for profit, market share and secular trend. This result was robust regardless of the dependent variable and its definition of R&D activity. Graves concluded that his results indicated that high levels of institutional ownership may inhibit engagement in longer term investments, such as R&D. Consequently, Graves argued that this could have profound implications for the U.S. economy, as it might harm the competitiveness of American firms.

In 1990, Graves (1990) added to his previous research by expanding the industries studied to include five more in addition to the computer industry. These were aerospace, chemicals, drugs and pharmaceuticals, computer peripherals, and soaps, detergents and specialty chemicals. As in his prior paper, Graves (1990) still aimed to examine the supposition that managers of firms with higher institutional ownership are pushed to increase focus on short-term profits. Graves extended the covered time span to 1965-1984 and the examined firms to 133. By using a similar methodology to the first study but also adding controls for liquidity, market share, and interest rates, Graves was unable to find any significant relationship between institutional ownership and R&D investment. Similar results of no significant relationship have also been found by David, Hitt and Gimeno (2001), who studied 73 large US firms in 1987-1993 and concluded that ownership alone was not sufficient to explain institutional owners' influence on R&D policies.

In contrast to Graves' findings, multiple articles have found evidence that institutional owners foster R&D investments (e.g., Jarrell, Lehn and Marr, 1985; Baysinger, Kosnik and Turk, 1991; Hansen and Hill, 1991). By examining a dispersed set of 19 industries and 324 firms, all listed in the Business Week's *R&D Scoreboard*, Jarrell, Lehn and Marr was one of the firsts to study

the association between institutional ownership and innovation. The authors drew on the concept of myopia and used the short-term argument in formulating the hypothesis that greater institutional ownership should be related with lower R&D. In spite of this belief, the authors were reversely able to conclude a positive relationship between institutional owners and long-term investment, thus contradicting the formulated hypotheses.

In line with the results of Jarrell, Lehn and Marr (1985), Baysinger, Kosnik and Turk (1991) as well as Hansen and Hill (1991) also found evidence that institutional investors encourage R&D investments. Baysinger, Kosnik and Turk examined 176 *Fortune 500* companies, partly selected on the basis of their R&D spending level. Using linear regression analyses with R&D spending per employee as the dependent variable and the percentage of institutional ownership as the main explanatory variable, the authors found that higher concentration of institutional holdings had a positive influence on the level of R&D spending.

This result is similar to the evidence found by Hansen and Hill (1991), who studied 129 firms in four research-intensive industries over a period of 10 years. As the relationship found was positive, Hansen and Hill concluded that managers in these industries did not show any signs of altering their R&D policies as a consequence of large institutions' short-term focus and profit pressures. The authors mentioned that two factors might have contributed to the positive relationship. First, that institutions are professional investors and decision makers who have learnt what to look for in a firm. Thus, because of experience, institutional investors are more likely to make rational choices and not disregard investments based on temporal differences. Second, institutional investors take substantial positions in companies. Due to high costs of exit, institutions are ''forced'' to engage in long-term strategies such as R&D investments.

Moreover, Kochhar and David (1996) recognized that anecdotal and empirical evidence presented contradictory results and an incomplete picture of institutional investors. As a consequence, the authors developed three competing hypotheses to test the validity of the most prevailing viewpoints on the behavior of such investors. In the first viewpoint, institutions were described as *myopic* investors. As previously mentioned, the myopic investor is one looking for short-term gains. Thus, Kochhar and David asserted that the myopic investor hypothesis predicted a negative relationship between institutional investors and R&D. The second hypothesis described institutions as *active* investors. According to Kochhar and David, active investors are more likely to influence firms in a direction of more innovation. This is because

active investors are closely involved in monitoring the managers and the strategic management of their portfolio companies. As active institutional investors usually hold large equity stakes that could be complicated to divest, Kochhar and David suggested that these investors are more open to long-term strategies and investments.

Lastly, the third hypothesis described institutions as *superior* investors. This hypothesis suggested that institutions are better positioned to process information before investing. As a consequence, they are said to have greater judgment, in turn enabling them to better select firms with value potential and innovative ability. As with the active investor, Kochhar and David predicted a positive relationship between institutional ownership and R&D for the superior investor. All in all, Kochhar and David's results provided evidence indicating a positive relationship between institutional holdings and R&D. Therefore, the authors did not find support for the hypothesis that institutions in general foster short-term orientation. Conversely, Kochhar and David suggested that the active investor hypothesis was valid, as institutions covered in their sample were shown to favor long-term investments such as R&D.

2.3.2 Impact of different types of institutional investors on R&D activity

Critics of the above-mentioned studies contend that institutional investors cannot be treated as a homogenous group due to potential variations in their approaches and behaviors. Consequently, several studies have investigated whether different types of institutions have varying effects on firm innovation. For example, Bushee (1998) separated between three groups of institutional investors: *transient*, *dedicated,* and *quasi-indexer*, as he aimed to answer how R&D expenditures were affected by drops in earnings the previous year. The study is conducted on US firms between the years 1983-1994 and the result is twofold: partly, Bushee's results indicate that if institutional ownership is higher, managers are less likely to cut back on R&D to make up for an earnings decline; partly, the results indicate that when institutional ownership is greater and the institutions have high portfolio turnover and are engaged in momentum trading, managers are more likely to draw back on R&D investments to cover prior year's earnings decline. Thus, Bushee argued that the relationship is dependent on the firms' current earnings performance and the characteristics of the institutional ownership.

Consistent with Bushee's (1998) nuanced results, both Eng and Shackell (2001) as well as Brossard, Lavigne and Sakinc (2013) also found a positive relationship between certain types of institutions and R&D, and a negative relationship for others. Eng and Shackell's study

covered large US industrial firms in the period of 1981-1991 and found that holdings by banks, insurance companies and investment advisors tended to be lower in firms with higher R&D. Reversely, holdings by ‘’other’’ types of institutional investors, including colleges and universities, private and public pensions, and private foundations, were higher when R&D was higher. Eng and Shackell suggested that some institutions are more ‘’influential’’ and that this could have implications for the level of R&D spending. However, the authors were cautious to establish a relationship with certainty, as they argue that the causation could go both ways; the relationship between institutional ownership and R&D could be because institutions have an impact on R&D policies, however, it could also be because different institutions are drawn to certain R&D policies.

Corresponding to Eng and Shackell’s hypothesis that some institutions are ‘’influential’’, Brossard, Lavigne and Sakinc (2013) found that institutions described as ‘’impatient’’ had a negative effect on R&D spending. Their study spanned over eight years and encompassed 324 large European innovative firms. The authors differentiate between ‘’gray’’ and ‘’independent’’, as well as ‘’patient’’ and ‘’impatient’’ institutional shareholders. ‘’Impatient’’ shareholders, who were shown to discourage R&D investments, include most notably mutual funds and hedge funds. In spite of these findings, Brossard, Lavigne and Sakinc argue that other types of institutional ownership can be effective in promoting innovation, given that ‘’impatient’’ shareholders do not hold large enough blocks of shares to hinder this influence.

Additionally, by including interaction variables between the level of institutional ownership and firm size, Brossard, Lavigne and Sakinc found that the negative influence of impatient shareholders was significant only for the 50% of the smallest companies in the sample. As companies with smaller capitalizations typically have more open ownership structures, they argue that impatient investors are more likely to reach a sufficient stake to be influential in such firms. In larger companies, however, it is less feasible for impatient shareholders to produce a negative influence on R&D spending, as ownership is more dispersed, and it is harder to reach the necessary threshold.

This view is shared by Mishra (2022), who examined S&P 1500-firms between 2000-2018. Mishra found evidence that banks, insurance companies, and public pension funds influence R&D spending positively, however, mutual funds and hedge funds have the opposite effect. Interestingly, Mishra suggests that the relationship between institutional ownership and R&D

in general is positively related until a certain threshold is reached. When ownership by institutional investors exceeds this threshold, managerial myopia sets in as a consequence of short-term focus and pressure from institutional investors.

2.4 Hypothesis development

Based on the theoretical framework and empirical research presented above, the views on the relationship between institutional ownership and R&D appears to be somewhat conflicting. The anecdotal evidence, largely related to the theory of the myopic institution, strongly suggests that the relationship is negative. Supporters of this hypothesis apply the short-term argument and propose that institutions are inherently affected by short-term pressures, in turn resulting in a preference for gains and earnings today, rather than tomorrow. Nevertheless, also taking the empirical evidence into account, the image becomes more nuanced and less angled in one direction. Although some empirical studies have found a negative relationship between institutional holdings and R&D activity, the center of gravity seems to be in the belief that institutional investors conversely facilitate engagement in R&D projects. In addition to this, some studies have suggested that institutional owners must not be regarded as a single, homogeneous entity. Depending on the characteristics of institutions ownership, and the goals and objectives of these investors, their influence on firms' R&D activities might vary.

Altogether, the literature provides an inconclusive picture of the researched relationship. Based on the theoretical and empirical framework, the following hypotheses are formulated:

H_0: *Institutional ownership has no significant impact on the level of firm innovation.*

H_1: *Institutional ownership has a significant impact on the level of firm innovation.*

3. Data

3.1 Sample description

This study is conducted using an unbalanced panel dataset of Swedish listed firms throughout the period of 2012-2021. This construction of the sample provides several benefits. Unbalanced panel data does not require panel members to have observations for all years. Consequently, this enables a larger sample. Furthermore, as has been highlighted before, Sweden has a history of high institutional ownership and a large focus on firm innovation. By examining the relationship between institutional ownership and R&D expenditures in such a setting, valuable insights can be extracted to better understand how institutional investors are impacting R&D activity in already innovative countries. Furthermore, by limiting the study to Sweden and focusing on a single country, the results are expected to be more explicit compared to if a greater area or region would have been studied. For example, if studying a sample of observations from different countries the results could be impacted by such as differences in regulations and tax incentives connected to R&D. Lastly, the chosen time span covers a recent period of time which may offer updated insights and fill in the gaps left by the somewhat outdated existing literature base.

Moreover, the data necessary for investigating the relationship between institutional ownership and R&D has been extracted from the financial data provider Bloomberg. Using a single source for all data collection is expected to lower measurement bias and improve data consistency as separate databases could calculate financial ratios and ownership data differently. Furthermore, as this study intends to examine the Swedish market overall, an index that captures large-cap, mid-cap, and small-cap companies was deemed necessary. Consequently, observations included in this study's sample come from the OMX Stockholm Index (OMXSPI). This index comprises all the shares trading on the Stockholm Stock Exchange (Nasdaq, 2023), thus including large-, mid-, and small cap firms.

In accordance with for example Jarrell, Lehn and Marr (1985) and Baysinger, Kosnik and Turk (1991), the sample includes firms from several industries. The distribution of observations by these industries is displayed in Exhibit 5. By not restricting the sample to certain sectors, the results are expected to be more credible and generalizable as they are not influenced by the choice of a small number of industries. However, to ensure the quality and reliability of the

data, firms that operate within the utilities and the financial services sector have been excluded. The main reason for this is that both utilities and financial firms are usually highly regulated (Scott, 2014). In addition, financial statements and ownership structures in those industries tend to differ from those of other industries (for example, utilities are not seldom partly owned by the state).

Ultimately, after also excluding firm observations where R&D expenditures were reported to be zero, the final sample of this study consisted of 1059 observations. These observations were distributed over 168 firms. While excluding observations with zero R&D expenditures may lead to sampling bias, we argue that these firms are likely to be fundamentally different from the firms that do invest in R&D. Therefore, we believe zero-R&D firms would have zero R&D regardless of their level of institutional ownership. Consequently, the findings of this study apply only to the subset of firms that have R&D expenditures and we caution against generalizing our results to firms that do not engage in R&D. By excluding mentioned observations, the aim is to obtain more accurate estimates of the impact of institutional ownership on R&D investments among the relevant firms, thereby enhancing the validity and reliability of our findings. This is in line with previous literature that either only studied certain industries with high R&D intensity (e.g., Graves, 1990; Hansen & Hill, 1991; Jarrell, Lehn & Marr, 1985) or firms with R&D expenses greater than zero (Eng & Shackell, 2001).

3.2 Variable definition

3.2.1 Dependent variable

In prior research, various approaches have been utilized to define and measure innovation. However, this study adopts the approach of using a firm's R&D expenditures to quantify it. R&D projects involve investments in the development of new products, processes, and technologies, making it a suitable proxy for innovation. Moreover, to allow for differences between companies, R&D expenditures are most commonly scaled by an appropriate denominator such as firm assets, sales, or employees (e.g., Brossard, Lavigne & Sakinc, 2013; Eng & Shackell, 2001; Graves, 1990). This study will apply *R&D-to-assets* as its dependent variable and main definition of firm innovation, thereby capturing the intensity of R&D expenditures relative to the size of each firm. According to Brossard, Lavigne and Sakinc (2013), this provides a more structural measure of R&D effort compared to R&D-to-sales and R&D per employee. Consequently, it is also more responsive to structural ownership

characteristics, which makes it suitable for this study. In addition to this, total assets tend to be less volatile and susceptible to external influences than sales and employees.

Importantly, proxying research and development expenditures for firm innovation only measures input and not output. Obviously, there is more to innovation than plainly allocating resources to investment projects. A company must be able to successfully manage the resources directed to R&D activities in order to create output value greater than the input value. Therefore, it is important to note that there are many aspects of innovation. In this paper, however, the focus will be on the corporate strategies and policies that promote innovation, i.e., the extent to which firms allocate resources to R&D activities, and what impact institutional ownership has on this decision-making process. Consequently, applying R&D expenditures as a proxy for firms' innovative efforts is assessed to be appropriate. The dependent variable is denoted as the following:

$$R\&D\ to\ Assets \quad = \frac{R\&D\ Expenditures}{Total\ Assets}$$

3.2.2 Main explanatory variable

The main explanatory variable used in this study is *Institutional ownership*, measured as the percentage of shares held by institutional investors. This approach of quantifying the amount of institutional ownership is common practice in existing research and has previously been applied by for example Jarrell, Lehn and Marr (1985), Graves (1990), and Kochhar and David (1996). As a consequence of data availability and the scope of this study, institutional investors will be treated as a homogeneous group and a single entity. This is in accordance with the work of for example Graves (1988; 1990), Jarrell, Lehn and Marr (1985), Baysinger, Kosnik and Turk (1991), Hansen and Hill (1991), and Kochhar and David (1996). In this study, the variable *Institutional ownership* includes banks, brokerage firms, foundations, governments, hedge funds, holding companies, insurance companies, investment advisors, mutual funds, pension funds, private equity firms, sovereign wealth funds and, lastly, venture capital firms (Bloomberg L.P., 2023).

3.2.3 Control variables

3.2.3.1 Insider ownership

The first control variable used in this study is *Insider ownership*, which represents the percentage of shares held by managers and directors. These insiders play an active role in the company's operations and are recognized to exert substantial influence over corporate policies (Morck, Schleifer & Vishny, 1988). According to Kochhar and David (1996), who also control for this variable, insiders with significant ownership stakes may prioritize long-term investments to increase firm value.

3.2.3.2 Size

Controlling for firm size is a customary practice in corporate finance research. Following the approach of Kochhar and David (1996) and David, Hitt and Gimeno (2001), this study will apply the variable *Size* using the logarithm of firm sales. Kochhar and David suggest that larger firms often possess greater capabilities and resources to pursue new product development and engage in R&D initiatives. Therefore, including this variable should be relevant for this study as well. Additionally, as discussed by Brossard, Lavigne and Sakinc (2013), firm size might have moderating effects on the relationship between institutional ownership and R&D as differences in ownership structures may affect institutions' ability to exert influence over managers' decision making.

3.2.3.3 Tobin's Q

Tobin's Q has frequently been employed as a control variable in prior studies examining the relationship between institutional ownership and firm innovation (e.g., Bushee, 1998; Brossard, Lavigne & Sakinc, 2013; Eng & Shackell, 2001; Mishra, 2022). This metric is calculated by dividing a firm's market value of equity and debt by its total assets (Bushee, 1998). Since Tobin's Q captures the incremental benefit-to-cost ratio of pursuing new investments, it serves as a proxy for growth and investment opportunities (Bushee, 1998; Eng & Shackell, 2001; Brossard, Lavigne & Sakinc, 2013). Accordingly, incorporating Tobin's Q into the regression equation is appropriate, as it is likely that firms with greater growth prospects also exhibit higher levels of R&D investment. *Tobin's Q* is denoted as the following:

$$Tobin's\ Q\ = \frac{Market\ Cap\ +\ Total\ Liabilities\ +\ Preferred\ Equity\ +\ Minority\ Interest}{Total\ Assets}$$

3.2.3.4 ROA

The fourth control variable is *ROA* (return on assets), which serves as a proxy for accounting performance. This variable has previously been employed by for example David, Hitt and Gimeno (2001) and Scott (2014). Return on assets provides an indication of how profitable a company is in relation to its assets, and how effectively assets are employed to generate a profit (Hargrave, 2022). Intuitively, more profitable firms are expected to have greater capacity and resources to invest in research and development. Consistent with this notion, prior research has identified a positive association between R&D and profitability (David, Hitt & Gimeno, 2001). *ROA* is denoted as the following:

$$ROA = \frac{Net\ Income}{Total\ Assets}$$

3.2.3.5 Leverage

Leverage is a frequent control variable in studies similar to this one and has previously been employed by for example Kochhar and David (1996), David, Hitt and Gimeno (2001) and Mishra (2022). Following the approach of Kochhar and David, leverage will be defined as firms' debt-to-equity ratio. The amount of leverage may influence a firm's ability to invest in research and development as highly leveraged firms may have more financial constraints. In turn, this could limit their capacity and ability to engage in innovative projects (Huang & Ritter, 2009; Kochhar & David, 1996). *Leverage* is denoted as the following:

$$Leverage = \frac{Total\ Debt}{Total\ Equity}$$

3.2.3.6 Liquidity

The last control variable included is *Liquidity*, measured as current assets divided by current liabilities. According to Kochhar and David (1996), it is important to control for liquidity as firms' short-term resources may impact their ability and capacity to allocate funding to research and development activities. Thus, by including it in the regression model, it is ensured that the results are not driven by differences in short-term liquidity. *Liquidity* is denoted as the following:

$$Liquidity = \frac{Current\ Assets}{Current\ Liabilities}$$

4. Methodology

4.1 OLS regression

In the analysis conducted in this study, an ordinary least squares (OLS) regression is employed using unbalanced panel data. This method has previously been applied by for example Jarrell, Lehn and Marr (1985), Baysinger, Turk and Kosnik (1991), and Eng and Shackell (2001). Panel data analysis is a widely utilized method in empirical research, particularly in studies involving multiple observations of the same set of individuals, firms, or countries over time. Unbalanced panel data involves utilizing all available observations, even if some firms have missing data for specific time periods. Consequently, by employing this method, the relationship between institutional ownership and innovation can be estimated while considering the entire dataset. This approach allows for the utilization of all available data for each firm throughout the entire period, accounting for both individual heterogeneity and time-varying factors.

4.2 Model specifications

To mitigate potential endogeneity concerns and individual heterogeneity in the analysis, the fixed effects method is adopted. This method allows for the control of company-specific unobserved time-invariant factors that might have correlations with both the independent and dependent variables, thereby reducing bias arising from omitted variable issues. In prior research, firm fixed effects have been applied by for example Graves (1988), Baysinger, Kosnik and Turk (1991), David, Hitt and Gimeno (2001), and Scott (2014). Furthermore, the suitability of the fixed effects method in this study is confirmed by the Hausman test, which determines its appropriateness over the random effects method (Exhibit 1).

Furthermore, to account for time-specific effects, the regression model incorporates year controls. By including these controls, any time-varying factors that could impact the relationship between institutional ownership and innovation are considered. Additionally, panel data analysis commonly encounters heteroskedasticity, which refers to unequal variances across observations. To tackle this issue, robust standard errors are employed, accounting for the clustering of observations at the firm level. This method enables the attainment of consistent and efficient parameter estimates in the model, even when heteroskedasticity is present

(Woolridge, 2018). As seen in Exhibit 2 in the appendix, the White test confirms the presence of heteroscedasticity in the data sample and supports the use of clustered robust standard errors.

4.3 Main model

In addition to the selected methodology, various firm-level characteristics that have been previously identified as significant determinants of R&D expenditures are controlled for. These characteristics, as described in section *3.2 Variable definition*, encompass *Insider ownership*, *Tobin's Q*, *Size*, *Liquidity*, *ROA*, and *Leverage*. By incorporating these control variables into the analysis, a more precise assessment of the impact of institutional ownership on innovation can be achieved.

To address the potential effect of extreme values, winsorization at the 1st and 99th percentile is applied to all independent variables except *Size*, which is calculated as the logarithm of firm sales. Winsorization helps minimize the impact of outliers by replacing extreme values with less extreme values falling within a pre-established range. Furthermore, the dependent variable *R&D-to-assets* is also subjected to winsorization, ensuring that extreme values do not disproportionately affect the estimated relationship between institutional ownership and innovation. The following represents the plain model of our multivariate panel regression:

$$R\&D\ to\ Assets_{i,t} = \alpha + \beta_1 InstitOwner\%_{i,t} + \beta_2 Insider\%_{i,t} + \beta_3 Tobin's\ Q_{i,t} + \beta_4 Size_{i,t} + \beta_5 Liquidity_{i,t} + \beta_6 ROA_{i,t} + \beta_7 Leverage_{i,t} + u_{i,t}$$

where *R&D to Assets*$_{i,t}$ is the dependent variable and the proxy for innovation of firm *i* at year *t*, α is the intercept, and β_n is the coefficient of the independent variables.

5. Empirical results and analysis

5.1 Summary statistics

The tables below present the summary statistics for all variables included in this study. The first table displays the raw variables, while the second table displays the variables as applied in the main regression model. Here, all variables except for *Size* have been winsorized at the 1st and 99th percentile to reduce the effect of outliers. As can be seen in Table 2, the dependent variable *R&D-to-assets* shows a minimum value of 0 and a maximum value of 0,87 after winsorization. Importantly, as observations with zero R&D were excluded from the sample, the minimum value of this variable is not in fact 0, but just somewhere in the decimal range. The mean value of 0,08 indicates that firms R&D-expenses were on average 8% of their total assets. As the mean value is greater than the median of 0,03, this indicates that the variable is slightly right skewed with a few larger values that pull the mean upward.

Furthermore, the mean and median value of the main explanatory variable *Institutional ownership* is relatively close to each other, suggesting fairly low variability in the sample. This is supported by a low standard deviation of 0,25. The mean value reveals that on average 57% of equity was held by institutional investors. However, as can be seen in Table 1, the maximum value indicates that institutional ownership exceeds 100 percent in some observations. According to Loth (2022), possible explanations for this could be delay in updates or short selling between investors. Regardless of the cause, ownership exceeding 100 percent is technically impossible, and to address this issue the variable is winsorized. After doing so, the maximum value is lowered to 1,05 which is more reasonable, yet still slightly above 1.

The issue of ownership exceeding 100% is also observed in the variable *Insider ownership* as the maximum value is 1,75. After winsorizing this value drops to 0,61. Furthermore, the mean value of 0,05 indicates that insiders held 5% of total equity on average. This is significantly lower than the mean value of *Institutional ownership*, which is expected since institutional investors typically manage significant amounts of capital. Moreover, the minimum value of -0,83 for *ROA* reveals that there are companies in the sample that are not profitable. As seen in Table 1, the mean value of *Sales* was 37 192 MSEK, thus significantly larger than the median. However, after taking the natural logarithm of sales to account for firm size, the variability decreases considerably (Table 2). Lastly, it appears that the winsorization had a significant

impact on the variables *Tobin's Q*, *Leverage* and *Liquidity*, considerably lowering the maximum values of these variables.

Summary statistics (raw variables)

	Mean	Median	SD	Min	Max	N
R&D-to-assets	0.08	0.03	0.15	0.00	1.78	1059
Instit. ownership	0.57	0.59	0.26	0.00	1.13	1059
Insider ownership	0.06	0.01	0.13	0.00	1.75	1059
Tobin's Q	2.81	1.81	2.90	0.50	41.34	1059
ROA	0.03	0.05	0.19	-1.41	1.28	1059
Sales	37192.13	3740.30	70679.69	0.03	431980	1059
Leverage	0.58	0.41	1.59	0.00	32.00	1059
Liquidity	2.33	1.62	2.51	0.17	27.49	1059

Table 1. Summary statistics of raw variables. *Sales* is reported in MSEK.

Summary statistics (winsorized variables)

	Mean	Median	SD	Min	Max	N
R&D-to-assets	0.08	0.03	0.12	0.00	0.87	1059
Instit. ownership	0.57	0.59	0.25	0.00	1.05	1059
Insider ownership	0.05	0.01	0.12	0.00	0.61	1059
Tobin's Q	2.74	1.81	2.40	0.73	13.81	1059
ROA	0.03	0.05	0.17	-0.83	0.54	1059
Size	22.01	22.04	2.75	10.17	26.79	1059
Leverage	0.50	0.41	0.55	0.00	3.57	1059
Liquidity	2.29	1.62	2.22	0.50	16.70	1059

Table 2. Summary statistics of winsorized variables. *R&D-to-assets*, *Institutional ownership*, *Insider ownership*, *Tobin's Q*, *ROA*, *Leverage*, and *Liquidity* have been winsorized at the 1st and 99th percentile. *Size* is the log of *Sales*.

5.2 Correlation matrix

Table 3 displays the pairwise correlations of this study's variables. Most notably, all independent variables except *Insider ownership* are highly statistically significant with the dependent variable *R&D-to-assets*. As seen in column (1), the main explanatory variable *Institutional ownership* is negatively correlated with *R&D-to-assets*. This indicates that when *Institutional ownership* increases, *R&D-to-assets* tend to decrease. Furthermore, among the control variables, *ROA*, *Size*, and *Leverage* also have negative correlation coefficients. As was described in the variable definition section, *ROA* and *Size* were predicted to have a positive impact on *R&D-to-assets*. Consequently, the negative correlations are somewhat surprising, although it does not imply causation. Moreover, the variables *Insider ownership*, *Tobin's Q*, and *Liquidity* all have positive correlations with the dependent variable. As these variables were predicted to impact *R&D-to-assets* positively, the positive correlations were expected. Lastly, it appears that all independent variables except for *Insider ownership* exhibit relatively high

correlations with the dependent variable. This suggests that the independent variables should have fairly strong potential to explain the dependent variable in the subsequent regression analysis.

Furthermore, looking at column (2), it is shown that the main explanatory variable *Institutional ownership* is highly significantly correlated with *Insider ownership*, *ROA,* and *Size*. The correlation is positive between *Institutional ownership* and the two latter variables, indicating that when *Institutional ownership* increases, *ROA* and *Size* also tends to increase. Moreover, the variable only shows a moderately significant correlation with *Liquidity* and no statistically significant correlation with *Tobin's Q* and *Leverage*. The correlations between *Institutional ownership* and these three variables are quite close to zero, indicating weak relationships. Overall, the correlation tables do not reveal any significantly high correlations between any of the variables. Therefore, based on the correlation matrix, there is no evidence of strong multicollinearity among the independent variables.

Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) R&D-to-assets	1.000							
(2) Instit. ownership	-0.205***	1.000						
(3) Insider ownership	0.049*	-0.306***	1.000					
(4) Tobin's Q	0.358***	-0.028	0.124***	1.000				
(5) ROA	-0.636***	0.192***	0.019	-0.061**	1.000			
(6) Size	-0.465***	0.318***	-0.232***	-0.415***	0.356***	1.000		
(7) Leverage	-0.209***	0.000	-0.083***	-0.216***	0.014	0.242***	1.000	
(8) Liquidity	0.197***	-0.073**	-0.002	0.363***	-0.211***	-0.523***	-0.333***	1.000

**** p<0.01, ** p<0.05, * p<0.1*

Table 3. Correlation matrix. *R&D-to-assets*, *Institutional ownership*, *Insider ownership*, *Tobin's Q*, *ROA*, *Leverage*, and *Liquidity* have been winsorized at the 1st and 99th percentile. *Size* is the log of firm sales.

5.3 Main model

Regression (1) down below presents the results for the main model of this study. Here, the dependent variable is *R&D-to-assets* and the main explanatory variable is *Institutional ownership*. As shown in Exhibit 1 in the appendix, the White test suggests the presence of heteroscedasticity. As a consequence, and as already described for in the methodology section, clustered robust standard errors are applied to account for this. Moreover, regression (1) also includes year controls and firm fixed effects, thereby accounting for time-invariant variations in R&D spending across different periods and firms in the sample. As exhibited in Exhibit 2 in the appendix, the Hausman test supports the applicability of fixed effects.

	(1)
VARIABLES	R&D-to-assets
Institutional ownership	-0.029**
	(0.012)
Insider ownership	0.056
	(0.041)
Tobin's Q	0.012***
	(0.004)
ROA	-0.233***
	(0.072)
Size	-0.017
	(0.011)
Leverage	-0.019
	(0.015)
Liquidity	-0.010**
	(0.005)
Constant	0.473*
	(0.242)
Year controls	Yes
Company fixed effects	Yes
Standard errors	Clustered
Observations	1,059
Number of firmid	162
R-squared	0.341

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4. Regression analysis using *R&D-to-assets* as proxy for innovation. *R&D-to-assets*, *Institutional ownership*, *Insider ownership*, *Tobin's Q*, *ROA*, *Leverage*, and *Liquidity* have been winsorized at the 1st and 99th percentile. *Size* is the log of firm sales. Year controls, company fixed effects, and clustered robust standard errors are applied in the model.

5.3.1 Main explanatory variable

As displayed in regression (1), the negative coefficient of the main explanatory variable *Institutional ownership* is statistically significant at the 5% confidence level. Consequently, this indicates that there is a statistically significant negative relationship between institutional ownership and R&D-to-assets, in turn implying that institutional investors have a damaging effect on the level of resources allocated to innovative projects and activities. Based on this finding, the null hypothesis presented in section *2.4 Hypothesis development* is rejected and it is concluded that institutional ownership does appear to have a significant impact on firm innovation, as proxied by R&D-to-assets.

The coefficient of the main explanatory variable *Institutional ownership* is -0,029, which implies that when the percentage of shares held by institutional investors increases by one percentage point, the ratio of *R&D-to-assets* on average decreases by 0,029, holding other variables constant. This can be compared to the mean value of *R&D-to-assets* of 0,08 (Table 2). Since the difference between these values are relatively small, this suggests that the economic impact of institutional ownership on R&D is considerable. However, as can be seen in the summary statistics (Table 2), the max value of R&D-to-assets was 0,87. Therefore, there are firms in the sample exhibiting significantly higher R&D intensity than the rest of the sample. Comparing the coefficient of -0,029 with the firms that deviate with a considerably higher R&D intensity than the average firm, the negative effect of institutional ownership appears to be less significant, economically speaking. Consequently, the R&D intensity of these firms are likely to remain relatively unchanged regardless of the level of institutional ownership.

The exhibited negative relationship could stem from various factors. Among previous literature, similar evidence has been found for example by Graves (1988), Eng and Shackell (2001), and Brossard, Lavigne and Sakinc (2013). In essence, the findings of regression (1) are supported by the theory of myopic institutions and the viewpoint that institutional investors are inherently more short-term oriented than strategic ones such as families, individuals, and industrial companies. As our results are in line with this reasoning, it should be considered as a plausible explanation. According to Jarrell, Lehn and Marr (1985), there are two major sources of this short-termism: the intense competition among actors managing capital on behalf of others, and the continuous scrutiny such actors are facing. Interestingly, this scrutiny and

evaluation have likely intensified in recent years as advancements in technology allows stakeholders more information to compare, assess and make transparent choices regarding which institutions they entrust with their money. Consequently, this may further foster a short-term mindset among institutional owners and, subsequently, a dismissive attitude towards risky R&D investments that require large upfront costs with potential benefits further down the line.

Furthermore, there has been a notable increase in the presence of institutional investors over the past decades. In Europe, Sweden is one of the countries that stands out with a considerable proportion of institutional ownership to non-institutional ownership (Blackrock, 2020). As institutional investors increasingly have come to dominate the ownership of equity in Sweden, it is also likely that the competition among such institutions has grown. With the heightened competition among institutional investors, it is possible that the pressure to deliver higher short-term returns and performances has intensified even further. Failure to do so would implicate a greater risk of losing clients, market share, and profitability to competing institutions. Consequently, it is conceivable that this escalating competitive landscape further has accelerated a short-term focus among institutional investors. In turn, this could serve as an explanation for the results indicating that institutions discourage R&D investments in their operating companies.

In contrast to the anecdotal suppositions and the views of the myopic institutions theory, a large proportion of the existing research base finds a positive relationship between institutional ownership and R&D (e.g., Baysinger, Kosnik & Turk, 1991; Hansen & Hill, 1991). The findings in regression (1) may deviate from this part of the existing literature for various reasons. Importantly, the majority of previous studies have been conducted on distant markets and date back in time. It is possible that the attributes of institutional ownership have undergone changes over time, potentially contributing to the divergence of our results from the mentioned studies. As previously discussed, two factors that could account for these changes may be the increased competition among institutional investors in Sweden and the enhanced capacity of their clients to scrutinize, assess and benchmark the performance of these investors. Also, more general and temporal factors such as changes in economic conditions and regulations should be considered as potential reasons for diverging findings.

Furthermore, it appears that the composition of institutional investors has changed in Sweden over time. Starting from the early 1990s, investment funds share of total ownership has

increased whereas insurance companies, pension funds and social security trust funds have experienced a slight decline in their ownership share (Statistics Sweden, 2023). In this study, institutional investors are treated as a homogeneous group. However, it is likely that the composition of sub-categories of institutional owners in our sample closely replicate that of Sweden. Moreover, it was shown by Brossard, Lavigne and Sakinc (2013) that ‘’impatient’’ shareholders, such as mutual funds and hedge funds, tend to discourage R&D investments whereas more ‘’patient’’ shareholders, including insurance companies and pension funds, have the opposite impact. Similar evidence has been found by Mishra (2022), who also suggested that insurance companies and pension funds belonged to the group of institutions influencing R&D spending positively, while mutual funds and hedge funds were shown to have a more short-focused approach.

Consequently, although not determined by certainty in this study, the varying investment behavior of different subsets of institutional investors in Sweden could serve as an explanation for the negative relationship found between institutional ownership and R&D in regression (1). A reason for this could be the growing presence of investment funds such as mutual and hedge funds, that have been found to be more impatient and short-term oriented than other institutional investors (Brossard, Lavigne & Sakinc, 2013; Mishra, 2022). Additionally, a large fraction of total ownership in Sweden is held by foreign institutions. Foreign investors tend to move swiftly between securities and asset classes based on macroeconomic conditions, currency exchange ratio, and overall risk and sentiment (Öqvist, 2018). Therefore, it is likely that these investors have a short-term orientation that could further help to explain our results.

Moreover, the sample of this study includes observations from multiple industries. It is likely that the relationship between institutional ownership and R&D can vary across industries and sectors, as some are more and some are less oriented towards growth and innovation. In this study, observations where R&D expenditures were reported to be zero were excluded and, consequently, the sample only includes firm observations with reported R&D expenditures. Apart from this sample choice, as well as the exclusion of financial and utility firms, no industries have actively been included or excluded based on their level of R&D intensity. As some of the studies in the existing literature base that finds a positive relationship between institutional ownership and R&D expenditures have focused solely on R&D intensive industries (e.g., Baysinger, Turk & Kosnik, 1991; Hansen & Hill, 1991), this could be a factor causing differences in our findings to others. As mentioned earlier, the main reason for not

following such an approach was mainly to be able to get generalizable results and a more conclusive picture of the studied relationship in Sweden.

Lastly, reversed causality must be considered when discussing potential explanations for the findings in regression (1). Above, the potential explanations for the negative relationship between institutional ownership and R&D largely revolved around institutions' supposed preference for short-term gains and benefits at the expense of long-term value creation. This explanation is built on the assumption that it is institutional ownership that has an impact on R&D, and not the other way around. As previously described, basic financial theory suggests that positive net present value investments should be undertaken regardless of the timing of costs and benefits. Consequently, if the explanations above are accurate it could imply that institutional investors on aggregate are irrational and disregard basic financial theory as a consequence of their short-term orientation.

An alternative explanation could therefore be that the causality is reversed, meaning that it is the R&D intensity in operating companies that affect the level of institutional ownership, and not the level of institutional ownership that affects the R&D intensity. This ''simultaneity problem'' has previously been considered by Eng and Shackell (2001) and could be a factor in our findings as well. If this proposition carries any truth, potential explanations for the negative relationship found could be that Swedish institutions are risk averse and invest in companies with lower risk, thus avoiding companies with high R&D intensity. The reasons for this risk aversion could be explained by pre-determined risk mandates that prevent certain institutions from engaging in risky investments. Additionally, the short-term performance pressures institutional investors face could influence them to allocate their capital to less risky investments.

5.3.2 Control variables

Apart from the main explanatory variable *Institutional ownership*, three other independent variables show statistical significance: *Tobin's Q*, *ROA*, and *Liquidity*. The coefficient of *Tobin's Q* is positive and statistically significant at the 1% confidence level. As *Tobin's Q* is applied as a proxy for growth and investment opportunities, a positive relationship was expected between this variable and *R&D-to-assets*. Consequently, it appears to hold true that companies with higher investment opportunities also invest more heavily in R&D. The coefficient of the two other variables mentioned above is somewhat more surprising. As

discussed in the variable definition section, higher profitability and liquidity should be associated with greater ability to engage in R&D activities and projects. Nevertheless, the findings of regression (1) are in contradiction with this proposition as the coefficients of both *ROA* and *Liquidity* are negative.

It is difficult to determine exactly what causes this divergence. Obviously, better profitability and liquidity improves firms' ability to provide resources to R&D projects, however, it does not reveal anything about these firms' willingness to do so. Although the variable *Size* is not significant, regression (1) shows that its coefficient is negative. Consequently, it could be that the larger firms in our sample engage relatively less in R&D activities compared to the small firms. Since larger firms are generally more profitable and have greater liquidity than smaller firms, this could offer an explanation to the negative coefficients of *ROA* and *Liquidity*.

Finally, the independent variables that do not show statistical significance include *Size*, as mentioned above, *Insider ownership*, and *Leverage*. The coefficient of *Insider ownership* is positive, which was anticipated since insiders generally prioritize long-term investments to increase firm value. Furthermore, *Leverage* shows a negative coefficient in regression (1). As highly leveraged firms should have less ability to engage in R&D investments, the sign of the coefficient was expected. Importantly, however, the coefficients of the mentioned variables were not significant and consequently no conclusions should be drawn from them.

6. Additional model

6.1 Interaction variable

Following Brossard, Lavigne and Sakinc (2013), the interaction term *Institutional ownership x Size* is incorporated into the main regression model. This interaction term allows us to examine whether the relationship between institutional ownership and innovation is contingent upon firm size. Given the differences in resources and capabilities between larger and smaller firms, it could be valuable to investigate if institutional ownership affects innovation differently depending on the size of the operating firm. In addition to this, Brossard, Lavigne and Sakinc (2013) made the argument that the ownership structure of smaller and larger firms may vary. In turn, they suggested that this could have an impact on institutional investors' influence on R&D.

Moreover, the inclusion of the interaction term enables us to capture any potential synergistic effects between institutional ownership and size on innovation. For example, although both institutional ownership and size were shown to have negative effects on R&D-to-assets above, it is possible that when these two factors interact, they may induce different effects on innovation compared to the independent effects of each variable. Additionally, the inclusion of the interaction term helps to further address the issue of potential omitted variable bias. Altogether, the following represents the model of our multivariate panel regression with the interaction term:

$$R\&D\ to\ Assets_{i,t} = \alpha + \beta_1 InstitOwner\%_{i,t} + \beta_2 Size_{i,t} + \beta_3 InstitOwner\% * Size_{i,t} + \beta_4 Insider\%_{i,t} + \beta_5 Tobin's\ Q_{i,t} + \beta_6 Liquidity_{i,t} + \beta_7 ROA_{i,t} + \beta_8 Leverage_{i,t} + u_{i,t}$$

where $R\&D\ to\ Assets_{i,t}$ is the dependent variable and the proxy for innovation of firm *i* at year *t*, α is the intercept, and β_n is the coefficient of the independent variables. Similarly to the main model, the additional model includes year controls, firm fixed effects, and robust clustered standard errors. This is supported by the Hausman test (Exhibit 3) and the White test (Exhibit 4), shown in the appendix.

6.2 The moderating effect of size

Regression (2) down below displays the results when the interaction term is included in the model. Similar to the main model, the results indicate that *Institutional ownership* has a negative main effect on *R&D-to-assets*. The coefficient of -0,359 suggests that, on average, a one percentage point increase in the variable *Institutional ownership* leads to a decrease of 0,359 units in *R&D-to-assets*, holding other variables constant. This implies that higher levels of institutional ownership alone are associated with a reduction in the allocation of assets to R&D activities. Consequently, companies with a greater proportion of institutional ownership may prioritize other uses of their assets over R&D. As seen below, this result is consistent with the results in regression (1). Notably, however, the coefficient of *Institutional ownership* increases considerably between the models, indicating that the negative impact of institutional ownership on R&D-to-assets becomes stronger when including the interaction variable.

	(1)	(2)
VARIABLES	R&D-to-assets	R&D-to-assets
Institutional ownership	-0.029**	-0.359***
	(0.012)	(0.135)
Insider ownership	0.056	0.053
	(0.041)	(0.040)
Tobin's Q	0.012***	0.012***
	(0.004)	(0.003)
ROA	-0.233***	-0.230***
	(0.072)	(0.071)
Size	-0.017	-0.024**
	(0.011)	(0.012)
Leverage	-0.019	-0.019
	(0.015)	(0.015)
Liquidity	-0.010**	-0.010**
	(0.005)	(0.004)
Institutional ownership x Size		0.015**
		(0.006)
Constant	0.473*	0.607**
	(0.242)	(0.259)
Year controls	Yes	Yes
Company fixed effects	Yes	Yes
Standard errors	Clustered	Clustered
Observations	1,059	1,059
R-squared	0.341	0.349
Number of firmid	162	162

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5. Regression analyses using *R&D-to-assets* as proxy for innovation. *R&D-to-assets*, *Institutional ownership*, *Insider ownership*, *Tobin's Q*, *ROA*, *Leverage*, and *Liquidity* have been winsorized at the 1st and 99th percentile. *Size* is the log of firm sales. Year controls, company fixed effects, and clustered robust standard errors are applied in both regression (1) and (2). Regression (2) includes the interaction term *Institutional ownership x Size*.

Furthermore, the variable *Size* has a negative main effect on the *R&D-to-assets* ratio in regression (2). This was already observed in the main regression model, although the variable was not significant. The coefficient of -0,024 indicates that larger companies, regardless of institutional ownership, tend to allocate a smaller proportion of their assets towards research and development. Here, a one-unit increase in *Size* is associated with a decrease of 0,024 units in *R&D-to-assets*, holding all other factors constant.

When it comes to the interaction term *Institutional ownership x Size* however, different results than intuitively expected are observed. The coefficient of 0,015 for the *Institutional ownership x Size* interaction term signifies an additional effect when both institutional ownership and size are considered together. When institutional ownership and size increase simultaneously, there is an incremental increase of 0,015 units in the *R&D-to-assets* ratio beyond what would be expected based on the individual effects of each variable. This implies that the joint influence of institutional ownership and size amplifies the allocation of assets towards research and development. It suggests that as companies become larger and attract higher levels of institutional ownership, they may be better positioned to leverage resources and expertise in R&D, leading to a greater emphasis on innovation activities. Since the coefficient is statistically significant on a 5% confidence level, it can be concluded that firm size appears to have a moderating effect of institutional ownership on firm innovation.

A possible explanation for the findings could be that larger companies have inherent advantages in terms of resources, networks, and organizational capabilities, making it easier for them to adopt and integrate innovations. Size provides companies with the necessary infrastructure and capacity to allocate assets towards R&D efforts effectively. As companies grow and attract higher levels of institutional ownership, it is possible that they can leverage these advantages to further enhance their innovation capabilities. Higher levels of institutional ownership indicate a greater degree of monitoring and oversight, which could lead to increased expectations for innovation and long-term growth. As a result, large companies with higher institutional ownership may allocate more assets towards R&D to meet these expectations and enhance their reputation and legitimacy in the market. Consequently, the simultaneous increase

in institutional ownership and size can signify a greater access to resources, expertise, and external networks, which are essential for effective innovation diffusion.

Moreover, Brossard, Lavigne and Sakinc (2013) argued, based on their findings, that the negative influence of ‘’impatient’’ and short-term oriented institutional investors diminishes as firm size increases. The authors proposed that these ‘’impatient’’ institutions need to reach a certain threshold of ownership to produce a negative influence on R&D. In larger companies where ownership is typically more dispersed, reaching this threshold is more challenging. In our sample, institutional investors are treated as a homogenous group. Consequently, this group likely includes both patient and less patient institutional investors. Regression (1) indicates that institutional ownership has a negative impact on R&D-to-assets. However, if Brossard, Lavigne and Sakinc’s (2013) supposition holds true and the negative influence of ‘’impatient’’ institutions on R&D decreases with firm size, this may provide an additional explanation for the findings in regression (2). In such a scenario, the impact of short-term oriented institutions would be less pronounced in larger firms, while the impact of long-term-oriented institutions would be more significant. As the latter ones are more likely to favor long-term investments such as R&D, this could serve as an explanation for the positive coefficient of the interaction variable.

7. Conclusion

7.1 Main findings

The purpose of this study was to examine the relationship between institutional ownership and firm innovation in a contemporary Swedish context. To achieve this objective, an OLS-regression analysis was conducted using a sample of 1059 observations spanning a 10-year period from 2012 to 2021. The results of the regression analysis indicated that institutional ownership had a statistically significant negative effect on firm innovation, as measured by R&D-to-assets. As a result, the null hypothesis was rejected and it was concluded that institutional ownership does appear to have a significant impact on firm innovation.

The findings of the main regression model are largely supported by anecdotal evidence and the myopic institutions theory. The myopic viewpoint suggests that institutional investors often prioritize short-term gains, which could help explain the observed negative impact on R&D investments. Various factors may contribute to this short-term orientation, including heightened competition among institutional investors and the increased ability of their clients and stakeholders to scrutinize, evaluate and compare their performance more effectively. These factors may create additional pressure for institutional investors to achieve favorable short-term results and could consequently offer a plausible explanation for our findings.

Furthermore, to assess the robustness of the main regression model and gain deeper insights into the relationship between institutional ownership and R&D, an additional model was introduced in section 6. This model incorporated an interaction variable between institutional ownership and size to explore the potential moderating effect of size on the impact of institutional ownership on R&D. Consistent with the findings of the main regression model, both institutional ownership and size were found to have independent negative effects on R&D-to-assets. However, the inclusion of the interaction variable revealed, somewhat surprisingly, that the joint effect of institutional ownership and size amplified the allocation of resources towards R&D.

7.2 Limitations and future research

The most notable limitation of this study is that it treats institutional investors as a homogenous group. Although this approach has frequently been employed in previous research, it is important to recognize that subsets of institutional investors may have varying goals, objectives, and investment behaviors. Consequently, their temporal preferences regarding the timing of costs and benefits, as well as their attitudes towards risk, are likely to vary. This could have an influence on individual institutional investors' view on R&D investments and firm innovation. As a result, treating institutional investors as a single entity to some extent ignores these differences, potentially overlooking the nuanced effects of institutional ownership on R&D.

Given the aforementioned limitation, future research should therefore focus on examining the effects of different types of institutional investors on R&D investments in Sweden. This approach would produce a more nuanced analysis, enabling a deeper understanding of the specific institutional characteristics that have varying impacts on firm innovation. By considering diverse strategies, goals, and behaviors of institutional investors, future researchers could obtain valuable insights into how different institutional investors influence R&D activities in Swedish firms.

Lastly, it is important to acknowledge that proxying firm innovation by R&D expenditures only captures the input aspect and not the output aspect of innovation. Consequently, future research could refine the definition of firm innovation and examine the relationship between institutional ownership and firm innovation using alternative measures, such as the introduction of new products or commercialization of R&D outcomes. This expanded perspective would provide additional insights into the role and expertise of institutional investors in fostering innovation within companies.

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Appendix

Exhibit 1. Regression (1), Hausman test

Hausman (1978) specification test

	Coef.
Chi-square test value	23.906
P-value	.012

Note: Hausman test for regression (1). As the p-value is below 0,05, it is concluded that fixed effects are preferred above random effects.

Exhibit 2. Regression (1), White test

White's specification test

White's test H0: Homoskedasticity Ha: Unrestricted heteroskedasticity chi2(107) = 413.44 Prob > chi2 = 0.0000 Cameron & Trivedi's decomposition of IM-test chi2	df	p
413.440	107	0.000
91.400	16	0.000
8.520	1	0.004
513.350	124	0.000

Note: White test for regression (1). As the p-value is below 0,05, it is concluded that the sample suffers from heteroscedasticity.

Exhibit 3. Regression (2), Hausman test

Hausman (1978) specification test

	Coef.
Chi-square test value	25.493
P-value	.004

Note: Hausman test for regression (2). As the p-value is below 0,05, it is concluded that fixed effects are preferred above random effects.

Exhibit 4. Regression (2), White test

White's specification test

White's test H0: Homoskedasticity Ha: Unrestricted heteroskedasticity chi2(43) = 333.76 Prob > chi2 = 0.0000 Cameron & Trivedi's decomposition of IM-test chi2	df	p
333.760	43	0.000
83.210	8	0.000
8.720	1	0.003
425.690	52	0.000

Note: White test for regression (2). As the p-value is below 0,05, it is concluded that the sample suffers from heteroscedasticity.

Exhibit 5. Tabulation by Industry

Tabulation by Industry

Industry	Freq.	Percent	Cum.
Automobiles and Parts	29	2.74	2.74
Basic Resources	108	10.20	12.94
Construction and Materials	100	9.44	22.38
Consumer Products and Services	75	7.08	29.46
Food, Beverage and Tobacco	10	0.94	30.41
Health Care	242	22.85	53.26
Industrial Goods and Services	236	22.29	75.54
Media	9	0.85	76.39
Personal Care, Drug and Grocery Stores	20	1.89	78.28
Technology	163	15.39	93.67
Telecommunications	60	5.67	99.34
Travel and Leisure	7	0.66	100.00
Total	1059	100.00	

Note: Tabulation by Industry for the full sample of 1059 observations.