Stockholm School of Economics
Accounting Department
Course 639

The Direct and Indirect Impact of Ownership on Research and Development (R&D)

A study on 50 largest publicly traded firms during 2005-2010

Abstract

This essay investigates the direct as well as the indirect relation between ownership and R&D-to-Sales, using capital structure variables as intermediaries. The data sample of the study is based on the 50 largest publicly traded firms in Sweden for the period of 2005-2010. Although previous literature suggested the prevalence of a relation between ownership and R&D, our analysis has shown it is far more spurious than though before. Nevertheless, by studying the empirical results along with the causal relation that we have envisaged for the text along with vetted econometric techniques as well as solid theoretical overview – we have been able to provide and interesting peek into some of the more dynamic factors impacting R&D.

Keywords: Ownership; Research and Development; Innovation; Leverage and Liquidity.

Supervisors: AP. Torkel Strömsten & AP. Henrik Andersson
Submission date: 09.00 May 14th
Author: Ranj I. Bafri (21181)

Acknowledgements

I would like to thank my advisors at Stockholm School of Economics, Associate Professor Torkel Strömsten and Associate Professor Henrik Andersson, for giving insightful comments on drafts of this paper and helped me to design, develop and deploy the idea into operation. This essay would not be possible without the interference of these two men and for that I thank them greatly. I would also like to thank Professor Johnny Lind, whom initiated and steered the idea in the first place into what it subsequently came to be.

This essay is dedicated to all those who choose knowledge over ignorance – and succeed.

Ranj I. Bafri

Table of Content

1 Introduction

"Scientia est potentia" or knowledge is power – that is an age-old phrase that was phrased during the Roman Empire, but they could just as well have said it of today's conditions – when the stock of information is doubled every five years, causing the increasingly asymmetrical world to change like never before (Jungwirth 2002:90). The impact of this has left few immune to the forces of globalization – but nowhere is the cost of failure greater than in the marketplace were companies compete with their products in an ever tighter globalized and interconnected world. Since it is in the natural interest of the state to induce large-scale knowledge production and research in order to stay competitive, you might be alarmed to learn that the majority of the advanced research is being run out at corporate R&D-centers (OECD 2008). As such, we will be looking to investigate the impact of ownership on R&D in the 50 largest publicly traded firms in Sweden. The impact of ownership on corporations has been described in the literature based on *profitability* (Westord et al 2010), *corporate governance* (Bhabra et al 2003), *cost efficiency* (Mutter et al 2007), *valuation* (Clark et al 2005), *legitimacy* (Chan et al 2007), *competitive situation* (Ramaswamy 2001), *market entry* (Brown et al 2003) but also *strategy* (Amihud et al 1999). The added value of this essay is in furthering the knowledge of the dual impact (direct vis-à-vis indirect) of ownership on R&D. Yet, our starting position will be to establish the variables impacting R&D and leveraging that in order to hone in the prevalent Swedish conditions in based on the data set.

The dependent variable in this essay is the level of *R&D-intensity* and the independent variables are categorized into the direct effect (of ownership) and indirect effect (of leverage and liquidity) for more on this see figure 1 in appendix. Our main focus however, is and will always be the relationship between ownership and R&D – i.e. the direct impact. Yet, the study into the indirect variables, are just as important and there has been multiple studies concentration on the impact of *capital structure* (Chen 2010), *average industry R&D-level* (Doh et al 2009), *high-tech* (Gökce et al 2010) and *foreign direct investments* (Ray et al 2008) but until recently few studies had made a focused attempt on establishing both the direct and indirect impact on R&D. Nevertheless, this should not be seen as an invitation to include all sorts of intermediate variables that might impact R&D-funding. Therefore our contention is to keep all, but few and most relevant factors – having an already established and significant relation with R&D – outside the preview of the text.

Our motivation for this is, since ownership structure impacts other aspects of business such as *governance* (Bebczuk 2005), *planning* (Wood et al 1979) and *dividends* (Shah et al 2011) – we should be able, by studying the ownership-impact on R&D, derive general deductions on the level of impact that ownership has on strategic corporate issues beyond the scope of R&D. However, and it should be abundantly clear, that we don't expect the relation between ownership and R&D to be strong – since ownership is merely one among dozens of variables impacting R&D–and we are lucky if we get a handful of variables that are significant. Further, to complicate things a bit, there is no unanimous taxonomy of ownership in the literature and the definition is dependent on the article of interest and the study-design. Studies have included typologies ranging from *wealth* (Kabir et al 1997), *corporate control* (Franks et al 1990), *ownership concentration* (Slovin et al 1993), *classes of shares* (Agrawal et al 1990) and *voting rights* (Bhagat et al 1991). We will proceed with *operationalizing* ownership in order to empirically test in subsequent sections.

1.1 Research question and purpose

The overall purpose of the essay is to empirically test whether different kinds of *ownership* structures – either *directly* or *indirectly* – have an impact on *research and development* (R&D). The intermediate variables that we utilize are the capital structure variables such as *leverage* and *liquidity*. The sample selection will contain 50 largest firms in the Sweden for the period 2005–2010. The casual relationship that we have envisaged can best be depicted in figure 1 and we use the Hirschman-model as a conceptual tool to analyze.

1.2 Choice of material and Disposition

The essay will start-off with the theoretical foundation of the topic and will cover the issues that are most relevant at hand, concerning R&D as well as ownership. In the last segment of this section, we present a hypothesis were we choose to view the empirical results with. In the next section we eventually cover the methods of the essay by creating the regression-models that we will run in the results-section. Also it is here were we will make necessary econometric and economic considerations to be able to draw inferences from the results section. In the results-section, section 4, we present the results and make necessary analysis in order to understand the test results and it is here where judge the validity of our hypotheses. The body-text of the essay is finished with the conclusion, summary and discussion of the essay and the final section is the literature.

2 Background and Theoretical Overview

Since our intention in this essay is to establish the link between ownership and R&D, we will in this part provide the literature review of R&D, ownership and *nested* hypothesis based on the literature review. We will start with the R&D and review the common features of R&D such as importance, characteristics and determinants and review some of the variables included in our models. While in the ownership review we introduce the ownership typology that we have subsequently tested in the empirics. We have therefore badged up hypothesis and theory nested definitions of ownership in order to provide better structure and easier reading while keeping all but the most relevant elements of the text outside the scope of the essay.

2.1 Research and development (R&D)

Research and development (R&D) refers to the fundamental research, as well as applied research and development tests conducted in order to develop a product, technique or enhance a method of doing business. Here, the organization for economic corporation and development (OECD) has defined R&D as,

> *"[…] creative work undertaken on a systematic basis in order to increase the stock of knowledge […] including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications […]."* (OECD 2008:69)

R&D does of course make up a strong residue of the importance of the scale of development in an organization or even a country and advanced research often represents the value added by the firm in a competitive market (Aboody et al 2000; Franko 1989 and Hall 1998). Here, even if R&D is being considered to be the main driver of innovation, it is not always clear that innovation has historically been driven by focused R&D research. Most of the great contributions to the cutting-edge science and technology have historically been done by chance and accident rather than committed and dedicated effort. Such is the case with the invention of penicillin, the creation of laser and x-ray – all of which was not intended and as such was creation by chance and often byproduct of something else, hence the residue. Nevertheless, advanced research has made a great impact in the capital-intensive industries of information technology, telecom, biomedicine and healthcare over the last decades. These combined efforts have been made with the help of dedicated team of scientists and engineers focusing on one specific task at hand. As such, innovation and cutting edge science comes in an area were

there are a dedicated effort to create a solution for a specific problem. Furthermore, in some industries, the level of R&D is vital for the survival of the firm – such as the case in biotech, health sciences, IT and other capital-intensive firms (Chan et al 1990). Nevertheless, different firms in same or different industries differ in their R&D activities – which is something that has a great impact on profit performance and the longevity and success of the firm (Ettlie 1998 and Mosakowski 1993). As stated above, we have in this essay chosen to investigate the R&D-relation both *directly* and *indirectly* – although our main concern is the direct relationship between R&D and ownership, hence most energy will go there. But since ownership is hardly the only variable impacting the level of R&D, we have in addition chosen to look at the indirect relation, and for the purposes of this essay we look at the *leverage* and *liquidity* impact on R&D, something that previous studies have shown to impact R&D (Cyert et al 1963; Bourgeois 1981; Singh 1986; Zajac et al 1991; Long et al 1985; Taylor et al 1998; Chen 2010; Hsu et al 2011 and La Porta et al 1999). The causal relation that we have envisioned in this context is viewed in figure 1 – were we have pin down both the direct as well as indirect relation between ownership and R&D.

==========
Insert Figure 1 about here
==========

We have already pointed that although R&D is, sometimes, crucial for firm survival – there is a discretionary element involved in making these decisions and often is expressed within the firm's top echelon. Yet the management of the firm is appointees by the shareholders, i.e. largest owners, and we argue that all strategic decisions are taken in congruence with the influential owners. Jensen et al (1976), for instance, noted that there are a great correlation between management actions and firm ownership, implying that firm ownership does play a significant role on the onslaught of management discretion on R&D intensity. As such, the foundation for R&D-decisions can either be *financial theory*, that focus on pecking order, information asymmetry and this field has generally been overwhelmed by the agency theory, or the impact of *ownership structure*. The main focus of the role of ownership is that different types of owners have different positions, barging power, monitoring ability, investment horizons and *pressure points* with corporate executives (Hoskisson et al 2002). The ultimate decisions on R&D-levels are taken by managers and the influence of (different) owners are varied which indicate that (voice) owners have greater ability in exerting their will on managers while other lack that and as

such it is our hope to provide an insight into this still unknown territory.

The indirect relation between ownership and R&D, include two types of intermediary variables, being liquidity and leverage. These two variables, as stated above, have in the literature been analyzed, researched and proven to have an impact on R&D and as such it could not elude us the fact that ownership might work indirectly thru these variables and impact R&D (Cyert et al 1963; Bourgeois 1981; Singh 1986; Zajac et al 1991; Long et al 1985; Taylor et al 1998; Chen 2010; Hsu et al 2011 and La Porta et al 1999). Starting with *liquidity*, there are two main streams in the literature viewing excess liquidity and slack as either a prelude to increased R&D-commitment levels (Cyert et al 1963; Bourgeois 1981 and Singh 1986) or it is being viewed as a feature of inefficiency, complacency and disincentive toward innovative solutions (Chen 2010). We have in this essay only focused on the high-discretion liquidity (slacks) that involve cash and marketable securities, dividends and liquidity.[1] The empirical studies into these issues have all showed that increased slack is positively correlated with *innovation* (Zajac et al 1991) and additional *risk taking* behavior (Singh 1986). Hence we argue in this essay that slack is positively correlated with R&D-levels. Going over to *leverage*, the literature is divided on how leverage might impact the R&D-levels. There is a consensus that the increased levels of long-term leverage will have a negative impact on R&D based on several studies that has been done (Baysinger et al 1989 and Taylor et al 1998). Financial and long-term leverage is viewed as a risky position for companies to be in but empirical studies have shown that the higher the financial leverage the greater impact on anticipated profit performance (Song 2005). As such, leverage is being used to alter the cash flows of firms and financial position of a company. Yet often times, leverage is essential for additional *risky* projects in terms of R&D-commitments were studies have shown that the short-term leverage is essential for increased R&D-commitments (Martinez-Ros et al 2007).

2.2 Ownership

Berle and Means (1968) were among the first to point that corporate control without ownership was the natural outcome of the modern day corporate development (Berle et al 1968:66f.). Although this was the common consensus for long time – Hirschman (1970) launched a theory that came to turn this idea upside-down and emphasized

[1] There is also a low-discretion slack that involves fixed assets, inventory and labor.

increased involvement by different interests. The Hirschman model was particularly practical tool of analysis in the ownership research were it became interpreted as ownership involvement in day-to-day operations. In subsequent of that, Hawley (1995) developed the concept even further and based on the Hirschman-typology, argued that there has, in some respect, been a "remarriage" between ownership and corporate control (Hawley 1995418f. and Hedlund et al 1985:56f.f.). For the purposes of this essay, we will look at the thru the lenses formulated by Hawley and Hedlund. The starting point of the Hirschman-model and how it is applicable in the ownership classification is the issue of definition. *Voice*, according to Hirschman (1970:30), is,

> […] *any attempt at all to change, rather than to escape from, an objectionable state of affairs, whether through individual or collective petition to the management directly in charge, through appeal to higher authority with the intention of forcing a change in management, or through various types of actions* […]. (Hirschman 1970:30)

In this regard – voice is the main variable to consider in this venue – since its impact on business operations is the most interesting. One can always include exit in the interest of symmetry and logic of the typology and system of the theory, but the main point is how voice in general and investor influence in particular, impacts day-to-day operations in the business whether being exerted in a *overt* or *tacit* manner (Hedlund et al 1985 and Hawley 1995). As such, voice mitigates corporate influence on behalf of investors while retaining the integrity of corporate control to managers (Hawley 1995:420f.). The governing symmetries of the impact that voice and exit model has on the level of R&D-commitments can further be disaggregated by the type of ownership based on legal and hierarchal classification. We have in this essay decided on a five-class ownership typology – which can be seen in section 2.3 and the impact of voice versus exit is differing dependent on the type of ownership class that one chooses to view the issue with respect to R&D-funding. Here the general rule of thumb is, the longer the ownership outlook of an investor, the higher the voice involvement in the day-to-day operations of the firm and by definition the more willingness to ensure the ius accrescendi, i.e. the survivability and continuance of the firm. This can best be served by the higher R&D-funding in order to remain competitive on the market. Traditional long-term investors beside family owners are, large institutions such as corporations (subsidiary) and pension funds, government and state and other non-financial and non-government organizations – such as unions and cooperatives of industries. We will in the coming sections be going over

the ownership classification that we have chosen and connect it to the voice and exit model – for more on this see section 2.3. Before that, we go through how voice and exit behavior impacts R&D-to-Sales commitment levels.

The extent of exit characteristics is to a large degree emanated from the size and sale of block of shares. On a functioning capital market, it entails that every time the expected return on the amount invested is due to increase elsewhere, there will be an immediate retreat and liquidation of the position (Hedlund et al 1985:57f.). A strong exit-behavior by the majority of the investor constituents insert that the management of the corporation is a poor one and slacks in terms of providing adequate market return and as such becomes a take-over target for potential raiders (Hedlund et al 1985:60f.). Therefore and despite that liquidity and financial slack might be positively correlated to the R&D-levels, it is viewed as a slack by management and viewed as to leading to poor performance. Per definition, the exit behavior is widely combined with decreased R&D-commitments (Hawley 1995) and this kind of investors will therefore lead to diminished rate of R&D-funding allocation and yield-increasing fund managers are the prime example of that. Here, the managerial responsibility is to combine and balance off two contrasting forces, of managerial incentive for heightened R&D-reallocation (and by definition to increase the ability of empire building Liu 2007; Mayers 1984 and Mezghanni 2009) on the one hand, and to cut slack and increase the attractiveness of the organization in question from the preview of investors on the other. This type of behavior is common among institutional investment managers that are evaluated based on performance on the stock market and has characteristically short investment interval. Pension funds and family owners are however the typical long time investors looking to ensure the longevity as well as development of the firm and they exert their voice to that end (Hedlund et al 1985:60f.f.). The decisions to allocate a set of R&D-funding are commonly taken on the highest echelon of the firm – usually corporate managers, that in turn are block-share-owner-appointees. As such, it is not totally out of order, to assume that the decision to allocate a set of resources to R&D-activities follows the overall corporate strategy and as such is taken with, at least tacit, knowledge of voice-owners. Further, just like the owners impact on corporate appointment is prevalent – so is the impact on day-to-day-operations. Thereby, the active voice owner might be a relay for increased R&D-funds when purchasing a block of shares in the firm.

2.3 Typology of Ownership

In the previous section we went through the conceptual Hirschman-model and how to view the investor and ownership behavior toward R&D-funding. In order to complete the picture, we look at the more concrete ownership typology of legal and hierarchal classification and R&D-intensity. Although the Hirschman model is an important one, it's vague and has to be backed up by more concrete definitions that provide an enhanced opportunity to operationalize it. Nevertheless, the guidance and support attained thru the lenses of Hirschman's model, is an essential component in completing the circle of investor influence, on the one hand, and strategic commitments and conceptualizing the theory, on the other. The variables that we have chosen to view the ownership typology with, has been decided by both Hawley (1995:416f.f.) and Thomsen et al (2000:692f.f.) and we have created a typology that consist of *bank, family, institutional, pension funds* and *foreign ownership*. The reason, which we have chose this categorization was due to our desire to make a substantial overhaul and examine the relation between ownership and R&D-funding, which has always been the driving purpose of this essay.

Bank Ownership: Bank ownership is to a large degree non-existent in the Anglo-Saxon world but very prevalent in the Germanic model (Charkham 1994 and Thomsen 2000) with the high emphasis on the role of the creditor and creditor protection (Bafri 2011). The sole function of the bank is not only to provide credit but also to provide auxiliary services to industrial companies and other organizations. One of the main advantages, from the perspective of the firm, of bank ownership is, since firms have internalized their relationship to the bank with the ownership, we assume that the they might be granted access to privileged information, beneficiary assessment of capital injection and have access to the pool of the services that they offer (Thomsen et al 2000:693f.). These are all important features that one needs to keep in mined, since rationing of credit (Ramirez 1995) is usually one of the major obstacles in R&D commitments. In the typology of the voice and exit investor, their impact can best be described as the voice investor and they use their internal resources to exert influence on the company holdings (La Porta et al 1999:472f.f.).

Family Ownership: Family ownership is often associated both with the ownership as well as management of the firm. We have in this definition included individual ownership that are the largest segment of owners, by number – yet their power and influence is small in

all the listed ownership types. Maug (1996) has noted that the family ownership is associated with specific investment decisions on the level of human capital and traditions, as such – they are most reluctant to give that control away (Thomsen et al 2000). Furthermore, the family ownership is best described as long term and strategic ownership. As such, the survival of the company and the long-term commitment is essential for investment planning and in time of low valuation and stock prices, family owners look to "ride the storm" instead of liquidating the position. Furthermore, due to long standing bonds with the company, there is plenty of hesitant in terms of adding excess risk by, for instance, taking on risky R&D projects and allocation of funds. The individual investor, on the other hand, behaves in strong correlation of their *holding to institutions* (Osagie et al 2005), *economic downturn* (Liu et al 2007) or *news flow* (Jackson 2003), just to name a few variables inducing of their ownership and are therefore more *fluid* than family ownership. But similar to family ownership, they want to become voice investors and impact the modus operandi of the corporation. We have in this essay looked to collect data from the 50 largest owners of the chosen observations (see table 1 appendix) and these owners tend to be voice owners[2] and not small time investors that look to liquidity shocks and behave as they were exit investors. Yet, one of the main obstacles to family and individual ownership and R&D financing is, that the family is not liquid enough and has rationed credits and as such might not be able to take necessary R&D investments for the survival and competiveness of the company. As such, and for the previously mentioned reasons, family ownership is a strong voice owner (Villalonga et al 2006:389f.f.).

Institutional Ownership: The institutional ownership means due to its design and structure, low-financing costs, low risk aversion and long time horizon (Thomsen et al 2000:693). Also, institutional investors usually do not invest in one single company – their strategic investments entail that they are organized in portfolios and as such their influence is best exerted according to the arms-length principle. Unlike family owners, who see the strategic survival of the company to be imperative, institutional owners are measured through the lenses of financial analysts and the score of financial success is, therefore prevalent. Therefore, shareholder-value and liquidity is crucial for the institutional owner (Thomsen et al 2000). Although their ties to the managerial positions of the organization are slim, their strategic impacts on firm-decisions are higher and are an active investor.

[2] Essentially they are high net worth individuals.

Pension Funds Ownership: Pension funds, along with insurance ownership are long-term owners and often invest for a period of roughly 10 years on end (Gilson et al 1991). These entities have become the single most important player in the global market for active investments (Hansen et al 1991), were the CalPERS[3] has played a significant role in allocation of assets across the board (Hawley 1995). Unlike other investors – i.e. hedge funds and mutual funds that look to evaluate the performance of managers and have significant monitoring in place for their investments, pension funds and insurance firms hold diversified portfolios that look to provide stable return for a pension plan over long period of time. This category of investors is very risk averse while in the same time look to long-term survival of the firm and solid returns for the principals and willing to invest and have little constraints in terms of acquiring credit from the market (Hawley 1995). As such, we have met all the right conditions for an active ownership being, having an untapped credit line as well as willingness to invest in large-scale format. .

Foreign Ownership: Foreign ownership is often associated with institutional ownership but has key distinguishing characteristics. The majority of the foreign investors purpose of investing in a foreign firm is diversification and to reduce systematic risk. As such, the main purpose of the investment in Sweden is not the attractive market but rather to ensure satisfactory return and firms investing in Sweden probably invest elsewhere. As a consequence, the foreign ownership in Sweden has varied over time, from an all time high during the height of the dot-com bubble of ca. 40% to roughly 30% just a few years later (Affärsvärlden generalindex 1996-2005). Previous foreign ownership in the Sweden has been tattered with plenty of regulations involving limits and caps, which has altogether long been lifted, except in the real estate and the physical property market. The major foreign investors in Sweden are often investors from other EU-countries as well as U.S.-investors. Although their impact on the stock market might be significant, foreign investors do not look primarily to the long-standing survival of the firm, since they only look to invest in diversification purposes, and as such can be defined as an exit-investor.

2.4 Hypothesis About the Empirical Results

Although the relationship between ownership and R&D are prevalent, there are no clear authorities in terms of how different kinds of ownership might impact R&D-intensity.

[3] *CalPERS*, California Personal Employee Retirement Systems.

However it is our aim that in order to better calibrate our expectations for the empirical outputs, it is advisable to establish a conceptual-and-theoretical-preview of how the results might come to look like, in order to better interpret the results as well as to provide a platform to integrate theory into empirics. This is of course an offspring from established research and the predictions, which we make, are highly tailored to the task at hand. The structure of the text will start with operationalization of the definition of different types of ownership and that will be compounded to the hypothesis that we make for each ownership-type. Although it is not the custom to include the operationalization of the independent variables in, what best can be described as, the theoretical section it is still important to note that our main source of thrust in the essay has been the ownership data and by combining it with the hypothesis we make powerful statements on the direction of the empirical fallouts. The starting point of the typology of investors is the Hirschman model that encompasses investor activism, we have leveraged that and included Hawley (1995) and Thomson et al (2000) to better integrate the legal and hierarchal ownership classification. We will follow the same schematic and theoretic overview as the theoretical section to better provide structural comparison of the text and start off with bank ownership.

==========
Insert Figure 1 about here
==========

2.4.1 Bank and Financial Services

The definition of bank ownership includes not only the traditional banks but also other investment companies and advisors that have according to the Swedish Company Act (2005:551) similar fiduciary responsibilities and as such take similar positions on the market and thus can be put into the same basket together (Del Guercio 1999). We have also included bank-funds and other index-funds, due to its similar characteristics, institutional framework, working context and the fact that they are often issued by bank-owned entities. However, some banking and other institutions and the type of holding they have, can be categorized into more than one variable and we have chosen to the greatest extend highlight the role of the holding assign them to either institution or bank-ownership. One such consideration has been, related to financial intermediaries were we have chosen to exclude it due to their characteristics that they follow the financial mainstream rule of voting with large institutions (Brickely et al 1988:276f.). These

definitions are all prelude from the U.S. SEC filing 13F forums, which is widely used categorization forum for ownership structure. With regards to the bank ownership impact on R&D, previous research has noted that *bank and financial services ownership* might be related to higher R&D investments (Kochhar et al 1998 and Lee et al 2003) although the results are far cry from being united. The hypothetical prediction for this study is that we expect to see a positive impact of bank and other financial services on R&D commitments and there are several reasons for that. As Kroszner et al (2001) has noted, bank and other financial institutions maintain an extended relationship with firms in excess of the standard creditor, lender and service provider one. This exposes these organizations to an extended relation were it both increases its risk beyond standard lender vis-à-vis creditor role to include ownership.

Furthermore this extended relation adds another dimension to the equation, were by involvement and increased exposure to the firm, the bank ownership becomes an active owner looking to influence the strategic considerations of the firm to better protect its collaterals as well as equity (La Porta et al 1999). Also, Peterson et al (1994) has noted that the presence of bank and other financial services induces increased use of credits and rising of debt financing as well as services from these entities. As previously noted, shortage of credits are often cited as the premier source of shortcoming in R&D-activities. This bias, according to the model we have set up, should enhance the extensive R&D-funding commitments from the perspective of the bank ownership. As such, our first hypothesis is,

H1: *Bank ownership increase the R&D commitments as made by a corporation*.

2.4.2 Family and Private Individuals

The second definition is the one related to family ownership and the share of family ownership is defined as the block of shares owned by a family or a family-controlled entity (Brickely et al 1988). We have in this aspect not distinguished between family and individuals and have assigned individuals as well as families the same role, were the emphasis is on influential shareholders with strategic intent, i.e. voice owners. The reason we have chosen to converge individual and family-ownership is due to the common denominators of family and individual ownership. However it is not our contention to implement a surgical definition of what a family is about, but rather look to the

established practice of this definition elsewhere in academia and business world. The definition of family has been used extensively in the literature, to include *close relatives* (Brickely et al 1999), to *ultimate* vs. *widely held* owners (La Ports et al 1999) to merely define it as the *influence* as exerted by family (Ji et al 2009). We have in this essay chosen to define family as large share block holders and with significant *attachment* (Eklund et al 2011:7f.) to the organization in question.[4] This definition is all-inclusive and covers the area of interest.

In terms of family ownership impact on R&D-commitments, we assert that with an increase of family ownership with its long-term commitment to the corporation will have a *negative* impact on the R&D commitments of the firm. Family ownership is long-term investments and has therefore longer time horizons compared to other class of investors but often suffer from finding the funds for financing the ventures, which is necessary for the firm's survival (Bushee 1998). As such, when institutional investors and other yield increasing organizations look to get liquidity shocks and immediately liquidate the position in time of financial distress, family owners suffer since it often lacks the adequate resources for making the necessary investments in order to maintain needed capital expenditure-levels (Andersson et al 2010). But in order to retain control over the firm and its assets, it prefers to internalize the funding of R&D-projects and do not look to increase the leverage ratio of the company to finance its R&D-activities (Jensen et al 1976 and Myers et al 1984). Furthermore, we have previously noted that one of the main drivers of R&D-funding's is the managerial appetite for risk. Family owners are traditionally very conservative and look to protect their investment and characteristically for voice owners they look as much as possible to induce barriers for managers to climb and before making none-sense R&D's and to derail the risk of empire building. The family owners act as a gateway and restrict the managers from taking on additional risks with low probability and negative NPV-R&D-projects, and this in itself hinders, excess R&D-spending. As such, the second hypothesis is,

H2: *Increased family ownership has a negative impact on R&D commitments*.

[4] This definition is not that uncontested either, since it relates strongly to the start-up and closely held companies were the founders and/or founding families influence is strong. Yet, I do not look to implement the rules of closely held firms to this operationalization since this is not a legal essay but an accounting one and the 3:12-rules of Swedish Income Tax Act do not implement here. More on this see, Income Tax Act (1991:1229) chapters 56-57.

2.4.3 Institutional

For the definition of institutional owners, we have used the U.S. SEC 13F filing procedure were it states that institutional investors is an organization that has in excess of 100 million USD of qualifying assets and include insurance companies, banks, pension funds, investment advisors and brokerages (Securities Exchange Act of 1934, Section 13 paragraph H-F). Although an important regulation in the area, we have only chosen to follow the spirit of 13F filing procedures by adapting it to Swedish conditions. However, we have for the purposes of research design distinguished between banks, pension funds and other institutions and we maintain this discrepancy due to the fact that it has ultimately been called for by our interpretation of the Hirschman-model. We argue that institutions in general seem to be more concerned with short gained earnings compared to potential for compounded future yield. This point of difference is directly called by the voice and exit behavior of investors and can be attributed to the Hirschman model. Another issue that the reader might consider is that institutional ownership has an enlarged definition, being that, due to the definition of the chosen variables, we have included *all other* non-family, non-private and non-bank ownership observations into this variable. This means that we have classified "institutional ownership" to include everything from brokerage houses, non-bank trusts, miscellaneous financial institutions, and other unidentified institutions including government and none-financial institutions. Although, all institutions are not the same, the formulation of the theory and the variables that it entails, all encompassing and as such valid classification of the ownership structure, since they have a common denominator among them.

For the third hypothesis, we have added that the role of institutional ownership in the literature being described to have a negative impact on R&D-intensity (Hill et al 1988 and Hansen et al 1991). Further there are some institutions among the observations that look to high market yield and short-term gains and will therefore easily settle with short term quarterly positive revenue earnings and high stock price before long term R&D-commitments (Kochhar et al 1996). As such, despite the fact that these institutions might have an easier time in securing funding for additional R&D-projects, they almost certainly will not going to because they simply don't care of the longevity of the firm and look instead to short term cash yields because that is how they are evaluated. We argue that these types of investors look to rely on the internal resources of the organization and as such already developed products to maintain the market position and compete, hence

the positive impact of financial slack that we refer to it. This has been described as the "myopic" or "exit" investor behavior by Kochhar et al (1996), unlike the other type of investor, which is noted, to be active institutional investor is best characterized as "active" institutional *investors*. Yet, since there are different kinds of institutional owners were some are less successful than others to impact the corporate decisions, some institutional owners are successful in actively influencing the rate that R&D commitments. Nevertheless, and for the purposes of this essay, we have chosen to view the institutional investors as short term, yield increasing owners. The support for this assumption has been found in the relative share of exit compared to voice owners including the fact that our sample observations consist of firms traded in Stockholm Large Cap, which by law is bound to have few controlling owners.[5] As such, our third hypothesis is,

H3: *With the involvement of the institutional owners, there will be a negative impact on R&D commitments*.

2.4.4 Pension funds and Insurance

In order to operationalize the definition of pension funds ownership, we glean over to the U.S. SEC 13 F filing procedure once again and find that pension funds is one of the variables defined in the forum. Here, there are different types of pension funds ownership-plans ranging from *closed* hold to *openly* pension funds. Closed pension funds are restricted to certain range of members such as employees and state regulated pension funds and could be classified into, single employee, multiple-employer, related member and individual pension plans. While the openly pension funds have no restrictions and obligations in terms of who might become a members and supports everybody's application to become a member, pending on paid fee of course. We have in this essay, when sampled the data, accounted for this and included both types of pension funds. Further, and as we noted in the previous sections, insurance firms behave in a similar manner due to the obligations that they are faced with and the institutional framework that they are bound by, and as such we have also included all insurance companied in the same category. Although the definition of the pension plans and the insurance companies might not be the same, their intention with the holding and the long-range

[5] Or conversely to release a large block of shares in the market in order to promote higher stock activity.

institutional ownership does behave similarly. Furthermore, they both have long term and fixed rate payment obligations that needs to be meet with their customers and/or retirees.

In terms of the development of the hypothesis, we argue that a pension fund has a positive impact on R&D-commitments. Nevertheless, pension funds ownership, might impact corporate strategy and managers to produce a certain R&D-output, especially if the firm has experienced short-term negative earnings (Graves et al 1988; Hoskissons et al 2002 and Chen 2010). The main reason for this is due to pension funds desire to secure stable return over longer time periods.[6] The remedy to this might be found in diversifying the product lines and as such decrease the risks involved in the short-term negative earnings reports by investing in new and upcoming new sources of revenues. Here, the importance of R&D-intensity is at its height were the higher the R&D-expenditures, the higher probability for success that yield stable earnings over longer time periods. As such, fund-managers have different incentives from "other" institutional owners, which are evaluated by short-term basis but furthermore, they are different in their way of financing their R&D-projects. Here, in order to maintain market position for their portfolio and remain attractive in the eyes of pension holders they need to demonstrate that they are likely to put short term gain before the longevity in any company. Therefore, pension funds have other institutional constraints such as inability of short sale, not to invest more than a fraction of its funds in any particular asset as to diversity and for the purposes of a Swedish context – not to invest in certain type of assets that deem immoral, such as tobacco and weapons (Hoskissons et al 2002; Fortune Magazine 1993 and Bethel et al 1993). But these institutional constraints along with the need for the pension fund managers to succeed in the eye of the pension holders, it all *could* have an blowback effect were the impact of pension fund ownership is highly liquid, short term and yield increasing – thanks to the institutional, diversification and as well as the structural context of the pension fund. Nevertheless our forth hypothesis still will be,

H4: *With increased level of pension funds and insurance company ownership in a corporation, the corresponding levels of R&D-intensity will increase.*

[6] The CalPERS funds were among the first to apply this strategy of actively taking position in poor performing firms and making turn arounds.

2.4.5 Foreign

Foreign ownership is often associated with institutional ownership. We have defined foreign ownership as ownership by a foreign entity, being an institutional owner, private individual or simply and often a corporation. The data for this has also been gained from the same source but the main difference is that foreign ownership, unlike, other types of ownership, has been clearly marked and distinguished by the vendor. As such, the sampling of this data has been rather straightforward and has provided us with the unique opportunity with disaggregating the data even more in order to draw better inferences from the overall regressions. In terms of the hypothesis, we argue that foreign ownership has a neutral to negative impact on the R&D-levels. One of the main reason for the foreign entities to have a stake in the Swedish capital market is diversification of the risk faced in an increasing global market were the flow of capital is free across the borders. Another characteristic of foreign institutional owners are that they are heavy traders and "bet" frequently on would-be growth stocks that are deemed to create instant cash injections (David et al 2006). Although this might gauge the market to reduce asymmetric information while keeping up liquidity, we argue that it has another feature interesting for our essay, being that foreign investors look as much as possible to increase liquidity and long term leverage in terms of source of funding for new projects. Foreign investors do not look to make additional investments and commitments for new R&D-projects, they only look to use whatever means possible toward innovation, preferably internalized funding source – much similar to the family owners. As such, as the domestic fund manager lacked the incentive to wait for R&D-made innovation, so does the foreign investor and they will, according to this line of reasoning, have most likely negative impact on the level of R&D-output. All in all, the overall implication of the analysis is that foreign investors are not looking to actively pursue a policy of increased involvement rather by taking a position in a Swedish firm, they signal diversification and pursue the opportunity of exploiting misallocations in pricing. The fourth hypothesis is,

H5: *With the higher ownership-level in the firm by foreign entities, it will reduce the R&D-intensity.*

2.4.6 Capital Structure: Leverage and Liquidity

After concluding the review of the hypothesis over the ownership types we have come to the impact of capital structure on the other variables in our dataset. We have included these two items in order to better control for some indirect factors that might have an

impact on R&D-investments. As such, these are not the prime drivers of the essay as we have been detailing it in the previous sections, but nevertheless they make up an important factor in what we see as a handful of variables in a labyrinth of variables impacting R&D-intensity. Going over to the R&D-commitments, generally a firm needs to finance its R&D-commitments either thru internal channels or seek outside equity or debt. As such, it is natural for us to pose the question of whether certain usage of resources would culminate into different effect on the R&D-levels. Here, we have chosen look to the *liquidity* and *leverage* ratios and their impact on R&D-commitments and how ownership is impacting these ratios. Liquidity is of course the internal production of resources and leverage is the debt ratio that firms acquire from outside investors. Starting with liquidity, we argue the implication of liquidity and financial slack (as defined by cash and cash related securities-to-assets) has a *positive* impact on R&D-levels (Bourgeois 1981; Cyert et al 1963; Trushin 2010 and Chen 2010). That being reaffirmed, it is also possible that with an increased financial slack and liquidity, we would have managers to exceed in their attempt to finance new R&D-projects with low or non-existent NPV-outlooks. As such, the results emanated from the type of impact that increased liquidity might have on R&D is dependent on the main variable of ownership. Given that there is an active voice owner, it is likely that managers will allocate the funding to other purposes than in purely empire building attempts, while from the onset of an exit owner, cutting slack is the driving ethos and by definition reduced R&D-outputs. In terms of the leverage and debt impact on R&D-outputs, we argue that the higher the R&D-activities are the lower is the propensity for R&D-activity should be. Needless to say that the type of investors attracted by high R&D-levels would choose to invest in ventures that has low leverage (Long et al 1995 and Chen 2010). Despite the lack of further data on the issue it is possible to allude that firms having high leverage levels, often is closely associated with yield increasing and short-term engaging managers. In a leverage buyout or management buyout, the private equity firm often has little of its own funds compared to the leverage that has been added to the firm, just to take an example. In this way increased leverage acts to cut slacks when the firm is under the ownership of exit owners. As such, increased levels of leverage are closely associated with low levels of R&D-investments. Therefore, the hypothesizes that we present are that,

H6A: *Increased liquidity ratio is associated with increased R&D-activities.*
H6B: *Increased leverage ratio is associated with decreased R&D-activities.*

3 Methods

In order to attain the answer we seek and test the hypotheses that we posed earlier (see section 2.3), we will in this section be looking to formulate a plan, design the empirical process while maintaining integrity by presenting different considerations and choices that we have taken in order to give a complete picture of the study. The data that we have used in this essay has been based on the 50 largest firms traded in the Stockholm OMX (Mid Cap and Large Cap). The complete list of firms is in appendix table 1.

==========
Insert Table 1 about here
==========

We have divided the section into three sub-sections, being variables-in-use (3.1), data collection and assignment (3.2) and model design and assumptions (3.3). The variable section includes all the denominated variables that we have used in the essay while last piece of the section contains the model-regression that we ran and how it came to be.

3.1 Variables-In-Use

3.1.1 Endogenous Variable

The endogenous variable in this essay is *research and development* (R&D). We have chosen to use R&D-to-sale because it is the main purpose of our essay, without which no inferences can be drawn with regards to the theory and hypothesis. We measure the level of R&D as the ratio of R&D spent during one year divided by the gross revenue and annual turnover of that same year and arithmetically looks like $R\&D_t/Sales_t$ and as such needs to be calculated for each year and this measure has been utilized in a multitude of studies ranging from Greve (2003), Lee et al (2003), Kim et al (2008) and Chen (2010). One should also note that this variable is a ratio but since the data from the ownership structure, on leverage and on liquidity are ratios too, it should not have any serious implications of the overall readiness of the study.

3.1.2 Exogenous Variables

The main exogenous variables in this essay are the level of ownership. We have in section 2.3 and 2.4 provided in addition to description, hypothesizes and motivation – also the sampling method and related it to the overall goal of the essay. As such, we will not be repeating the intel here and advise the reader to proceed to sections 2.3 – 2.4, for

more. However, it is something else that we should note, being that since all the ownership data has been sampled in the same way – we only describe the procedure only once. After categorizing the data among the four ownership types (excluding foreign that was already given by SIS-ägarservice) we summed the data up for each company during each year and repeated this across the board. Since the ownership data was already prefixed with percentage points, we did not need to make any further adjustments. However, we only sampled the data from the largest 50 owners in each firm because that was what was given by the SIS ägarservice and this sampling suited us well since we looked to investigate the impact of ownership according to voice and exit model. Investors having a slight fraction of a percent beyond 50th place in the tablet can rarely be described as a significant factor on the strategic considerations of the firm – and therefore we chose to only focus on the significant power brokers of the firm.

3.1.3 Control Variables

The main reason that one chooses to use control variables in the design of an empirical study is to eliminate the systematic bias (King et al 2008:24f.) that are in the data and prevents us from establishing the true link between ownership and R&D. The control variables that we have chosen to include in the study is employee as a proxy for size, assets and average R&D as a way for controlling variations among firms R&D-spending. The control variables are run along with the independent variables in the module-tests and we have chosen them because it is motivated by the study design in general, and model regressions, in particular.

- Firm size*:* As the proxy for firm size we use the *natural log* of the total *number of employees* in order to reduce the heterogeneity in the data among the firms. Here we follow the path as supported by studies made for *block ownership* by Brickley et al (1988), impact of *business models* by Malone et al (2006) and impact on *R&D* by Chen (2010) and also *generally verified* by Choi et al (2008). Also, since the sole intent of this essay is to relate the ownership structure to the impact on R&D, were firm size might play a major role, we have motivated to include this variable into the equations.

- Average Industry R&D-intensity*:* Since the importance of the R&D intensity is different for different industries, sectors, companies and seasons were there is a strong assumption that the level of R&D activities might pose a systematic bias on the

data that we have in the empirics. We have therefore tabulated different R&D-intensity levels for different firms depending the way their business is organized. We have chosen to define four ways in which the business is making money (i.e. rights sold) and organized the sampled observations based on that. The support for this assumption has been found in Malone et al (2006) were business income has been divided into multiple subsections. The rights sold are *creator*, *distributor*, *landlord* and *broker* (Malone et al 2006:28, also see appendix table 2 for more).

==========
Insert Table 2 about here
==========

We have sorted the observed firms according to this four-variables and we have calculated the level of R&D intensity for each sector by calculating an *average for the* $R\&D/Sales$ ratio for the firms. This is a reasonable control variable since we have data for the entire Stockholm OMX were capital intensive and R&D intensive industries, such as production and telecom is being combined with other less R&D intensive and services firms, also evidence from Chen (2010) and White et al (2003) have proved that this is a valid way to compare companies from different sectors. The reason for using this typology of business model income stream has been to better capture the differences among the variety of firms instead of the way they are doing business. The traditional viewpoint of sorting observations based on the industry in which they are active in is nevertheless important, yet for the purposes of this study not valid. The main reason is due to the ongoing consolidation of the industry and the fact that different firms often have more than one line of business and as such compete in different segments. The proper way of remedying this issue would be to look at the rights sold, which – not only captures the true picture of the industry, but serves our essay purpose, as to classify R&D-activities in a new and true way.

- Total assets*:* We have here taken the *natural log* of *total assets* in the mother-firm. We have added this variable to control for the impact of assets in use. Studies have shown that the level of assets is strongly correlated to the level of R&D-intensity of the firm (Berrone 2005). Also, in the previous studies that this essay has been envisioned after, Brickley et al (1998) and Malone et al (2006) has included the variable of assets into the run equations to better control for the systematic omitted biases.

3.1.4 Intermediary Variables

Although the main focus of this essay might be the role of ownership (direct) impact on R&D, we still will investigate the relationship between leverage and liquidity variables as an intermediary mean for (indirect) impacting on R&D. As such we have used the definition of debt, leverage, liquidity and slack ratio to perform these regressions. One practical consideration was raised when the denominated data for the sampled variables were of USD and we overcame that by converting according to table 3.

==========
Insert Table 3 about here
==========

- Financial slack*:* We have used financial slack as a measure of liquidity in this essay. We have for the purposes of this essay defined it as by taking the ratio of *cash and cash related securities* divided by *total assets* (Singh 1986). It essentially is the quick ratio divided by total assets, but one could also use the annual turnover to calculate the same rate – but we have calculated by taking it divided by total assets.

- Dividend ratio*:* The second liquidity tool is *dividend* to *assets* and calculated it by $dividend_t/asset_t$ and we have chosen to include this variable in order to better capture the impact of surplus revenue and how it might be used (Muñoz-Bullón 2011). The source of the data could only provide dividend data with the USD-denominator, look at table 3 for exchange rates – we used December/31.

- Liquidity*:* The liquidity ratio is an additional variable to the financial slack variable and we have measured it by taking *current liabilities* to *current assets* and as such are a current ratio definition.

- Solvency*:* The solvency ratio is one of the debt-related ratios that we have added that are including conveying the long-term rate of firm's debt ratio. It is calculated by taking NOPAT (net operating profit after tax) including depreciation and dividing it by total liability. The formula is $(NOPAT + Depreciation)_t/Liabilities_t$.

- Interest Coverage*:* This definition is one that we have used to note the ability of the firm to be able to pay its outstanding interest while maintaining business operations. We have calculated it by, earnings before interest and taxes (EBIT) divided by interest expenses – i.e. $EBIT_t/Interest\ expenses_t$.

- Gearing ratio*:* This is one variable that we have used to accommodate the need to demonstrate the gap that exists between ownership and debt financing of operations (including R&D-expenses). The definition is total liabilities less cash and defined as, $Total\ liabilities - Cash\ \&\ Cash\ related\ securities_t / Total\ assets_t x\ 100$.

3.2 Data Collection

The data for this essay has been from all the traded firms in Stockholm OMX listed corporations. The vendor for the *ownership* data has been the "SIS-ägarservice" and we have sorted the data according to the above classification system, for more on this see section 2.3 (for the theoretic foundations) and section 2.4 (for operationalization of it), look at table 4 for more on the variables that we have used. SIS-ägarservice is a reliable vendor of data and it is valid for us to use it as a source of information, hence we have no reason to account that this might pose us with extra load of econometric and statistical problems in terms of adjusting the data. We have also no reason to believe that the sampling method of this dataset is skewed and wrong in any way - since SIS-ägarservice is the most trusted name in this field, often acting as vendor for large institutions and other entities. For all variables used see table 4 in appendix.

==========
Insert Table 4 about here
==========

The data for the dependent variable as well as the control and intermediary variables (such as firm size, R&D, assets, interest coverage ratio etc.) has been acquired from the "Orbis - Bureau van Dijk Electronic Publishing" – also a very reliable data vendor for both company information and research. The sampling method has been done on the *mother/parent/concern corporations* and *not the subsidiaries* and as such can be viewed as to represent the entire business group. The data period for which we have chosen to test the model regression with is based on the timeline of 2005-2010. One note though, some of the datasets are ranging from 2004-2010 and the main reason for that is the way in which we have lagged some of the regressions, for more on this see table 9. The data has been collected from the vendors on and about the last week of March 2012 and contained 6100 data entries (ownership variables), 900 (control variables) and 1800 (intermediate variables) – we used MS-Excel package to run the regressions.

3.3 Model Design and Assumptions

This is the last leg of our methods section were we put the pieces together and create the model regressions that we have spent the theoretical and methods sections to motivate the different parts with that entail the regression model. We have designed the causality relation as we have imagined it and can be viewed in figure 1 in the appendix.

==========
Insert Figure 1 about here
==========

Starting off with the *direct relation* model, we have designed this model with the intention of answering hypothesis 1-5. The model has therefore been formulated to relate to the ownership-classification and level of R&D-spending rate. The *direct* model is,

$$R\&D - to - Sale = \alpha + \beta(Bank\ Ownr.) + \beta(Fmly.Ownr.) + \beta(Pension\ Ownr.) + \beta(Inst.Ownr.) + \beta(Forgn.Ownr.) + \beta\log(Firm\ Size) + \beta\log(Assets) + \beta\text{Average(R\&D)}$$

In this equation, and as noted above, R&D along with most of the exogenous variables is ratios compared to the total asset and firm size, which is a *natural-loged value*. These would naturally be considered to be posing an econometric challenge – but since we have added these variables as control variables to decrease the amount of omitted variables, we expect this not to be posing any problem here. The model that we have used is a standard OLS and we have chosen this model due its simplicity and broad application to this regression models that we are about to test. We have presented the regression output in the table 8 and 9. Considering the persistence of the results, we ran the model but lagged the ownership variables by t-1 and t-2, utilizing data from 2004-2009. We lagged the variables to better comprehend the impact of ownership on R&D-commitments and the results are to be seen in table 8 and 9. In addition of lagging the variables, we ran the model with data from 2005 and 2010 only – in order to check for multicollinearity and persistence in direction and strength of the data, output is seen in table 8. The reason we have chosen these two time-points, is due to the prolonged interval should have evolved the firm into another organization and as such provide an excellent opportunity to test for multicollinearity of the data-output and test whether the initial foundation of the regression was persistent.

Considering the *indirect relation* of ownership on R&D-funding, we ran the indirect model-regression in order to be able to capture the indirect impact of ownership as gauged on R&D-activities with capital structure intermediary variables. The *indirect* model is thus,

$$R\&D - to - Sale = \alpha + \beta(Bank\ Ownr.) + [\dots] + \beta(Forgn.ownr.) + \beta Fin.Slck. + \beta Liqdt. + \beta Solvncy. + \beta Div. - to - Asset. + \beta Interst.Covrg. + \beta Gear.rat.$$

In the indirect relations regressions model, we only have ratios and as such it would not pose us with any significant econometric challenges. The main purpose of this model is twofold, on the one hand we look to answer the hypothesis 6A and 6B, while in the other hand we look to reaffirm the regression outputs as gained in the primary and direct regression model and whether ownership behaves in a similar manner here. We have in order to better isolate the impact of ownership run the regression five times, for the five ownership models and outputs are seen in table 10. Looking at the causal relation in figure 1, we can see that beside the indirect relation between ownership and R&D-funding, there are a direct relation between intermediary variables (capital structure) and the endogenous variable (R&D). Because these regressions are not the main concern in this essay, we have chosen not to include it in the analysis – to better keep the streamlines of the essay.

Now – going over to the underlying assumption pertaining to the models that we have created in this essay we will go thru two main issues related to *model design* and *implementation*. Despite the fact that we have used data for this model from a variety of sources that is deemed to be valid and have been used in other instances, does not say anything of the validity, reliability of the model-regressions as depicted in figure 1. The model-regressions that we have used are of course, regressed using vetted techniques (i.e. OLS) such that are common for testing in the academic and business world. Yet the models that we have tested might be incomplete in the sense that there are more variables that impact R&D-intensity, than ownership and the relation that we have depicted in figure 1 is not supported by the reality. We have taken that risk into consideration and added several control variables in order to isolate the role of ownership on R&D intensity and by including both direct as well as indirect causal relation of ownership and R&D, we feel that right level of support has been gauged to

reaffirm our positions. Yet, despite the fact that we have attempted to control for most important of the variables, there is a strong possibility that there are more than the included variables that might impact R&D-activities, hence we could have regression outputs, that are contaminated by bias. The lagged variables have been included to control of *multicollinearity* and variable interdependence among the run regression sample variables the second has been to better test for *robustness* of the results at hand. This has been done with the full purpose of making the test results, empirics and deduction of the analysis we are making in section 4, to be as legitimate as possible. However, it cannot be excluded – that even in the most thoughtful regressions some issues get past by, but to our defense we can state that we have taken plenty of precaution. This would provide the reader with the ability to judge the pretenses of our grasp in the context of our commitment. Furthermore, we have described to the best of our ability different variables and methods that has been utilized in order to attain the results that we have presented in this essay.

This brings us to the second point that we tried to make, being that the implementation of the model is just as important as the model itself. We have in this essay attempted to describe the steps that we have taken in an attempt to give the reader the complete picture related to the development and testing of the model. Any motivation and critical analysis of the techniques, procedures and models that we have utilized is a clear sign that we have made our job in informing the reader of the full extend of our text. However, given the context and framework, it is the author's firm conviction that a clear picture of the planning, process, content and strategic considerations posed by the study has been communicated to the educated reader and investor.

4 Results

In this section we will be presenting the empirical results from the regression tests that we have motivated, entailed, related and detailed in the previous sections – see figure 1 for causality. We have put all data, regression and other outputs back in the appendix.

4.1 Empirical Measurements

The *dependent variable* of research and development (R&D) intensity is the measured as total R&D-to-sales. When looking into the variables the initial reaction is that we can see

that the standard deviation is roughly twice the size (4,41) of the variable (2,2). This dispersion of the data might be considered problematic since it poses some inferences challenges deducted from the regression-models. One of the explanations is in the fact that we have data ranging from a wide range of different businesses and as such, the wide dispersion of the variables is expected. This becomes clearer when looking to the variation width (32,36%) between the most intensive R&D firms and (0%) for the non-R&D-intensive firms (often real estate businesses) – for more see figure 2. The firms that are very intense in their R&D commitments are not surprisingly heavy industry (ex. Hexagon, Scania and Atlas Copco), manufacturing (ex. SAAB, Volvo and Trelleborg) and IT (ex. Ericsson) all the while the lesser intensive firms active in real estate (ex. Lundbergs, Hufvudstaen and Wallenstam), banking and finance (ex. Latour, Ratos, Swedbank and SHB) and production (ex. Axfood, H&M and Electrolux) lack even the basic R&D-account. Look at figure 2 for the R&D-intensive firms for more.

==========
Insert Figure 2 about here
==========

This dispersion of R&D-intensity in our data exposes us to some tricky economic considerations, such that this would entail that we have accounted not only from one type of industry or segment of the market, rather by providing the total array of the 50 largest firms traded in Sweden, we have exposed ourselves for the multitude of business models present in these firms and their R&D-commitments – as such the wide dispersion of the R&D-commitments. Yet this is also a source of strength were by including data from a variety sources of companies, we have considered the overall R&D-commitments in among all firms on the market. More so, the overall trend is altogether rather clear and seems to follow the general smooth path, see more on figure3.

==========
Insert Figure 3 about here
==========

The *exogenous variables* are ownership concentration of the 50 largest owners in the firm. The data is rather entailing and we can state that bank, foreign and family ownership has among the largest variation wedge among the variables that we have sampled. Looking at family ownership (93,3%) and foreign ownership (91,7%) that has among the largest

variations in question. This is not an extraordinary event since the number of initial public offerings (IPOs) in the Swedish capital market has been at its heights during the first decade of the 21st century. For more see table 6 below. Yet the trend are different in different firms were bank ownership is at its heights in the "commanding heights" of the economy with focus on manufacturing and heavy industry (ex. Assa Abbloy, Atlas Copco, Alfa Laval Skanska, Investor and Holmen), family ownership is focused in real estate and production (ex. Lundbergs with 93,3%, Balder with ca. 92%, Hufvustaden with ca. 89%, Nibe industirer with ca. 75% and H&M with ca. 70%), institutional ownership is at its heights in the investment sector (ex. Latour, Hakon Invest, Swedbank), pension funds are most active in production (Industrivärlden, Indutrade and Volvo) and foreign ownership most influential in commodity, gaming and manufacturing (Lundin petroleum, Swedish Match, Betsson and Scania), also see tale 7 below.

==========
Insert Table 5 and 7 about here
==========

Going over to the remaining variables, were we have used log-sized employee (firm size), average R&D-intensity with the already prescribed way of calculating (see section 3.3) and log-sized total assets. One distinct feature here is that the control variables have lesser and smaller standard deviations compared to the exogenous as well endogenous variables, see table 5 for more.

4.2 Empirical Results and Hypothesis

In order for us to show the empirical results that we have used in order to prove or refute the hypothesis that we have in this essay and presented in the previous sections, we will in this section be addressing the different hypothesis that we have made and present the results related to them. See table 6 in the appendix,

==========
Insert Table 6 about here
==========

Table 6 shows the correlation matrix for all the variables involved in the study and it shows that the correlation among the different variables are not that high between the different variables, something that would otherwise indicate high multicollinearity among

the regressed variables. In particular see also table 8 and 9 were we have presented the data and ran regressions with the diminished dataset and lagged the variables – although sometimes different, we still have obtained solid outputs, reinforcing the initial results that the regression outputs are significant and determinant.

==========
Insert Table 8 about here
==========

Leaping over to the output, we can from the results gained in table 8, conclude that the control variables are very significant and as such valid estimates to add in this model, see table 2 for compartmentalization and section 2.4 for its modus operandi. The main take-a-way points from the model-regression outputs are, the negative (-0,093) and significant (<0,05) impact of pension funds and the prefixes of the included variables have all maintained direction and strength, indicating that our sampling is valid and do not, as previously feared, suffer from multicollinearity. Also we can see that the F-value of the model as given by ANOVA was 17,28 and significant at all imaginable and thoughtful levels something that is backed by the R-sq levels of 0,32 that indicate that we have formulated a solid regression that corresponds to the estimate variables impacting R&D. Further, in table 10, we can see that pension funds has negative (-0,087) and significant (<0,05) impact on R&D when ran alongside with the capital structure variables that we have added in this modeling. The same is the case in table 9, were we have lagged the variables by two time periods and still find that the impact on R&D is negative – yet significant – by the pension funds ownership.

Going over to the hypothesis that we presented in section 2.4, we stated that pension funds would have a positive impact on R&D. On the contrary and as presented above, the output has been highly significant yet negative impact on R&D, and we have double confirmation to that effect. One explanation for that might be found in what Malkiel et al (1998) that argued that due to the increased covariance between different stocks, investors are ever more willing to "enrich the menu" (p.23) by adding more stocks to their portfolio in order to diversify. Another explanation might be found in the increased downward pressure from pension holders to engage ever-steeper risk-taking behavior to accommodate funds performance. Since the late 1980s, the pension funds and managers have been drivers of the global capital market, increasing liquidity and abandoning

borders – in the same time fund managers have become the poster-boy for attractive and high yielding investment-opportunities. As such, hypothesis 4 has not been supported in the data investigated.

Going over to the family ownership, the main hypothesis that we had in relation to family ownership impact on R&D, was that it would decrease the R&D-intensity in the second hypothesis. The data that we have has not supported this claim since looking at table 8 and 9, we have slight (-0,000) negative and insignificant impact on R&D in the main model and the effect is still prevalent in the shortened model, utilizing data for 2005 and 2010. Looking at table 9, we still see that the impact on R&D is still very close to null and it still is insignificant and in table 10, the impact is slight negative (-0,0109) but nevertheless insignificant. This means that although the slight impact of family ownership may seem insignificant and not make any further impression on the R&D-levels, it encompasses both the private individuals as well as families, and it still translates into multibillion-dollar investments over the course of the studied period.

==========
Insert Table 9 about here
==========

However, when looking at the outputs regression from table 9 and 10, we can see that the impact of family ownership on R&D is close to non-existent and as such reaffirms the previous notion that the impact of family ownership is negative or null. As such, although the data in hand does not support our claim in a slam-dunk-manner, that family ownership has a clear negative impact on R&D, our claim has nevertheless not been rejected. Since we foresaw the implication of mixing up family with individual ownership could yield low significance – the results might be interpreted as in affirmation of our previously held positions. One explanation might be found in the sampling of the data, were we have combined the data for both family and individual ownership, and these two constituents of investors has differing incentives impacting the level of R&D, in what we might be seeing netting out and residing into a null impact. Another issue that might have an impact is the role of funding shortage that has a diminishing impact on extensive undertaking of differing R&D-projects. The use of internal funds to finance new R&D-projects might be a functioning working order in the short term but R&D-projects require long term commitments and a capital structure over longer time

horizons, something that neither the family nor the individual investor can afford. As a conclusion of hypothesis 4, we parse the impact of family ownership is very much close to zero and there is no-way in determining the direction of impact on R&D and our data is no way near of supporting this notion of the hypothesis and as a consequence we lack the necessary significance levels.

Going over to the hypothesis 1 and 5, the impact of bank -and foreign ownership – we asserted in section 2.4 the impact of both bank and foreign ownership to be positively aligned to the level of R&D-intensity. Looking at table 8 and 9, we can see that the impact of bank ownership has a slight positive (0,028) tone to it as well as the impact of foreign ownership (0,014) – and that might indicate that the hypothesis that we posed earlier has been contradicted. But neither of the variables is significant at any considerable levels and as such we are posed with the question of how to interpret these results. Looking at the other regression outputs and particularly table 9, we can see that the impact of bank ownership is still persistent over two time lags, nevertheless it still is insignificant and the impact is very slight. Yet looking at same table and impact of foreign ownership, we can see that the impact changes prefix in the t-1 in order to change it back to the original position. This indicates an inconsistency in the way the impact of foreign ownership is being exerted on R&D.

Looking at table 10, were we ran the impact of ownership alongside capital structure features – we can see that the impact of bank is slight positive (0,021) and very significant (<0,05). While the same is the case for foreign ownership with a slight impact of (0,0282) and being rather significant (<0,05). These alongside the regression outputs above have us believe that the impact of bank and foreign ownership is having a positive impact on R&D. Although the regression outputs are not clear cut, they indicate that the impact would be positive on R&D. As such, in some respects, the level of impact that bank and foreign ownership has on R&D is rather positive and although the data does not support this notion of clear cut positive impact, mainly due to the lack of significance on the part of both variables. However, and as it goes for the hypothesis, we have given support – although incomplete – to the bank ownership and stated that increased bank involvement induces higher R&D-intensity. This relation is also seen in among foreign ownership and only when run with the capital structure variables – i.e. the bank and foreign ownership best can be captured in the indirect relations between ownership and

R&D. Since looking at table 8 were the main model were ran, we can see that the direct impact of bank and foreign ownership is giving a weak support to the hypothesis 1, yet the hypothesis 5 is not altogether that supported in the data and the relation can best be described as spurious and indirect. However, and as we noted before, foreign ownership consist of a variety of investor constituents, were one type of investors might be attracted to Sweden's notion that it is known for its world-class R&D-levels (Johansson et al 2008), other type of investor prefer some solid stocks in the use of indexing to diversify noise in the market (Hawley 1995), the third type of investor is looking for liquidity shocks and actively look to undervalued growth stocks (Tsang et al 2008). As such, although the foreign investors might be classed into one basked based on base of operations, their intent and purpose of the holding is as diversified as the domestic investors. That might be one reason we have received such insignificance values.

The last ownership hypothesis that we posed was related to the institutional impact on R&D-intensity. We argued that the effect of institutional ownership would have a positive impact on R&D and taking look at the table 8, were we ran the main model regressions and found that there is a slight positive (0,013), although insignificant, impact of institutional ownership on R&D. Going over to the table 9, were we have same impact on the lagged variables t-1 (0,006) and insignificant while the direction of impact has changed in t-2 (-0,016) – but nevertheless it still is rather insignificant. The take-away-point might be summed up as that we have a slight positive and impact that happen to be insignificant but looking at table 10, were we ran the indirect model the output became slight positive (0,007) and insignificant. The sum total of the regressions might best be summoned as although the theory and the starting framework of the empirical outlook gave indication of a slight negative impact on R&D, the level of certainty provided by the data that we have collected does not gave support of that. As such, we have a plausible confirmation of the positive institutional impact on R&D since nowhere is any of the repressors have a significant impact. One explanation of this might be found in the way with which we sampled the data and collecting data on all sorts of non-pension and finance organizations with differing incentive structures and outlooks and holding pattern might have something to do with the insignificance of the data.

Another issue that is closely related to the model regression output is the use of control variables in virtually all the regression-outputs. The control variables, log (assets), log

(employees) and average R&D-intensity have all consistency shown strong significance levels (<0,000) in the regression that we have run with positive implications on R&D-commitments. Naturally, we would have expected assets and number of employees to be significant since it has been widely researched in other papers and we felt confident about it. Yet the one variable that we alone constructed was average R&D-commitment as described in section 3.1 and operationalized in table 2 and its results are available in the subsequent regression output tables. This is of course a unique way in company classification by emphasizing the source of revenue as described by Timmers (1998) and Malone et al (2006), but nevertheless successful one. But even more important is the impact on which these control-variables are supposed to control for. Naturally the average R&D-level was expected to have a positive impact on R&D in each case and the reason for that is if the industry R&D goes up then it is expected that the rate of the firm R&D follow through. As we pointed to earlier in the theory section, we expected firms and corporations to act in clusters and as seen in figure 2, all the manufacturing, production, IT, distribution and real estates come together and here is another point that the impact of the cluster and group/industry R&D is positively correlated with the one in the specific firm. In terms of the total assets, we have also positive impact on R&D and it is very natural since increased assets in a corporation are positively correlated with R&D intensity and vice versa. While the same cannot be said about the number of employees since the increased in employee work in contrast with the rate of R&D.

==========
Insert Table 10 about here
==========

In *hypothesis 6A* were we noted that increased liquidity would have a positive impact on R&D we have in table 10 found that financial slack as well as liquidity ratio has a significant and positive impact on R&D when looking at the indirect model all ownership types. Although not all the regression outputs has the same significant rate, their implied impact is thus still the same – being that there are a positive impact being exerted by surplus cash. Here, once again – we get a double confirmation on the direction and strength of the impact of liquidity on R&D-commitments. Looking at hypothesis 6B, were we posed that the impact of leverage would be negatively reflected upon R&D, and we have found that gearing ratio has a negative and significant impact on R&D while solvency is negatively and significantly impacting R&D. These altogether

does not conclude that higher leverage will bring higher R&D-intensity, on the contrary – the gearing ratio – as an expression of funding internal activities thru either external source of owner equity – goes on opposite to the notion that leverage would decrease R&D. Here we can back that up with the solvency ratio data, were incremental increases in solvency is equal to decrease of R&D, which means the lower the leverage is the lower the R&Ds are – and this goes on contrary to the notion that we stated earlier. This is also backed up by the data from the interest coverage ratio – were we have slight negative, yet insignificant, impact on R&D.

5 Conclusions and Summary

Due to the importance of the investments and dedication in the field of research and development (R&D) in firms and corporations, we decided to investigate the role of ownership and how it might impact the level of R&D-commitments. We used data from the top 50 firms in Stockholm OMX, regardless of the type of industry that they belonged to over the years of 2005 to 2010. We found,

- Pension funds ownership had a negative and significant impact on R&D-intensity for all the tests that we ran on it. This is surprising since we hypothesized that we would get a positive impact on R&D.
- Family and individual ownership had a null and insignificant impact on R&D-intensity, and this is altogether not surprising but poses some questions about the validity of including family among the variable-set.
- We found that bank as well as foreign ownership behaved alike and although bank ownership gave slight support of the hypothesis that we posed, foreign ownership did not and to some degree refuted it. However, both variables were insignificant and as such the results of the regression tests can be questioned.
- Institutional ownership was one variable that was hardest to read since the results did not gave any indication to whether refute or disapprove the hypothesis we set out to investigate, since the numbers were all over the place.
- The last hypothesizes we investigated was related to capital structure and found that the notion of increased liquidity would lead to higher R&D, has been supported in the data this is very strong (table 10). While the 6B hypothesis, were increased leverage would lead to lower R&D-funding has been rejected and the auxiliary leverage variables in this field also support this notion.

5.1 Discussions

The initial though when gearing up for writing this essay was, to investigate the relation between ownership and a typology of different types of business-models but that idea turned out to be too large for our plate so we settled with investigating the impact of a typology of ownership on R&D-intensity, which we viewed as a business model. Standard research on this area focuses too much on the role of agency theories and the effect of stewardship but we chose to study the impact of ownership, based on Hirschman's voice and exit investor and impact on the level of R&D. Furthermore, and based on the literature study on R&D, we found that the impact of ownership on R&D takes more than just one shape and therefore designed the study to include both the direct and indirect impact of ownership on R&D. Nevertheless, the focus of the study was always aimed at the direct impact that ownership had on R&D-intensity. Yet, it should be bared in mind what we predicted in the introduction, namely since ownership is just one among dozens of variables, it might be the main reason that we lack the sufficient significance levels that we would needed to in the empirical results. But by re-emphasizing the notion that the impact of ownership has multiple nexus, being direct or indirect – we pointed to the fact that ownership is merely one among a labyrinth of variables that impact the level of R&D-funding.

One interesting issue that we might see as the hallmark of this empirical analysis is that previous researches have found that the impact of pension funds mitigates long-term ownership. Hawley (1995) for instance, showed that since the mid 1980s pension funds has been one of the important features of the increased R&D-intensity yet, we did not find any residue of that in the empirics that we engaged in. It could be due to the role of diversification across the board that has had a negative impact on pension funds R&D-expenditure. Viewed this from the Hirschman model, we can see that the ownership influence might have taken a backseat position due to increased demands on fund managers. In the long run, this study could possibly be seen as a referendum on how effective the Hirschman model is as a conceptual tool for analyzing ownership influence. Maybe, Berle and Means (1968) were right after all, that the best way to understand the dynamics of ownership is thru the lenses of agency theories. However some empirical results drives a wedge between these arguments, since the empirical outputs in section 4, to a degree are in line with the hypothesis we made in section 2.4 and sure, they might not be that significant as hoped – nevertheless, they support the Hirschman model.

5.2 Limitations

The implications of this study were reached in a developed nations (Sweden) stock market history for the period of 2005-2010. Furthermore, the preview of the data collection – which was based on the 50 largest firms in Stockholm OMX – is not that entailing for drawing inferences of the population for the entire enterprise community in Sweden. Since SMEs are more R&D intensive than larger firms per dollar spent. In terms of the actual results, some of the empirical section outputs were in direct contradiction to the established theories and other literature in the area. Pension funds are traditionally a custodian of increased R&D (Hansen et al 1991) but we were unable to find any residue of this in our study. As such, that might be the first implication that this study is not accurately representing the established literature. Altogether, they pose some deductive caps on the conclusions drawn from the study.

5.3 Implications

There are several issues that have been raised during the course of this essay that is related not only to methodology but also to the configuration and design of the study. Despite the fact that previous studies have shown that the impact of different types of ownership yield variances among the level of R&D-funding, we did find marginal support for that and the relation can best be described as spurious and expectedly, there are more third-party variables effecting R&D than ownership. Another implication is in the regression outputs, were we have found that the impact of the Hirschman's conceptual tool, although elegant, not without question in implementation. Investor influence might have been marginal all along but since the beginning of 21st century, the increased volatility and intra-correlation among stocks in seemingly wide range of sectors, has presented a real challenge in terms of diversification. Therefore, the new motto of active investors and investor activism might be to increase yield and that means eventually to cut R&D.

Literature

Aboody, D. and Lev, B. (2000) *Information asymmetry, R&D and insider gains*, The J. of Fin., Vol. 55, pp.2747-66.

Andersson, Ronald C and Reeb, David M (2003) *Founding-Family Ownership and Firm Performance: Evidence from S&P 500*, The J. of Fin. Vol. 58(3), pp.1301-28.

Abdullah, Shah; Abdullah, Fahad; Iqbal, Abdulllah M. and Gohar, Raheel (2001) *The effect of Family Ownership on Firm Performance: Evidence from Pakistan*.

Afuah, A. and Tucci, C. (2001) *Internet business models and strategies: Text and case*, MH:NY.

Agrawal, A. and Mandelker, G. N. (1990) *Large shareholders and the monitoring of managers: The case of antitakeover charter amendments*, J. of Fin. and Quant. Anly., Vol 25, pp. 143-61.

Amihud Yakov and Lev, Baruch (1999) *Does Corporate Ownership Structure Affect Its Strategy towards Diversification?,* Strtgc. Mangt. J., Vol. 20, No. 11 (Nov., 1999), pp. 1063-69.

Bafri, Ranj (2011) *Tax relief programs: A content and comparative analysis of the venture capital market in US, Germany and Sweden - A Case Study of Tax Relief Programs in Entrepreneurial Companies – Underlying Assumptions, Defining Variables and Possible Course of Action*, Uppsala Univ. Law faculty.

Baysinger, B. D., Kosnik, R. D.and Turk, T. A. (1991) *Effects of board and ownership structure on corporate R&D strategy*, Academy of Management Journal, 34, 205-214.

Bebczuk, Ricardo N. (2005) *Corporate Governance and Ownership: Measurement and Impact on Corporate Performance in Argentina*, Departamento de Economía.

Berle, A. A., and G. Means (1968) *The Modern Corporation and Private Property*, Rev. Ed., New York: Macmillan Publishing Company, Inc., Corporate Data Exchange, Inc. CDE Stock Ownership Directory – Fortune 500 No.5, New York. 1981.

Bethel, J. E., and Liebeskind, J. D. (1993) *The effects of ownership structure on corporate restructuring*, Strategic Management Journal, Vol. 14, pp. 15-32.

Berrone, Pascual; Surroca, Jordi and Tribo, Joseph A. (2005) *The Influence of Blockholders on R&D Investments Intensity: Evidence From Spain*, Working paper 05-46

Blake, David; Timmermann, Allan; Tonks, Ian and Wermers, Russ (2009) *Pension Funds Performance and Risk-taking under Decentralized Investment Management*.

Bhabra, Gurmeet S.; Ferris, Stephen P.; Sen Nilanjan and Yen, Peng Peck (2003) *Corporate Governance in Singapore: The Impact of Directors Equity Ownership*, Advances in Financial Economics, Volume: 8, 2003.

Bhagat, S. and Jefferis, R. H. (1991) *Voting power in the proxy process*, Journal of Financial Economics, 30, pp. 193-225.

Bourgeois, L.J. III (1981) *On the measurement of organizational slack*, Academy of Management Review, Vol. VI pp. 29-39.

Brickley, J., Lease, R. C. and Smith, J. R. (1988) *Ownership structure and voting on anti-takeover amendments*, Journal of Financial Economics, 20, 267-291.Brown,

Jungwirth; Bernhard (2002) *Information overload: Threat or Opportunity*, Journal of Adolescent & Adult Literacy, pp.89-99.

Bushee, B. and Abarbanell, J. (1998) *Abnormal returns to a fundamental analysis strategy*, The Accounting Review 73, 19–45.

Clark, Gordon L. and Wójcik, Dariusz (2005) *Financial Valuation of the German Model: The Negative Relationship between Ownership Concentration and Stock Market Returns, 1997-2001*, Economic Geography Vol. 81, No. 1 (Jan., 2005), pp. 11-29.

Chan, S.H., Martin, J.D. and Kensenger, J. W. (1990) *Corporate research & development expenditures and share value*, Journal of Financial Economics, 26: 255-276.

Chan, Christine M. and Makino, Shige (2007) *Legitimacy and Multi-Level Institutional Environments: Implications for Foreign Subsidiary Ownership Structure*, Journal of International Business Studies, Vol. 38, No. 4, International Expansion of Emerging Market Businesses (Jul., 2007), pp. 621-638.

Chen, Yanghua (2010) *Ownership Structure, Financial Structure and R&D Investment: Evidence from Korean Firm*, Institutional Knowledge at Singapore Management University.

Hsu, Hsuehen-En and Hsiung, Kao (2011) *Institutional Ownership, Capital Structure and R&D Investment*, IPEDR Vol.4 (2011) IACSIT Press, Singapore.

Charkham, Jonathan P. (1994), *Keeping good company: A study of corporate governance in five countries*, Clarendon Press (Oxford and New York), Book (ISBN 019828828X).

Choi Y. R.; T. Yoshikawa; Zahra S. A. and Han B. H., (2008) *The Effects of Institutional Change on Efficient R&D Investments among Korean Technology Firms: Do Business Groups Maintain Advantage?* Working paper.

Cyert, R. M., J. G. March (1963) *A Behavioral Theory of the Firm*, 2nd ed. Prentice Hall, Englewood Cliffs, NJ.

Doh, Johanathan P.; Jones, Gray K. and Teegen, Hildy J. (2008) *Foreign R&D and national innovations systems: An empirical study of host country influences*.

Guercio, Diane Del and Hawkins, Jennifer (1999) *The motivation and impact of pension fund activism*, Journal of Financial Economics, Elsevier, vol. 52(3), pages 293-340, June.

Gökce, Guravsar; Karatepe, Selma and Karagöz, Murat (2005) *The impact on High-Tech Exports: Case of Turkey and EU-27 Countr*ies.

Ettlie, J. E. (1998). *R&D and Global Manufacturing Performance*. Management Science, 44(1), 1-11

Franks, J. and Mayer, C. (1990) *Capital markets and corporate control: A study of France, Germany and the UK*, Economic Policy, 5, pp. 191-231.

Franko, L. G. (1989), *Global Corporate Competition: Who's Winning, Who's Losing, and the R&D Factor as One Reason Why*, Strategic Management Journal, 10(5), 449-474.

Greve, H. R. (2003), *A Behavioral Theory of R&D Expenditures and Innovations: Evidence from Shipbuilding*, The Academy of Management Journal, 46(6), 685-702.

Graves, S. B. (1988) *Institutional Ownership and Corporate R&D in the Computer Industry*, The Academy of Management Journal, Vol. 31 No. 2, pp.417-428.

Hall, Bronwyn H. (1998), *Innovation and Market Value*, NBER Working Paper Series. Available at SSRN: http://ssrn.com/abstract=226407

Hansen, G. S., & Hill, C. W. L. (1991). *Are Institutional Investors Myopic? A TimeSeries Study of Four Technology- Driven Industries*. Strategic Management Journal, 12(1), 1-16

Hawley, James P. (1995) *Political Voice, Fiduciary Activism, and the Institutional Ownership of U.S. Corporations: The Role of Public and No corporate Pension Funds, Sociological Perspectives*, Vol. 38, No. 3, On Inequality: Papers from the 56th Annual Meeting (Autumn, 1995), pp. 415-435.

Hedlund, G., Hägg, I., Hörnell, E., and Rydén, B. (1985) *Institutioner som aktieägare Förvaltare?, Industrialister?*, Klippare?, Studieförbundet Näringsliv och Samhälle:Kristianstad.

Hill, C. W. L., and Snell, S. A. (1988) *External Control, Corporate Strategy, and Firm Performance in Research- Intensive Industries*, Strategic Management Journal, 9(6), 577-590

Hirschman, Albert O. (1970) *Exit, Voice, and Loyalty: Responses to Decline in Firms*, Organizations, and States. Cambridge, MA: Harvard University Press.

Hoskisson, R. E., Hitt, M. A., Johnson, R. A., and Grossman, W. (2002) *Conflicting Voices: The Effects of Institutional Ownership Heterogeneity and Internal Governance on Corporate Innovation Strategies*, The Academy of Management Journal, 45(4), 697-716.

Jackson, Andrew (2003) *The aggregate Behavior of Individual Investors*, London Business School.

Jensen, M. C., and Meckling, W. H. (1976), *Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure*, Journal of Financial Economics, 3(4), 305-360.

Johansson, Börje; Lööf, Hans and Ebersberger, Bernd (2008) *The innovation of productivity effect of foreign takeover of national assets*, CESIS & KTH management center Innsbruck.

Jungwirth, Bernhard (2002), *Information overload: threat or opportunity*, Journal of Adolescent & Adult Literacy©2002 International Reading Association.

Kabir, Rezaul; Cantrijn, Dolph and Andreas Jeunink (1997) *Takeover Defenses, Ownership Structure and Stock Returns in the Netherlands: An Empirical Analysis*, Strategic Management Journal, Vol. 18, No. 2 (Feb., 1997), pp. 97-10

Kim, H., Kim, H., & Lee, P. M. (2008) *Ownership Structure and Relationship Between Financial Slack and R&D Investments: Evidence from Korean Firms*. Org. Sci. 19(3), pp. 404-418.

King, M. R., and Santor, E. (2008), *Family values: Ownership structure, performance and capital structure of Canadian firm*s, Journal of Banking & Finance, 32(11), 2423-2432.

Kochhar, R.; David, P., and Levitas, E. (1998), *The effect of institutional investors on the level and mix of CEO compensation*. Academy of Management Journal, 41(2), 200-208

Kroszner, Randall S. and Strahan, Philip E. (2001) *Bankers on boards: monitoring, conflicts of interest, and lender liability*, NBER.

Long, W. F.; Ravenscraft, D. J. (1985) L*BOs, Debt and R&D Intensity*, Strategic Management Journal, Vol. 14, pp. 119-135.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., and Vishny, R. (1999), *The quality of government*. J Law Econ Organ, 15(1), 222-279.

Lee, P. M.; O'Neill, H. M. (2003) *Ownership Structures and R&D Investments of U.S. and Japanese Firms: Agency and Stewardship Perspectives*, The Academy of Management Journal, Vol. 46 No. 2, pp. 212-225.

Liu, Hong and Loewenstein, Mark (2007) *Market Crashes, Correlated Illiquidity, and Portfolio Choice*, Washington Univ. and Maryland Univ.

Maug, Ernst (1996) *Corporate Control and the Market for Managerial Labour - On the Decision to go Public*, European Economic Review 40 pp.1049-1056.

Malone, Thomas W.; Weill, Peter; D'Urso, Victoria T.; Herman, George and Woerner, Stephanie (2005) *Do Some Business Models Perform Better than Others? A Study of the 1000 Largest US Firms*, Sloan School of Management MIT, Working Paper 226.

Martinez, Ros; Cassiman, Bruno (2007) *Product Innovation and Exports – Evidence from Spanish Manufacturing*, IESE Business School.

Myers, S. C.; N. Majluf (1984) *Corporate Financing and Investment Decisions When Firms Have Information Do Not Have*, Journal of Financial Economics, Vol. 13, pp.187-221.

Mezghanni, B.S. (2009), *R&D Investments and Firm Performance: The moderating effects of Ownership structure and Board of directors*, Working Paper, www.affi2009-brest.com

Miles, R. and C. Snow (1978) *Organizational Strategy, Structure, and Process*, McGraw-Hill.

Miller, D. (1987) *The structural and environmental correlates of business strategy*. Strategic Management Journal 8(1): 55-76.

Mosakowski, E. (1993) *A Resource-Based Perspective on the Dynamic Strategy Performance Relationship: An Empirical Examination of the Focus and Differentiation Strategies in Entrepreneurial Firms*, Journal of Management, Vol. 19 No.4, pp. 819-839.

Mutter, Ryan L. and Rosko, Michael D. (2007) *The Impact of Ownership on the Cost-Efficiency of U.S. Hospitals*, Advances in Health Eco. and Health Services Research, vol.18.

O'Brien, Robert M. (2007) *A Caution Regarding Rules of Thumb for Variance Inflation Factor*, Quality & Quantity (2007) 41:673–690, © Springer 2007.

OECD (2008) *Science, Technology and Industry Outlook*, OECD Publications.

Osagie, Johnston; Solomon, Gbolahan and Sutton, Cynthia (2005) *The Impacts Of Institutional Stock Ownership On Stock Returns And Performance: A Financial Market Perspective*, Journal of Business & Economics Research – March 2005, Vol.3 (3).

Ramirez, C. D. (1995) *Did JP Morgan's Men add liquidity? Corporate Investment, Cash Flow and Financial Structure at the Turn of the Twentieth Century*, J. of Fin. 50(2):661-678.

Ray, Pradeep K. and Venaik, Sunil (2008) *Foreign Ownership and Subsidiary Performance: Impact on Research and Exports?*, Eco. and Polt. Weekly, Vol. 43(39) pp. 57-65.

Singh, J.V. (1986) *Performance, slack, and risk taking in organizational decision making*, Academy of Management Journal, Vol. 29 pp. 562-585.

Singh, M., & Faircloth, S. (2005) *The impact of corporate debt on long term investment and firm performance*, Applied Economics: Routledge.
Song, Han-Suck (2005) *Capital Structure Determinants – an empirical strucy of Swedish Companies*, INFRA KTH.
Shah, Ali Syed-Zulfiqar; Butt, Ali-Safdar and Saeed, Mohammad Mohtasham (2011) *Ownership structure and performance of firms: Empirical evidence from an emerging market*, African Journal of Business Management Vol. 5(2), pp.515-523.
Slovin, M. B. and Sushka, M. E. (1993) *Ownership concentration, corporate control activity, and firm value: Evidence from the death of inside block holders*, J. of Fin, 48, pp. 1293-1321.
Suehiro, Akira (2001) *Family Business Gone Wrong? Ownership Patterns and Corporate Performance in Thailand.*
Taylor, P.; Jordan, J. and Lowe, J. (1998), *Strategy and Financial Policy in U.K. Small Firms.* Journal of Business Finance & Accounting, 25(1), 1–2.
Timmers, Paul (1998) *Business Models for Electronic Markets*, Elec., Vol. 8, No. 2, pp. 3-8.
Thomsen, S. and Pedersen, T. (2000), *Ownership structure and Performance*, Strategic Management Journal, 21:689-705.
Trushin, Eshref (2010) *Have European Pharmaceuticals Reforms Damaged R&D?*, School of Business, Queen Mary University of London.
Villalonga, Belen and Amit, *Raphael (2006) How do family ownership, control and management effect firm value?,* Journal of Financial Economics, Vol. 80:2, pp.385-417.
Westord, Peter; Kashian, Russ and Cummings Richard (2010) *Does ownership form in community banking impact profitability?* Managerial Finance Volume: 36 Issue:2 2010.
White, Gerald I.; Sondhi, Ashwinpaul C. and Fried, Dov (2003) *The Analysis and Use of Financial Statements*, 3rd edition Wiley.
Wood, Haydn K.; Stern, Robert N. and Hammer, Tove-Helland (1979) *Employee ownership in plant shutdowns: Prospects for employment stability*, W. E. Upjohn Institute.
Zajac, E. J., B. R. Golden and S. M. Shortell (1991) *New Organizational Forms for Enhancing Innovation: The Case of Internal Corporate Joint Ventures*, Mgmt. Scic. 37(2): 170-184.

Appendix

Table 1 – Sampled observations used during 2005-2010

Alfa Laval	Hexagon	Sandvik	TeliaSonera
Assa Abloy	Holmen	SCA	Trelleborg
Atlas Copco	Hufvudstaden	Scania	Volvo
Atrium Ljungberg	Industrivärlden	SEB	Wallenstam
Axfood	Investor	Securitas	Axis (MC)
Boliden	Kinnevik	SHB	Balder (MC)
Castellum	Latour	Skanska	Höganäs (MC)
Electrolux	Lundbergs	SKF	Indutrade (MC)
Elekta	Lundin Petroleum	SSAB	Intrum Justitia (MC)
Ericsson	Meda	SwedBank	JM (MC)
Getinge	Peab	Swedish Match	Nibe Industrier (MC)
H&M	Ratos	Tele2	Betsson (MC)
Hakon Invest	Saab		

Table 2 – Sorting according to the rights sold, used for *average R&D-to-Sales*

Creator (1)	*Distributor* (2)	*Landlord* (3)	*Broker* (4)
Alfa Laval	Axfood	Artium Ljungberg	Hakon Invest
Assa Abloy	Boliden	Castellum	Industrivärlden
Atlas Copco	H&M	Hufvudstaden	Investor
Electrolux	Holmen	Lundbergs	Kinnevik
Elekta	Lundin Petroleum	Wallenstam	Latour
Ericsson	Peab	Balder (MC)	Ratos
Getinge	Securitas		SEB
Hexagon	Swedish Match		SHB
Meda	Tele2		SwedBank
Saab	TeliaSonera		Indutrade (MC)
Sandvik	JM (MC)		Intrum Justitia (MC)
SCA	Betsson (MC)		
Scania			
Skanska			
SKF			
SSAB			
Trelleborg			
Volvo			
Axis (MC)			
Höganäs (MC)			
Nibe Industrier (MC)			

Table 3 – Conversion of USD using SEK denominated

Date	*USD-to-SEK*
12/31/2005	7.95307
12/31/2006	6.83988
12/31/2007	6.83988
12/31/2008	8.01341
12/31/2009	7.1251
12/31/2010	6.85027

Table 4 – Variables used in the essay

Dep.	Research and Development-to-Sales ratio
Ownership	Bank Ownership
	Family Ownership
	Institutional Ownership
	Pension funds Ownership
	Foreign Ownership
Control variables	Firm size (log Employee Number)
	Average R&D-level
	Total Assets (log Book Total Assets)
	Financial slack
Capital Structure	Dividend/Asset ratio
	Liquidity ratio
	Solvency ratio
	Gearing ratio
	Interest Coverage ratio

Table 5 – Summary statistics from the variables used in the regression model

		Average	*Stand. Error.*	*Medium*	*Std. Dev.*	*Kurtosis*	*Skewness*	*Variation width*	*Min*	*Max*	*Obs.*
Dep.	*Reasearch and Development*	2,20	0,25	0,37	4,41	14,10	3,42	32,36	0,00	32,36	300
Ownership variables	*Bank Ownership*	1,93	0,30	0,53	5,12	26,84	5,05	37,80	0,00	37,80	300
	Family Ownership	23,98	1,73	6,60	29,92	-0,47	1,01	93,30	0,00	93,30	300
	Institutional Ownership	30,96	1,24	27,75	21,52	-1,06	0,31	81,90	0,00	81,90	300
	Pension funds Ownership	7,24	0,39	5,30	6,68	3,15	1,57	40,70	0,00	40,70	300
	Foreign ownership	24,60	1,11	20,80	19,17	0,89	0,99	92,00	0,00	92,00	300
Control variables	*Total Assets Log(Assets)*	6,88	0,05	6,72	0,88	2,83	1,14	5,59	4,41	10,00	300
	Firm Size Log(Employees)	3,60	0,05	3,72	0,89	-0,42	-0,50	4,05	1,32	5,37	300
	Average R&D	2,20	0,10	1,95	1,76	-1,58	-0,02	4,68	0,00	4,68	300
	Fin. Slack (Cash&sec-to-assets)	0,18	0,02	0,02	0,40	15,24	3,66	2,80	0,00	2,80	300
Capital structure	*Liquidity Ratio*	5,46	0,99	1,00	17,13	13,67	3,88	85,36	0,03	85,39	300
	Dividend-to-Assets	141,16	70,46	10,14	1220,42	270,77	16,11	20679,70	0,00	20679,70	300
	Gearing Ratio	91,49	6,06	72,03	104,90	31,48	4,82	965,36	0,00	965,36	300
	Solvency Ratio	40,93	1,22	38,22	21,18	0,16	0,39	98,47	-3,28	95,19	300
	Interest Coverge Ratio	14,40	3,87	6,33	66,98	140,28	11,65	928,16	-54,16	874,00	300

Table 6 – Correlation matrix from the variables used in the regression models

	R&D	*Bank Ownr.*	*Fmly Ownr.*	*Ins. Ownr.*	*Pens. Ownr.*	*Forgn. Ownr.*	*Tot. Ass. Log(TA)*	*Frm. Siz.*	*Avrg. R&D*	*Fin. Slack*	*Intr. Covr.*	*Liquid. Rat.*	*Solvcy Rat.*	*Div/Asst.*	*Gearing Rat.*
R&D	1,00														
Bank Ownr.	0,05	1,00													
Fmly Ownr.	0,22	-0,16	1,00												
Ins. Ownr.	-0,20	-0,15	-0,66	1,00											
Pens. Ownr.	-0,16	0,01	-0,33	0,13	1,00										
Forgn. Ownr.	-0,09	0,18	-0,54	-0,13	0,03	1,00									
Tot. Ass.	0,39	-0,09	0,12	-0,07	0,00	-0,07	1,00								
Frm. Siz.	-0,06	0,09	-0,32	0,28	-0,03	0,12	-0,12	1,00							
Avrg. R&D	0,40	0,10	-0,09	-0,03	-0,03	0,11	0,18	0,43	1,00						
Fin. Slack	-0,11	0,10	-0,06	0,09	-0,05	-0,03	-0,09	0,27	-0,02	1,00					
Covr. Rat.	0,01	-0,02	-0,03	0,08	-0,05	0,01	0,05	0,06	0,10	-0,03	1,00				
Liquid. Rat.	-0,12	-0,05	-0,20	0,23	0,18	0,05	0,30	-0,06	-0,19	-0,09	0,01	1,00			
Solvcy Rat.	0,04	-0,03	0,10	-0,17	-0,16	0,07	-0,05	0,02	0,10	0,08	0,24	-0,40	1,00		
Div/Asst.	-0,05	-0,02	-0,06	0,07	-0,02	-0,01	-0,22	0,06	-0,10	-0,03	-0,01	-0,03	0,06	1,00	
Gearing Rat.	-0,06	-0,03	-0,17	-0,02	-0,12	0,40	-0,15	0,05	-0,08	-0,03	0,15	-0,03	-0,03	0,06	1,00

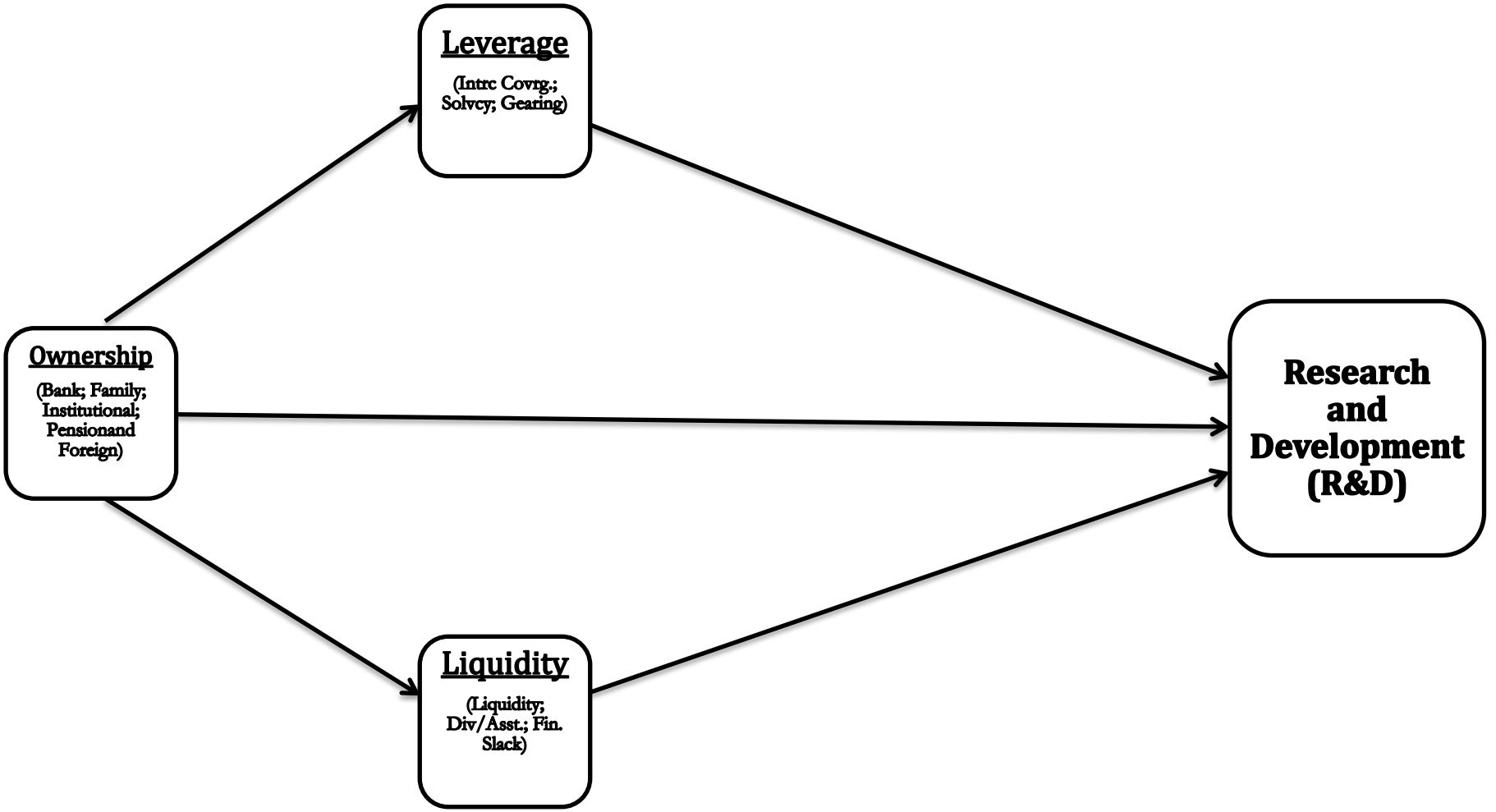

Figure 1 – The model that we have hypothesized and studied using the ownership, capital structure (liquidity and leverage) and R&D-to-Sales levels.

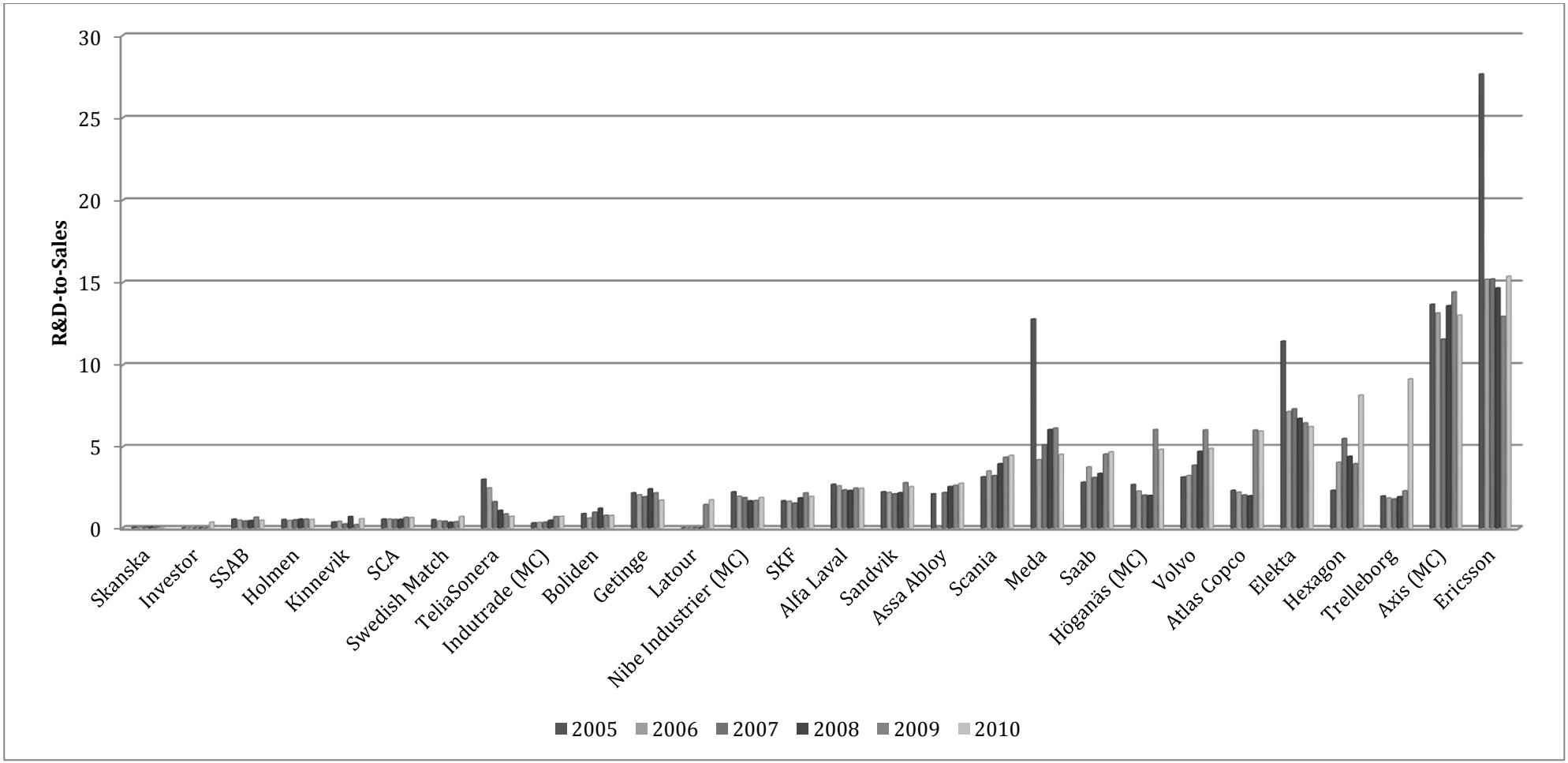

Figure 2 – Illustrations over the highest R&D-to-Sales (in %) expenditure firms for years between 2005 until 2010.

Table 7 – Cumulative trivariate distribution based on Average R&D classification

		2005	*2006*	*2007*	*2008*	*2009*	*2010*
Right sold	**Creator**	45,67%	50,99%	49,66%	48,97%	49,14%	47,68%
	Distributor	21,57%	20,47%	21,18%	21,77%	21,82%	22,16%
	Landlord	12,91%	10,37%	10,84%	10,85%	10,53%	10,50%
	Broker	19,85%	18,16%	18,32%	18,40%	18,51%	19,66%
	Sum total	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*

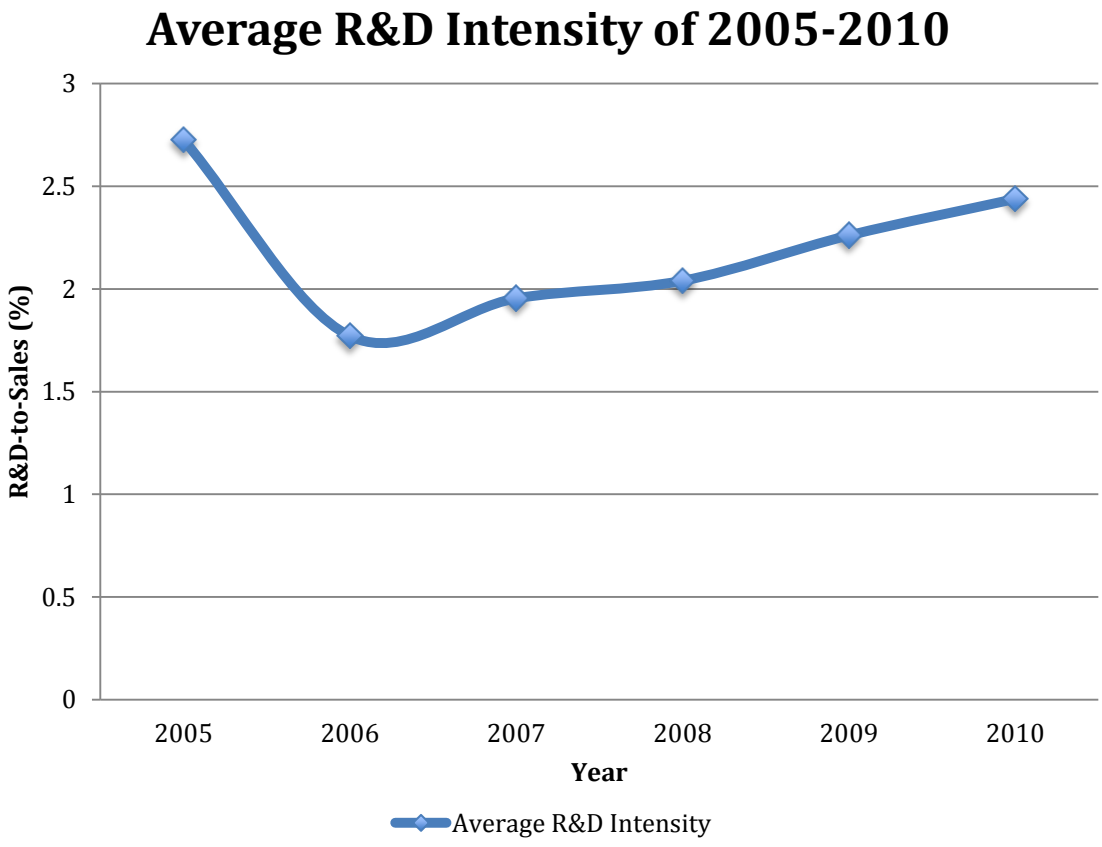

Figure 3 – The average rate of R&D intensity for all sampled firms 2005-2010.

Table 8 – Regression results from the direct model, the first model

The table reports estimates of the multivariate probit model described in Section 3. Coefficients are shown for the 'outcome' equation yit = $Y_{it} = \eta + \beta_1 X + \cdots + \beta_5 X + \beta_6 \varphi + \cdots + \beta_8 \varphi + \varepsilon_i$. The dependent variable yit is the R&D-to-Sales ratio for each year and observation. There are two models outputs here were one covers 2005-2010 and the other only 2005 and 2010. All variables are defined in the section three and described the sampling method in each subsection. Also, the variable statistical summary and data tabulates are noted in the table 3-5. Standard errors are reported in parentheses below. We have added significant for which described below the table.

	Dependent variable: R&D-to-Sales 2005-2010	*Dependent variable: R&D-to-Sales 2005, 2010#*
Constant	Coef.	Coef.
Bank Ownership	0,028	0,012
	(0,051)	(0,151)
Family Ownership	-0,000	-0,006
	(0,029)	(0,057)
Institutional Ownership	0,013	0,002
	(0,032)	(0,062)
Pension funds Ownership	-0,093**	-0,080
	(0,045)	(0,085)
Foreign ownership	0,014	0,016
	(0,030)	(0,057)
Firm Size Log (Employees)	-1,163***	-1,494***
	(0,278)	(0,633)
Average Research and Development	1,045***	1,114***
	(0,148)	(0,305)
Total Assets Log (Assets)	1,617***	1,285**
	(0,276)	(0,572)
Multiple-R	0,568	0,509
R-square	0,322	0,259
Adjusted R-square	0,303	0,194
F-value	17,28***	3,98***
Number of observations	300	100

1. The figures in the parentless are the standard deviations (σ) for the coefficients.
2. *** Indicates significance levels of at least 1%; ** Indicates significance level of at least 5%, * Indicates significance level of at least 10%

Table 9 – Regression results using the main model and lagged variables

The table reports estimates of the multivariate probit model described in Section 3. Coefficients are shown for the 'outcome' equation yit = $Y_{it} = \eta + \beta_1 X + \cdots + \beta_5 X + \beta_6 \varphi + \cdots + \beta_8 \varphi + \varepsilon_i$. The dependent variable yit is the R&D-to-Sales ratio for each year and observation. We have in this model deviated and ran the regression using all exogenous variables with t=0, t-1 and t-2.

	Exogenous variable t=0	*Exogenous variable t-1*	*Exogenous variable t-2*
	Dependant variable: R&D-to-sales	*Dependant variable: R&D-to-sales*	*Dependant variable: R&D-to-sales*
Coefficient	Coef.	Coef.	Coef.
Bank Ownership	0,028	0,056	0,027
	(0,051)	(0,047)	(0,047)
Family Ownership	-0,000	0,015	0,000
	(0,029)	(0,024)	(0,021)
Institutional Ownership	0,013	0,006	-0,016
	(0,032)	(0,026)	(0,024)
Pension funds Ownership	-0,093**	-0,072**	-0,139***
	(0,045)	(0,039)	(0,023)
Foreign ownership	0,014	-0,012	0,016
	(0,030)	(0,024)	(0,023)
Total Assets Log (Assets)	-1,163***	-1,409***	-1,186***
	(0,278)	(0,252)	(0,272)
Firm Size Log (Employee)	1,045***	-0,847***	-1,095***
	(0,148)	(0,286)	(0,287)
Average R&D-to-Sales	1,617***	1,069***	1,148***
	(0,276)	(0,141)	(0,143)
Multiple-R	0,568	0,586	0,591
R-square	0,322	0,344	0,349
Adjusted R-square	0,303	0,326	0,331
F-value	17,28***	19,06***	19,531***
Number of observations	300	300	250

1. The figures in the parentless are the standard deviations (σ) for the coefficients.
2. *** Indicates significance levels of at least 1%; ** Indicates significance level of at least 5%, * Indicates significance level of at least 10%.

Table 10 – Regression results from the second multivariate equation corresponding to the indirect model, the second model

	Dependant Variable: R&D-to-Sales	*Dependant Variable: R&D*	*Dependant Variable: R&D*	*Dependant Variable: R&D*	*Dependant Variable: R&D*
Constant	Coef.	Coef.	Coef.	Coef.	Coef.
Bank Ownership	0,021**				
	(0,044)				
Family Ownership		-0,0109			
		(0,009)			
Institutional Ownership			0,007		
			(0,011)		
Pension funds Ownership				-0,087**	
				(0,033)	
Foreign Ownership					0,0282**
					(0,013)
Financial Slack (Cash & Sec-to-Assets)	1,178*	1,166*	1,1889**	1,212**	1,198**
	(0,605)	(0,603)	(0,604)	(0,597)	(0,599)
Interest Coverage Ratio	-0,001	-0,001	-0,001	-0,008	-0,001
	(0,003)	(0,003)	(0,003)	(0,003)	(0,003)
Liquidity Ratio	0,061***	0,066***	0,062***	0,055***	0,067***
	(0,0156)	(0,0159)	(0,0157)	(0,015)	(0,0157)
Solvency Ratio	-0,030***	-0,0264**	-0,0283**	0,0337**	-0,030**
	(0,014)	(0,0141)	(0,014)	(0,0137)	(0,014)
Dividend-to-Assets	0,000	0,000	0,000	0,000*	0,000
	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)
Gearing Ratio	-0,006***	-0,0058***	-0,005***	-0,0066*	-0,008***
	(0,003)	(0,003)	(0,002)	(0,003)	(0,003)
Multiple-R	0,592	0,595	0,593	0,605	0,601
R-square	0,351	0,354	0,351	0,366	0,361
Adjusted R-square	0,329	0,332	0,329	0,344	0,339
F-value	15,619***	15,835***	15,647***	16,666***	16,327***
Number of observations	300	300	300	300	300

1. The figures in the parentless are the standard deviations (σ) for the coefficients.
2. *** Indicates significance levels of at least 1%; ** Indicates significance level of at least 5, * Indicates significance level of at least 10%.