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# Impact of Primary Insider Ownership on Firm Performance

- *An empirical study of primary insider ownership on the Oslo Stock Exchange*

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# Abstract

In this thesis, we study primary insider holdings' effect on firm performance. The objective is to shed light on the complex relationship between corporate governance mechanisms and firm performance, researching both the ownership structure and identity dimensions in the same theoretical framework. This is done to account for the internal conflict between shareholders.

We build on the model of Demsetz & Vilalonga (2001) using pooled OLS, fixed-effects and two-stage least squares regression analysis. Our choice of models provides us with robust estimates and mitigates the risk of bias due to omitted variables, enabling us to compare the results with different econometric approaches. We use a rich dataset of firms with a primary listing at the Oslo Stock Exchange from 2010-2017. Additionally, we introduce insider liquidity as an instrument for primary insider holdings, which to our knowledge has not been done before with data from the Oslo Stock Exchange.

Our findings suggest that the amount of primary insider shares held by individuals does not impact firm performance. Primary insider holdings are only significant when using two-stage least square estimation regression analysis, and the significance is dependent on the instrument used. These findings suggest that ownership characteristics are of little significance to firm performance. This is consistent with Demsetz (1983) equilibrium hypothesis. Still, the lack of significant results might be explained by weak instruments. We conclude that until there is a stronger theoretical framework in place, the simultaneous equations approach remains ambiguous.

Furthermore, we find that firm size and turnover are the most consistently significant factors for Tobin's Q, which corroborates our theoretical framework and previous research. We also find that our results, from regressions done with data from the OSE, are in line with results from the U.S. and the U.K. This suggests that the prevalent pooled OLS, fixed-effects and two-stage least square regression models are independent of the named country's regulatory frameworks.

# Acknowledgements

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The work on this thesis has been challenging and demanding, yet rewarding and informative. Our thesis is inspired by Bøhren and Ødegaard's 2001 paper "Corporate governance and economic performance in Norwegian listed firms" which found that insider ownership is almost always value-creating and increases economic performance. We saw the opportunity to study the object in further detail, using new and rich data that allowed us to use updated control variables and measurements.

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# 1. Introduction

The question of whether a firm's performance is dependent on the identity of its shareholders can be traced back to Berle and Mean's (1932) foundational book on corporate governance. It explored the separation of ownership and control, and argued that dispersed ownership would hinder effective shareholder scrutiny and value maximization. Since then we have had several waves of corporate governance based research which differs in approach and result, but there is no clearly defined theory of corporate governance yet (Larcker, Richardson, & Tuna, 2007). Cuomo, Mallin, & Zatttoni (2015) state that there are still several opportunities for making significant contributions in the area of corporate governance.

Earlier studies on corporate governance used Ordinary Least Squares (OLS) regressions to infer a relationship between corporate governance and firm performance. These papers treated corporate governance as an exogenous variable, failing to address the problem of simultaneity and unobserved heterogeneity (Brown, Beekes, & Verhoeven, 2011). This problem was first addressed by Demsetz (1983) who proposed that ownership structure was an endogenous outcome of a firm's balanced advantages and disadvantages in its equilibrium. Demsetz later combined with Lehn, and together, they provided evidence for his ideas in their publication; "The Structure of Corporate Ownership: Causes and Consequences" (1985).

The papers that address the endogeneity of ownership structure by using more complex econometrics generally find no statistically significant relationship between ownership structure and firm performance when using simultaneous equation models, and are in line with the equilibrium hypothesis of Demsetz (1983). Still, when using more complex econometric methods such as simultaneous equations there lacks a good discussion among the choice of instrument variables, which makes it difficult to judge if the results show a causal relationship. Demsetz & Villalonga (2001) suggest that, viewed in totality, earlier papers do not give strong evidence to support that there is a causal relationship between firm performance and ownership structure[1].

[1] (Jensen & Meckling, 1976), (Morck, Shleifer, & Vishny, 1988), (McConnell & Servaes, 1990), (Hermalin & Weisbach, 1991), (Loderer & Martin, 1997), (La Porta & Lopez-de-Silanes, 2000), (Cho, 1998), (Himmelberg, Hubbard, & Palia, 1999) and (Holderness, Kroszner, & Sheenan, 1999).

Demsetz (2001) later revisited the subject and wrote a restudy treating ownership not only as an endogenous variable, but at the same time splitting the ownership into two dimensions meant to represent the conflict of interest within shareholder groups. He used shares owned by management (insider shares) and the fraction of shares owned by the five largest shareholders to reflect these opposing sides. He also found that even though insider holdings and outside shareholders often are viewed as substitutes, and are highly correlated, they are believed to affect the firm in different ways. As a result, they are both used as measures in most studies of ownership structure. His paper strengthens the hypothesis that ownership structure is endogenous and finds no significant relationship between ownership structure and firm performance.

Since then there have been several studies that have built further on the Demsetz heritage and included different owner identities[2]. The results from these studies vary as a result of different econometric approaches. Bøhren and Ødegaard (2003) argued that relating firm performance to a particular aspect of corporate governance might not capture the real relationship between governance and performance unless one controls for other aspects of governance. This argument inspired several researchers[3] to construct a single governance scorecard index. Brown, Beekes, & Verhoeven (2011) review research on corporate governance from this period concluding that a better theoretical framework is required to explain the endogeneity issue, and stress the importance of how corporate governance is measured, the construction of indices, and the need to capture internal and external aspects of corporate governance. They suggest a multidisciplinary approach could enrich the body of knowledge in corporate governance research. Bhagat & Bolton (2008) and Daines, Gow, & Larcker (2010) find that there is no consistent relationship between governance indices and firm performance, and that the most commonly cited indices have no predictive power.

Recent approaches range from using machine learning to map the corporate governance framework (Hernandez-Perdmo, Guney, & Rocco, 2019), to the seemingly eternal quest for a global corporate governance scorecard. There is still much research to be done on the

[2] (Bøhren & Ødegaard, Corporate Governance and Economic Performance in Norwegian Listed Firms., 2001), (Pedersen T. T., 2003) and (Omran, Bolbol, & Fatheldin, 2008).

[3] (Bauer, Guenster, & Otten, 2004), (Drobetz, Schillhofer, & Zimmermann, 2004), (Black, Jang, & Kim, 2005), (Gompers, Ishii, & Metrick, 2003), (Klapper & Love, 2004), (Ararat, Black, & Yurtoglu, 2017), and (Brown, Beekes, & Aman, 2018).

relationship between corporate governance and firm performance. This is both because of limited research within the field of corporate governance, but also because valid data is hard to obtain.

## 1.1 Motivation and objective of the study

The objective of this study is to re-investigate the effect of primary insider holdings on firm performance, focusing on insider shares held by individuals. As ownership concentration is closely linked to ownership identity we correspondingly include this aspect in our analysis. We also introduce insider liquidity as an instrument variable, and asses its characteristics relative to the standard liquidity measure.

We run regressions building on Demsetz & Vilalonga's (2001) heritage. By focusing on primarily on insider holdings, we take a step back and aim to shed light on the foundational governance mechanisms of this aspect of ownership in an under-researched market with new factors.

Insider liquidity is measured as insider stock turnover per quarter, and is included in our empirical analysis, as asset pricing theory suggests that value is positively related to liquidity. Stock turnover has previously been used as a control variable (Bøhren & Ødegaard, 2001), but to the best of our knowledge, this is the first time the effect of insider stock turnover has been used as an instrument. We aim to gain fruitful insights from these two factors that can contribute to the growing body of research that aims to explain the relationship between corporate governance mechanisms and firm performance.

A majority of the data from previous research papers within the field of corporate governance stems from the U.S. and the U.K. market. This could lead to sample bias and context dependence towards these countries and their regulatory framework (Bøhren & Ødegaard, 2001). When applying results from these papers to other markets, we face several challenges due to differing local corporate governance mechanisms that according to classical principal-agent theory, might affect firm performance. Examples include differing firm sizes, regime, hostile takeover activity, ownership concentration, use of incentive contracts and insider director prevalence in boardrooms (Agrawal & Knoeber, 1996; Shleifer & Vishny, 1997; Tirole, 2001).

Since we seldom have a global sample, comparing results from markets with different corporate governance and market mechanisms gives us a deeper understanding of the order of causation between governance and performance. Hence we use quarterly panel data from Oslo Stock Exchange from 2010-2017[4] to see if we get different results for the Norwegian market than comparable studies done abroad. As an example of the difference found in the individual markets, we have included Table 1, highlighting the differences between the U.S. market and the Norwegian market, according to Bøhren & Ødegaard (2001).

*Table 1: Differing market characteristics*

| Market | US | Norway |
|---|---|---|
| **Firm size** | Large firms | Small firms[5] |
| **Regime** | Common law | Scandinavian civil law |
| **Hostile takeovers** | Prevalent | Very rare |
| **Ownership concentration** | Very low[6] | Higher |
| **Incentive contracts** | Prevalent | Less common |
| **Insider directors on board** | Prevalent | Rare[7] |

Furthermore, most research within the field of corporate governance makes a partial approach due to lack of data[8]. We include several corporate governance mechanisms from different

[4] Since 1999 companies listed on the Oslo Stock Exchange have had a requirement to post quarterly periodic financial statements in the form of quarterly reports. Due to EU regulations, Oslo Stock Exchange removed this requirement after the fiscal year of 2017.

[5] Bøhren & Ødegaard (2001) state that as a whole, Norwegian firms are generally smaller than firms in the US

[6] Becht and Meyer (2001) find that the largest owner in a listed firm in the U.S. typically owns 3%, compared to 45% in continental Europe. Bøhren & Ødegaard (2001) find that the typical holding of the largest owner in Norway is 30%.

[7]. Corporate boards never have more than one insider director.

[8] (Demsetz & Lehn, The structure of corporate ownership: Causes and consequences, 1985), (Morck, Shleifer, & Vishny, 1988), (McConnell & Servaes, 1990) and (Gugler, 2001).

governance dimensions, e.g. from both ownership identity and ownership structure to create a more comprehensive paper that allows us to capture a large number of mechanisms.

Most evidence in previous papers is based on a single year due to lack of data. This snapshot approach cannot tell if corporate governance mechanisms and firm performance relationships are stable over time, or due to the specific period chosen (Bøhren & Ødegaard, 2001). We use a comprehensive panel dataset with quarterly data for companies listed on the Oslo Stock Exchange from 2010-2017 to see if the results are consistent over time.

To our knowledge, there has been written a limited amount of papers on ownership structure and identity on the Oslo Stock Exchange. Bøhren & Ødegaard (2001) published a study with data from 1989-1997, and Pedersen & Thomsen (2003) included Norway in a broader study of ownership structure in Europe. As well, Sørensen (2007) performed an empirical analysis on dispersed public ownership that suggested that fragmented ownership to public induces cost-inefficiency relative to companies owned by a single political authority. More recently, Døskeland & Mjøs (2008) wrote a paper on the development of ownership structure on the OSE.

Since then, the market has become modernized in terms of a higher amount of foreign investors, a more transparent information flow, and increased focus on corporate governance in response to the financial crisis of 2008.

## 1.2 Scope and limitations

Previous research uses a large variety of econometric methods, and the results vary depending on method and performance measure. Generally, the results of tests allowing for endogeneity show a lack of significant relationships, which according to Bøhren and Ødegaard (2001) may not reflect optimal governance but rather that the theory of how governance and performance interact still is underdeveloped. After surveying previous academic papers as well as reviews of previous research, we select the following econometric methods: pooled OLS, fixed effects regressions and two-stage least squares (2SLS) instrument variables estimations.

If ownership is made multi-dimensional, it can be divided into ownership identity and ownership concentration. Demsetz & Vilalonga (2001) argue that by including both of these

dimensions, we can gain additional insights. Thus, we include said dimensions through governance mechanisms in our dataset, to get as detailed a picture as possible.

We define a primary insider as a person in the board, management or others in connection with a listed company in accordance to the Oslo Stock Exchange and the Securities Trading Act, and focus solely on their reported personal holdings. Holdings that are not registered in the name of the individual, e.g. family firms and holding companies, are not in the scope of this paper. The term "insider shares" will be used to describe primary insider holdings in the rest of this thesis.

Due to limitations in our dataset, we look at the company dimension, not the individual dimension. Furthermore, we focus on the shareholder perspective, not the stakeholder perspective.

We choose changes in Tobin's Q as our performance measure, following the tradition of previous research papers in corporate governance, allowing for a results comparison. A thorough discussion of firm performance measures will follow in part 3.2.6.

## 1.3 Outline

The rest of this paper is structured as follows. In section 2, we lay out our theoretical framework supported by previous academic research that enlightens the relationship between corporate governance mechanisms and firm performance. After that, we present and comment on previous research in section 3, with focus on econometric techniques, data quality and variable selection. We then follow by presenting our empirical analysis in section 4. In section 5, we present our results and discuss our discoveries. Section 6 concludes the thesis and brings forth suggestions for further research.

# 2. Theoretical framework and existing evidence

In this section, we will briefly outline the main theories behind corporate governance as well as the specific mechanisms we are going to analyse in the empirical section. The mechanisms are ownership concentration, ownership identity and insider liquidity.

## 2.1 Principal-agent theory

Berle & Means (1932) wrote one of the earliest academic papers on corporate governance and argued that those with legal ownership of companies had been separated from their control. This was due to the structure of the corporate law that enforced separation of ownership and control and especially allowed for dispersed ownership in big corporations. The result is a lack of effective shareholder activism, which gives those involved in the daily operational tasks the incentive to maximise their utility instead of the shareholders. Berle and Means found that when the number of shareholders increase and businesses grow, the directors end up having proportionally smaller capital stakes. As a result directors' income will mainly come from their labour as directors, not their capital stake. If the directors are purely driven by their monetary gain, “The owners most emphatically will not be served by a profit-seeking controlling group”. The proposed remedy was increased transparency, accountability, and embedded voting rights for all shareholders.

Jensen & Meckling (1976) developed on previous research and defined the agency relationship as a contract between the principal(s) and the agent where the principal delegates some decision making authority to the agent in the process of engaging the agent to perform some service on the principal(s) behalf. If both parties are utility maximising individuals, there is a reason to believe that the agent not always will act in alignment with the best interest of the principal. To reduce suboptimal behaviour, the principal establishes appropriate incentives which lay ground to the formalisation of agency costs.

They go on to define agency (both non-pecuniary and pecuniary) costs as the sum of:

1. **Monitoring expenditures by the principal**: This is incentives and monitoring costs designed to establish guidelines and limit unwanted activities by the agent, e.g. contracts and incentives.

2. **Bonding expenditures by the agent**: This occurs when the agent limits himself from acting a certain way by creating bonding expenditures, e.g. reporting his activities or creating legal mechanisms that will reimburse the principal if the agent fails.
3. **The residual loss:** This is the monetary reduction in welfare experienced by the principal as a result of the misalignment of interest in the agency relationship.

They go on to say that direct principal-agent relationships are better than indirect relationships through state holdings or large institutions, in contrast to Pounds (1988) who motivates that institutions and states might still outperform individuals given that the net effect of reduced monitoring costs is more significant than the reduced incentive effects.

## 2.2 Property rights

Property rights are rights that are possessed by individuals, and the theory aims to shed light on the fact that corporations contain individuals that are assumed to maximize their utility and seek their own interest, subject to the limits established within the organizational structure (Furubotn & Pejovich, 1972). Several patterns of property rights can exist, and wealth maximization is not assured. One central aim within this field is to analyse the interrelations between the institutional arrangements and economic behaviour.

In *Nature of the Firm*, Coase (1937) characterizes the bounds of the firm as the range of exchanges over which the market system was suppressed, and resource allocation was accomplished instead by authority and direction. He also stressed the importance of clear property rights and small transaction costs in the Coase Theorem that describes efficient allocation in the presence of externalities. Demsetz & Alchian (1972) later objected to his claim that authority was necessary, emphasizing the nature of contracts as a voluntary exchange. Jensen & Meckling (1976) later noted that most organizations at its core simply are legal fictions bound together by individual contracts.

## 2.3 Market efficiency

The efficient market hypothesis (EMH) is attributed to both Fama and Samuelson, where they in two independent articles published in 1965 both made an analysis where they interpreted fluctuations of prices as a consequence of rational behaviour. Still, they have different

conclusions (Delcey, 2018). Fama's EMH is defined as a competitive market where the fluctuation in price is a result of the price changing to its fundamental value. This is in contrast to Samuelson's EMH, which explains the fluctuation in price by competition between investors with no connection to fundamental value. Both theories give fruitful insights.

We choose to work with Fama's EMH in our thesis since it is most prevalent in previous research. It states that given an efficient market, a change in ownership structure should be reflected in share prices, stated that the market participants have an opinion about the effect of ownership structure. The implication is that a change in ownership structure should be reflected in stock prices immediately. A catch 22 here is that market participants need to have an opinion on the effect of ownership structure for it to be reflected on stock prices, but since scholars still debate what the ideal ownership structure should be, one could argue that investors are uninformed.

## 2.4 Corporate governance

The traditional definition of corporate governance refers to the defence of shareholders' interest. According to Shleifer & Vishny (1997) corporate governance handles “the ways in which the suppliers of finance to corporations assure that they get a return on investment”, and can be interpreted as a set of mechanisms that induces the controllers of the firm to maximise the value of the firm for the shareholders, hence to reduce agency costs (Shleifer & Vishny, 1997; Tirole, 2001; Becht & Bolton, 2003). Tirole (2001) argues that the above definition is too limited, and defines corporate governance as “the design of institutions that induce or force management to internalise the welfare of stakeholders” since the control structure must be held accountable for its impact on all stakeholders. We choose to work with Shleifer & Vishny (1997) definition in our thesis due to having a shareholder perspective.

Creating efficient corporate governance mechanisms is a significant challenge because it demands a deep understanding of how these systems work, and how they interact with other relevant factors such as capital markets, legal and regulatory systems, political systems and product and factor markets. The development we have been witnessing within technological, political and economic markets the last decades have been changing the worldwide economy, and with that, making it hard for organisations to keep up effectively with these changes.

There are multiple views of how well working the existing governance mechanisms are for this purpose, and they vary significantly among markets. Jensen M. C. (1993) believes that corporate governance mechanisms in the United States are highly flawed and argues for corporations to take a more highly leveraged position. On the contrary, Easterbrook & Fischel (1991) have a favourable view of the current corporate governance mechanisms in the United States. In a survey of corporate governance, Shleifer, Vishny, & Gennaioli (2012) still find that the United States has one of the best corporate governance mechanisms in the world, together with other large economies such as the United Kingdom, Germany, and Japan. Barca (1995) find that the Italian corporate governance systems are less developed, and hinder effective financing from external sources to companies. In Russia, there was until recently virtual nonexistence of external capital financing due to the prevalence of asset diversion by managers of corporations (Boycko, Shleifer, & Vishny, 1994).

Next, we present a few of the most common corporate governance mechanisms and establish hypotheses that will be tested in the empirical analysis. We have chosen to subdivide the governance mechanisms into internal, external and financial. In the empirical section, we only focus on internal corporate governance mechanisms, but we still present theory from other areas to get an understanding of the different multitudes of corporate governance.

### 2.4.1 Internal corporate governance mechanisms

#### *Ownership concentration*

The effect of ownership concentration on firm performance is not determined. Jensen & Meckling (1976) state that for an owner to hold economic incentives to carry the monitoring costs in regards to the agency cost problem, he must have a sufficient shareholding since minority shareholders are likely to free-ride. Schleifer & Vishny (1986) state that if monitoring improves firm performance and managerial performance, given no other effects from the ownership structure, performance and concentration will be positively correlated. Hence higher ownership concentration should bring with it more monitoring, a reduction in agency costs, and increased firm performance because of the interest alignment between principal and agent. Still, majority shareholders might use their majority stake and entrenchment power to maximize their utility at the disperse of minority investors if they do not share the same goal, sometimes destroying firm value (La Porta, Lopez-De-Silanes, & Shleifer, 2002).

Large shareholders might be overinvested in one firm, leading them to take less risk than optimal for the development of firm value. Still, high ownership concentration means that owners will have a strong incentive to be actively involved in their investments according to classic agency theory. Zeckhauser & Pound (1990) mention the ambiguous nature of reverse feedback from firm performance to ownership concentration. Large owners might be tempted to sell when share prices are high. Furthermore, companies seem to issue shares (and decrease ownership concentration) when share prices are high. Contrary, when share prices are low, the company becomes more attractive for raiders and block holders as the potential upside increases. These theoretical mechanisms point to a negative relationship between ownership concentration and firm performance. Still, Jensen & Meckling (1976) argued that ownership concentration increases incentive alignment that decreases agency costs and improves performance.

When a company have majority shareholders the risk of tunnelling surges, where the controlling shareholders can practice illegal business operations for their own gain on the expense of other shareholders. The risk of tunnelling is especially prevalent in emerging markets where the government and regulatory framework might be underdeveloped and incapable of discovering and hindering these operations. La Porta et al. (2000) find that in continental Europe where civil law is practiced, tunnelling routinely occurs, mentioning that certain kinds of tunnelling are less likely to pass legal scrutiny in common law countries. Still, even in the U.S where the legal system is rooted in the common law the letter of the law is highly respected and might allow the players that tunnel to avoid being persecuted due to technicalities.

Summarized, the theoretical relationship is unclear so this has to be researched empirically. As such, it leads to our first hypothesis;

Hypothesis 1: Ownership concentration does not affect firm performance

### *Insider liquidity*

Liquidity is a critical element for investors, and there is a significant difference between making a transaction in theory and in real markets. This difference is the implementation shortfall, which is the gap between the price that prompted the decision to act, and the final execution price that takes into account taxes, commission, and other slippages. All these costs erode alpha, and according to agency cost investors aim to minimize this shortfall and search

for liquidity. Besides, some theoretical models predict that there exists a liquidity premium in the stock market; however, empirical evidence is weak (Blitz, Van Brakel, & Vidojevic, 2018). Nevertheless, liquidity remains an important factor.

Bøhren & Ødegaard (2001) identify liquidity as a measure of ownership concentration (defined as equity turnover). The reasoning is that the block sales of large owners create price pressures they might be hesitant to sell out and stay longer as owners, hence less of the equity will be traded under concentrated ownership. Likewise, high liquidity suggests a large circulation of owners and more widely held shares. Turnover, as a liquidity measure was also used as an instrument by Bøhren & Ødegaard (2001) when researching the relationship between firm performance and ownership characteristics.

We hypothesize that insider liquidity (defined as insider equity turnover) might share the same characteristics as liquidity. Hence, we choose to use insider liquidity as an instrument in our 2SLS regression for insider shares, and present the following hypothesis;

Hypothesis 2: Insider shares do not affect Tobin's Q when instrumented by insider liquidity

### *Ownership identity*

As proposed by Short (1994) and Pedersen & Thomsen (1997), we include both ownership concentration and identity to achieve what they deem an appropriate measure of ownership. This is essential to account for different owners as they differ significantly in terms of competence, wealth, preferences, connection to the firm and consumer preferences (Thomsen & Pedersen, 2000). These differences affect the way owners choose to exercise their rights and directly impact the firms' decisions and thus, performance. Thomsen & Pedersen (2000) observe that owner identity matters for ownership concentrations effect on firm value, measured as Tobin's Q. The effect is positive for financial and corporate owners, negligible for family ownership and negative for governmental ownership.

In this thesis, we treat owner identity and ownership concentration as separate but dependent variables of ownership structure. Ownership identity serves as a proxy for shareholder preferences, whereas ownership concentration decides their power and incentives to reach them. We classify owner identity into the following categories: insider ownership, institutional ownership, and foreign ownership. These categories are chosen due to their extensive use in

previous corporate governance literature (Bøhren & Ødegaard, 2001; Brown, Beekes, & Verhoeven, 2011). Next, we will introduce these three measures of ownership identity.

**Insider ownership**

An insider is a person, or a closely related party of said person, who is a member of the board of directors or management of a listed company. Hence an outsider is a person who does not hold any managerial role in the firm or has any close connections to the firm. One of the fundamental attributes with insiders is that they do not need an agent to act on their behalf; hence monitoring costs can be reduced. Jensen & Meckling (1976) predicted a positive relationship between insider shares and firm performance, contrary to Morck, Shleifer & Vishny (1988) that argued that insiders were prone to entrench and exploit their position to maximize their utility.

Bøhren & Ødegaard (2001) find when revisiting their previous research that insider ownership is one of the governance mechanisms that matters the most for economic performance but that the results vary significantly with the approach. Unlike several scholars[9], Bøhren and Ødegaard (2001) do not view their results as support of the equilibrium hypothesis by Demsetz (1983) but rather hold their judgement. They state that instrumental variable results are driven mostly by choice of instruments, and since there is no theoretical basis for picking instruments, one cannot conclude which estimation system is better. This view is supported by Bhagat & Jefferis (2002).

Based on this theoretical framework we present our third and final hypothesis;

Hypothesis 3: Insider shares do not affect firm performance.

**Institutional ownership**

In many financial markets, institutional investors have grown to achieve a dominant presence during the last half of the previous century. Institutional ownership in the US increased from 10% in the 1950s to over 60% in 2005 (Reenen, Aghion, & Zingales, 2009), and institutional ownership grew by 150% for members of the European Union between 1992 and 1999

[9] (Agrawal & Knoeber, 1996), (Cho, 1998) and (Demsetz & Villalonga, 2001).

(Muirhead, 2003). Due to this substantial growth it is vital to look at the implications and consider the role of the institutional shareholders as monitoring entities.

Institutional investors[10] are assumed to have a goal of maximizing shareholder value since they are holding large blocks at arm's length and regularly are being evaluated on their financial results (Baker-Collins, 1998). A large shareholding would also give them a higher incentive to monitor or control activities, giving them the potential to limit agency problems according to agency theory, according to previous research[11].

If shareholders are dissatisfied with the elected board, they can threaten to sell their shares, hold their shares and voice their dissatisfaction, or do nothing. Hirschman (1980) characterized these actions as exit, voice and loyalty.

Duggal and Millar (1999) find that institutional ownership has a positive relation to corporate performance according to OLS regression and that it in no small degree can be explained by firm size and insider shares. When doing two-stage simultaneous equation regressions it does not confirm the shown relationship in the former OLS regression. They also cast doubt on the monitoring effect of institutional shareholders by finding no evidence that active institutional investors enhance efficiency in the market for corporate control.

**Foreign ownership**

Despite the diversification benefits of Levy & Sarnat (1970), and the eased controls of foreign investments depicted by French & Poterba (1991), Tesar & Werner (1995) show that there is strong evidence of home bias in international investor portfolios. Copper & Kaplanis (1994) test whether this bias is due to inflation hedging but reject their hypothesis. Brennan & Cao (1997) find that domestic investors have a cumulative informational advantage about their domestic market, and hence argues that monitoring costs for foreign investors might be higher than for domestic investors. This leads investors to make suboptimal portfolio decisions that do not adhere to financial theory due to their lack of knowledge for international markets and increased monitoring costs. Hill (2003) proposes that international investors should contribute with competence and human, financial and technological resources that are being added

[10] e.g. banks, insurance companies, funds, investment companies

[11] (Shleifer & Vishny, 1986), (Admati, Pfleiderer, & Zechner, 1994), (Huddart, 1993), (Maug, 1998) and (Noe, 2002).

through their investment. Douma, George, & Kabir (2006) show that a sustainable amount of the positive effect of foreign ownership on firm performance is attributable to foreign corporations that are characterized by large shareholdings, higher commitment and long-term presence.

### 2.4.2 External corporate governance mechanisms

Generally speaking, external governance mechanisms are beyond the control of the shareholders and the board, initiated by external forces, e.g. governments, financial institutions, media and trade unions. Some view them as complimentary for existing internal and financial mechanisms, and others view them as substitutes — either way, external governance has an effect on the result. We go on to briefly mention the theory behind the most common external corporate governance mechanisms.

#### *Market competition*

According to Palmer (1973) and Crespi, Garca-Cestona, & Salas (2004), the governance effect of market competition is a substitute for the outside owner monitoring effect. The stronger the competition in the market, the less room for wasting resources. In the stock market, there are several dimensions to market competition, ranging from mergers and acquisitions to secondary trading and research. One of the prevalent managerial threats is the threat of a hostile takeover, which functions as a disciplinary tool and makes the managers reduce agency costs (Bøhren & Ødegaard, 2003). In 2013 32% of the tender offers at OSE were hostile offers, as they were not recommended by the board members of the target company. Since then it decreased to 12% in 2014, before flattering out at 13% in 2015[12]. In a real-world environment, markets are not fully efficient and competitive; hence, there will always be a need for disciplinary action in corporate governance.

#### *Regulations*

There are several regulations that listed companies have to adhere to, from both government and state. In Norway, the government can intervene by either implementing rules and regulations or direct ownership. According to the government, they might intervene to reach one or more of the following political goals: To correct market failures, to anchor national key

[12] (Aabø-Evensen & Gjerdrum, 2015)

companies and make sure they have a central office in Norway, to manage the common natural resources, and lastly, to make sector political and social considerations. The companies which have state intervention can benefit from a large shareholder with a long-term view that might contribute to capital even in times of financial turmoil. Another prevalent positive effect of governmental ownership is that the strictness they bring in terms of demanding an auditor. Wong & Fan (2004) find that auditors in their sample consistently take into account their clients' agency problems when making audit report and fee decisions, suggesting that auditors have a role to play in corporate governance in emerging markets. Bøhren & Ødegaard (2001) argues that state owners hurt firm performance since they must adhere to social goals, e.g. higher local employment and reduced pollution, and hence abstain from value maximization. Stock market regulations give listed companies an ongoing duty to report inside information, accounting figures, as well as fulfilling specific criteria for what they deem good stock market practices. These include requirements for management, the board's suitability, competence, audit selection, free transferability and voting.

### *Public perception and media exposure*

Companies with good corporate governance practices have a better reputation, credibility and public perception. Since the financial crisis of 2008, there has been an increased focus on protecting whistle-blowers that contributed to the introduction of the SEC protection program for whistle-blowers in 2011.

In 2005 the Norwegian research foundation FAFO found that one-third of the workforce within the nursing, care, and school sector experienced conditions they should have reported but did not report out of fear of reprisals from employers and colleagues (Skivenes & Trygstad, 2005).

Because of this report and increased attention on whistle-blowers, the Norwegian parliament in 2006 decided to implement several changes in the working environment act that are intended to secure the whistle-blowers against reprisals and sanctions.

## 2.4.3 Financial corporate governance mechanisms

Financial governance deals with how the company monitor, collect and manage financial information. Based on this, the company can make choices concerning a broad range of company activities such as investment and financial decisions, valuations and risk management. Poor financial governance can lead to poor data, error in decision-making,

reduced market confidence and fraud. Hence, it is essential to have proper internal control mechanisms, financial policies and adhere to local laws that demand internal and external audits, data security, and financial controls.

### *Capital structure*

One major component within the finance field is capital structure which decides how a firm finance its activities. According to Jensen M. C. (1986), debt limits the manager's flexibility, and one might argue that self-interested managers prefer this flexibility instead of taking optimal capital structure decisions to increase shareholder value. Hence, optimal capital structure is not only a result of market frictions, as explained by Fischer, Heinkel, & Zechner (1989), but also by corporate governance mechanisms in the form of agency conflicts (Morellec, Nikolov, & Schürhoff, 2012).

### *Different equity classes*

One of the fundamental control mechanisms is the rights attributed to shareholder ownership that is meant to represent their voting power. In reality, these rights are not all equal since there exist several equity classes. The most common classes are full ownership rights (class A), restricted voting rights (class B), warrants, options and preferred shareholders. According to Grossman & Hart (1987) "one share-one vote" maximizes the shareholders' control of the management team. By separating the shareholders into dual-classes, they gain different rights and goals, which might cause a conflict of interest between the separate groups. Grossman & Hart (1987) go on to state that firm performance decreases when the amount of non-voting shares increases, except for in exceptional cases when both parties have significant private benefits and competition is limited.

### *Financial policy*

According to Easterbrook (1984), a dividend policy with recurring pay-outs reduce managers resources, which then forces them to obtain new capital from other sources. During that process, they become monitored by the capital markets and potential financiers. According to agency theory, such monitoring is value-creating together with dividend payments and debt financing.

## 2.5 Legal framework

Eckbo (2006) stresses that the corporate governance framework is defined not only by the company's internal mechanisms but also the legal framework that it exists in. In 1998, La Porta, Silanes, & Shleifer wrote a fundamental paper on legal differences between different countries that they argue help explain ownership structure. They found a considerable variation among the countries in their sample regarding dividend policies, access to external finance, depth in capital markets, and ownership concentration. One factor to their explanations was how investors (shareholders and creditors) is protected by law from expropriation by the managers and controlling shareholders. They found that widely held firms were scarce in existence except in economies with proper shareholder protection, in contrast to Berle & Means (1932) hypothesis of ownership structure in the modern corporation. La Porta & Lopez-de-Silanes (2000) later described the different laws and politics that might affect corporate governance and summarized their effectiveness, creating a new way to comprehend corporate governance instead of the previous financial focus. They classify a legal framework based on a set of key legal rules and divide them into shareholders and creditor rights. Common law countries have the strongest protection of investors, French law has the weakest protection, and German and Scandinavian countries fall somewhere in between even though they have strong creditor protection. In general, the differences between countries legal protection is that some protect all outside investors better than others.

Cuomo, Zattoni, & Valentini (2012) tested the "law and finance" view that suggests that when civil law exists in countries ownership structure should transition towards the US style of corporate ownership. Using longitudinal data from listed companies in Italy they find that after legal reforms were introduced to increase investors' rights, there was decreased use of control mechanisms, a decrease in the separation of control and cash flow rights while finding no clear relationship between introducing legal reforms and dispersed ownership.

## 2.6 Summary of theoretical framework

After surveying the leading theory behind corporate governance and its mechanisms, it is evident that corporate governance is a large field with complex relationships. We started our theoretical framework by limiting our scope to the definition of corporate governance that encompasses the shareholders perspective. Thereafter we presented theory from principal-

agent theory, defining the agency relationship and shedding light on the losses that naturally occur in a principal-agent relationship. We introduced property rights, stressing that when several patterns of property rights exist wealth maximization is not assured. Therefore clean property rights and small transaction costs are necessary for efficient allocation. Then we presented the EMH and decided to work with Fama's definition, noting that the market prices might not reflect ideal ownership since the theory is ambiguous. After presenting the foundation of our current understanding and interpretation of corporate governance, we went on to present the existing internal, external and financial corporate governance mechanisms. We treat the internal mechanisms in our regressions as separate dimensions of ownership structure. Finally, we presented the legal framework and stressed the importance of it as a significant factor in understanding ownership structure and offering shareholders protection.

We proposed the following hypotheses:

*Hypothesis 1: Ownership concentration does not affect firm performance*

*Hypothesis 2: Insider shares do not affect Tobin's Q when instrumented by insider liquidity*

*Hypothesis 3: Insider shares do not affect firm performance.*

# 3. Previous Research

## 3.1 Ownership structure and ownership identity

Corporate governance has grown to encompass an enormous amount of literature, but there still is no clearly defined theory (Larcker, Richardson, & Tuna, 2007). In this section, we are going to focus on the main trends in corporate governance research throughout the times, as well as previous academic works by scholars that are directly or indirectly about ownership identity and structure. Since these subjects are so intertwined, we present them together. We believe this approach is necessary to achieve a good understanding of research within ownership identity and structure since the field has yet to be fully developed.

One of the fundamental academic papers on corporate governance was written by Berle & Means (1932), where they performed an analysis of the separation of ownership and control. Their research suggests that when shareholders increase in numbers, it becomes increasingly challenging to enforce value maximisation. This might lead to corporate assets being used to benefit managers instead of shareholders. This paper created the image of the modern corporation as widely dispersed and started a large amount of research within the field of "managerialist" literature. Since then, a large number of papers has been written about the subject of ownership characteristics and firm performance, but the relationship remains ambiguous. The fundamental questions in governance research remain whether firm performance is affected by governance mechanisms. The empirical evidence is mixed and inconclusive; hence, we cannot yet specify what qualifies as the best governance system. This is both because corporate governance is a novel field, but also due to a lack of high-quality data material (Bøhren & Ødegaard, 2003).

In 1976 Jensen and Meckling started the first wave of corporate governance research. They integrated elements from agency theory, property rights and finance to create the concept of agency costs and theory of ownership structure in line with the Berle and Means hypothesis.

More recent papers have started to question the validity of the Berle and Means hypothesis. Until recently, most research has also been done with simple econometric methods which do not take into account the endogenous nature of ownership structure proposed by Demsetz (1983). Demsetz & Lehn (1985) provided evidence for the endogeneity of firms' ownership structure and cast doubt on the Berle and Means hypothesis with the following statement;

> A linear regression of an accounting measure of profit rate on the fraction of shares owned by the largest shareholding interests (and on a set of control variables), in which ownership structure is treated as an endogenous variable, gives no evidence of a relation between profit rate and ownership concentration (Demsetz & Lehn, 1985, p. 210).

Later research by Shleifer & Vishny (1986) and Morck, Shleifer, & Vishny (1988) ignore the endogeneity issue and find no significant relationship in linear regression between ownership structure and firm performance, using Tobin's Q and alternative accounting profit rates as measures of firm performance. They do however provide evidence of a non-monotonic relation where firm performance is negatively affected when insider shares are between five and 25 per cent, else positive. Morck, Shleifer, & Vishny (1988) later find that these results are not robust when substituting the measure of firm performance from Tobin's Q.

Most previous research has also been done in mature markets such as the U.S. and the UK. La Porta et al.[13] introduces the idea of country-specific regulation and regulatory regimes being an important factor for ownership structure, especially the role of a large shareholder as security in areas with a lesser developed legal protection and underdeveloped stock markets. This positive effect has to be weighted with the entrenchment that arises due to large ownership shares (Morck, Shleifer, & Vishny, 1988).

Following research by Morck, Shleifer, & Vishny (1988) there have been several articles written by scholars that differ in econometric techniques, measurements, sample used and conclusions[14]. The papers that take into account the endogeneity of ownership structure by using more complex econometrics generally find no statistically significant relationship between ownership structure and firm performance when using simultaneous equation models, and are in line with the equilibrium hypothesis (Demsetz H., 1983). Demsetz & Vilalonga (2001) suggest that viewed in totality, these papers do not give strong evidence to support that there is a causal relationship between firm performance and ownership structure.

[13] (La Porta, Silanes, & Shleifer, 1998), (La Porta & Lopez-de-Silanes, 2000) and (La Porta, Lopez-De-Silanes, & Shleifer, 2002).

[14] (McConnell & Servaes, 1990), (Hermalin & Weisbach, 1991), (Loderer & Martin, 1997), (Cho, 1998), (Himmelberg, Hubbard, & Palia, 1999) and (Holderness, Kroszner, & Sheenan, 1999).

Demsetz & Vilalonga (2001) later did a restudy treating ownership not only as an endogenous variable but at the same time splitting the firm into two dimensions meant to represent the conflict of interest within shareholder groups. He uses shares owned by management (insider shares) and the fraction of shares owned by the five largest shareholdings interests to reflect these opposing sides. His paper strengthens the hypothesis that ownership structure is endogenous and finds no significant relationship between ownership structure and firm performance.

Since then, there have been several studies that have included owner identity and built further on the Demsetz heritage[15]. The results from their studies vary as a result of different econometric approaches, and the effect of owner identity and ownership concentration remains ambiguous. Since Demsetz & Vilalonga (2001), the use of scorecards as composite measures of corporate governance has also become more widespread. Bhagat & Bolton (2008) and Daines, Gow, & Larcker (2010) find that there is no consistent relationship between governance indices and firm performance and that the most commonly cited indices have no predictive power. In addition, they mention that cross-sectional correlation is low among the indices, indicating that there is measurement errors or different measurement methods, i.e. unreliable results.

There is still much research to be done on the relationship between ownership structure, ownership identity and firm performance. This is both because of limited research within the field of corporate governance, and the fact that valid data is hard to obtain.

## 3.2 Comments on previous studies

The complex relationship between corporate governance and firm performance is about researching if there is causality between firm performance and governance mechanisms such as ownership structure, market competition, legal protection, board composition and financial policy. This allows for a great mix of approaches, and results from previous research vary based on econometric techniques, periods and data.

[15] (Bøhren & Ødegaard, 2001), (Pedersen T. T., 2003) and (Omran, Bolbol, & Fatheldin, 2008).

### 3.2.1 Econometric approach

When choosing an econometric approach in corporate governance research, the traditional method has been to use single equation models. In recent times this has been critiqued by several scholars for not taking into account endogeneity (Demsetz & Villalonga, 2001; Bøhren & Ødegaard, 2001). Bøhren and Ødegaard (2001) go on to state that endogeneity and reverse causality are severely underexplored, e.g. whether governance mechanisms are internally related and whether firm performance affects corporate governance or vice versa.

The proposed solution to this is simultaneous equations since it has the potential to capture endogeneity and reverse causation (Demsetz & Villalonga, 2001). This approach has been used in corporate-governance earlier[16], and the results differ from that of the single equation models. Becht & Bolton (2003) call this for third generation studies and consider them "vastly improved".

Still, Bøhren and Ødegaard (2001) find that the validity of relationships is heavily dependent on the choice of instruments when using simultaneous equations. One major problem in the literature is that there currently is no theoretical framework that allows for classification and ranking of different instruments. When used wrong, simultaneous equations might not necessarily be better than single equation models when looking at the relationship between corporate governance and firm performance. Since there is no theoretical or empirical framework as to what is right yet, the relationship remains puzzling.

### 3.2.2 Data quality

Anderson and Lee (1997) replicate several US studies using alternative data sources and empirically prove that changes in data sources and data quality reduce the validity of the results and distort conclusions. Since then data has become more readily available, but the difference in measurement methods and indices makes high-quality data hard to obtain.

[16] (Agrawal & Knoeber, 1996), (Loderer & Martin, 1997), (Cho, 1998), (Demsetz & Villalonga, 2001) and (Bhagat & Jefferis, 2002)

### 3.2.3 Biased samples

The context of the market region that data stems from affects factors such as law, ownership structure, dividend policy, board size, and firm size (La Porta, Silanes, & Shleifer, 1998). According to principal-agent theory, these factors affect firm performance. Hence, by only testing predictions for one market, you cannot fully judge the validity of the predictions (Bøhren & Ødegaard, 2001). Among the 28 studies on corporate governance and economic performance surveyed by Gugler (2001) 18 are from the U.S. and five are from the U.K., two are German and the remaining three are from Australia, France and Japan. All six papers regarding insiders are from the U.S.

The U.S. listed firms are known for being large corporations with low outside ownership, strong incentive contracts, and existing in an active market for corporate control. In contrast, the Norwegian market consists of smaller firms, relative high outside ownership, a weak tradition for incentive contracts, and an almost non-existing market for corporate takeovers (Aabø-Evensen & Gjerdrum, 2015; Bøhren & Ødegaard, 2001). The lack of data also makes researchers use the snapshot method and use time series that refer to one or two periods. This widespread lack of panel data allows a large holding bias that would be minimized with a long time series.

In the last years, we have seen several papers looking at the relationship between firm performance and corporate governance in several countries, contributing to the growing literature of corporate governance. Most of these fail to address the econometric methods used, proving most useful to compare results from simple regressions for different markets.

### 3.2.4 Partial approaches

Due to data limitation, most approaches use a partial approach that does not account for the complex set of corporate governance mechanisms, e.g. Demsetz & Lehn (1985); Morck, Shleifer, & Vishny (1988) and McConnell & Servaes (1990).

According to Bøhren and Ødegaard (2001), including more mechanisms is useful for capturing the full picture and make better-informed comparisons to more partial approaches.

Still, they go on to argue that their results from regressions on the relationship between governance mechanisms and firm performance seems to be persistent across several single-equation models, suggesting that governance mechanism might be analysed independently.

### 3.2.5 Measuring ownership concentration

Analyses of ownership structure in the U.S., Japan, U.K. and large parts of Europe tend to look at block holders since there generally is a legal obligation to report block holders (Becht & Mayer, 2001). In the U.S., firms must disclose holdings larger than five per cent to the SEC (Mehran, 1995; Bauguess, Moeller, & Schlingemann, 2009). In the U.K., the threshold is set at three per cent (Leech, 2002). Similar thresholds are found in Western Europe and Asia (Faccio & Lang, 2002; Claessens, Djankov, & Lang, 2000).

This limited approach creates a false threshold for ownership and leaves all holdings under this level unobserved, leading to negligence of many owners below the threshold as well as in between thresholds. This reduces the validity of the data (Bøhren & Ødegaard, 2001).

Another common way to measure ownership is to take the number of shares held by the "n" largest shareholders (Demsetz & Lehn, 1985; Thomsen & Pedersen, 2000) or to combine the shares held by the largest shareholders (McConnell & Servaes, 1990; Demsetz & Villalonga, 2001; Gedajlovic & Shapiro, 2002; de Miguel, PIndado, & de la Torre, 2004).

An additional common measure of market concentration is the Herfindahl-Hirschman index, calculated as the sum of the squared percentages of shares controlled by all shareholders. Several researchers use this as a measure of how shareholder power is partitioned within the company[17].

There are few studies on what impact the choice of ownership concentration measure has on governance research. Overland, Mavruk, & Sjøgren (2012) provide a comprehensive comparison of measures of ownership concentration used in previous research. They do not conclude what the best measurement is, but bring forth two challenges:

One technical problem that arises when using different measurements is that the underlying distributional properties could be different, breaking the normality assumption. This is

[17] (Cubbin & Leech, 1983), (Demsetz & Lehn, 1985) and (Leech & Leahy, 1991)

supported by Edwards & Weichenrieder (2009) who tested this for a sample of ownership measures and rejected the null hypothesis of equal distribution, concluding that all the measures cannot be as good for concentration “all else alike” since they provide them with different regression results.

Another challenge is that different ownership concentration measures capture different ownership dimensions. One is the relationship between managers and owners, and the other is the relationship between the owners, e.g. the agency costs that occur mentioned in the theoretical part of this paper. For example, the ownership concentration measurement “shares held by the largest owner” might be a reasonable proxy to measure monitoring costs but does not necessarily reflect the interest conflict between all shareholders.

Since there are several ownership dimensions, one cannot have one measurement to fit them all and might benefit from using several measurements. The reason behind this lack of a “one-size-fits-all” measurement might be due to lack of data. The result is that previous research greatly varies in measurement methods, which makes comparing results challenging.

To conclude this discussion, one should use caution when choosing what measure to use.

### 3.2.6 Measuring firm performance

Measures of firm performance can either be market-based or accounting based. The most prevalent performance measure in previous corporate governance literature has been the market-based Tobin's Q, calculated as the total market value of the firm divided on the total asset value of the firm. In general empirical financial research, abnormal returns are the common firm performance measure. This is not the case for corporate governance papers, where the norm is Tobin's Q. As such, for comparative purposes, we choose to follow the tradition and use this as our performance measure.

One common argument for market-based measurements is that they more accurately represent firm value at that point in time since they by nature are forward-looking, representing how the market expected the company to perform. This is in contrast to accounting based ratios that represent past periods and actual performance (Demsetz & Villalonga, 2001). Another advantage of using Tobin's Q is that it allows for easy comparison between different studies since it has been used as the prevalent measure of firm performance in corporate governance research.

Morck, Shleifer, & Vishny (1988) state that their results not are robust when substituting the measure of firm performance from Tobin's Q, and Bøhren and Ødegaard (2001) find that very few of the results based on Tobin's Q hold up under other firm performance measures, such as return on assets and return on equity. In a critical paper from 2010, Dybvig & Warachka highlights the ambiguity of using Tobin's Q when evaluating corporate governance and estimate that underinvestment is responsible for inflating Tobin's Q. They proclaim that since capital in the denominator of the formula for Tobin's Q is endogenous managers can underinvest and make the firm perform at the sub-profit-maximizing level. This mechanism increases Tobin's Q even though net present value decreases. Besides, strong corporate governance mechanisms can either decrease Tobin's Q by reducing under investments or increase Tobin's Q by lowering costs.

Summarized the net theoretical impact of governance on Tobin's Q is not clear, and one should, when possible, include several measures of firm performance to gain further insight about the validity of the regressions.

### 3.2.7 Measuring corporate governance

When measuring corporate governance, it has become normal to use corporate governance scorecards, e.g. the commonly used G-index (Gompers, Ishii, & Metrick, 2003), and the Gov-Score (Brown & Caylor, 2006). When creating these scorecards, the available local data heavily influence the outcome of the indices set and the fundamental key governance indicators. Most databases focus only on the internal choices that can be made by the shareholders and directors of said firm. Other, such as the Japanese Nikkei Databank System's corporate governance evaluation system rates firms according to external corporate governance practices as well.

Furthermore, most of the data is annual, and most corporate governance data remain unchanged over long periods. Brown, Beekes, & Verhoeven (2011) refer to this as “stickiness”, suggesting that initial public offerings are one of the few instances where shareholders, to a great extent decide board structure.

When choosing measurement for scorecards, they vary from composite measures[18] to summarized normalized scores[19]. The indices are also up for discussion, some scholars recognizing that certain dimensions are more important than others and should not be equally weighted (Bebchuk, Cohen, & Ferrel, 2009), while other researchers use pre-made indices from accounting and government firms that vary according to geographical location and according to the department they gather it from. Summarized the methods used are hampered by the fact that there is no agreed theory of corporate governance variable weighting or construction of indices. Bhagat & Bolton (2008) and Daines, Gow, & Larcker (2010) find that there is no consistent relation between governance indices and firm performance and that the most commonly cites indices have no predictive power. Besides, they mention that cross-sectional correlation is low among the indices, indicating that there is measurement errors or different measurement methods, i.e. unreliable results.

Concluding this section, it is essential to remember that firms act differently when dealing with agency problems which cannot be summarized into a single number and that this has to be taken into account when using scorecards (Bebchuk, Cohen, & Ferrel, 2009).

## 3.3 Summary remarks

To summarize the previous research above we present the following foremost challenges that could provide fruitful insights if further explored.

Firstly, there could be conducted a multidisciplinary research approach in line with Brown, Beekes, & Verhoeven's (2011) suggestion to enrich the current ambiguous corporate governance theory. Without a theoretical framework to support the correct choice of instruments in simultaneous equations, we end up with weak instruments, resulting in the regressions being as unreliable as simple OLS (Bøhren & Ødegaard, 2001). This multidisciplinary study would preferably be done with increased quality data, using corporate governance scorecards that control for internal and external mechanisms. The indices used should be created not because of easy access but should be chosen after a thorough comparison

[18] Used by (Gompers, Ishii, & Metrick, 2003) and (Brown & Caylor, 2006).

[19] Used by (Bertrand & Mullainathan, 2003)

of causal relationships and grounded in empirical research being less narrow than previously used measurements.

Secondly, the “stickiness” of corporate governance variables needs to be addressed, perhaps by doing more sophisticated research on the effect of corporate governance right after initial public offerings.

# 4. Empirical analysis

## 4.1 Introduction

Our empirical section starts by presenting our dataset and our adjustments. Thereafter we present our pooled OLS regressions in line with earlier research within the corporate governance framework. We discuss our results and the weakness of pooled OLS before we move on to fixed-effects models, adjusting for heterogeneity, cross-sectional dependence and autocorrelation. Lastly, we present the results from our 2SLS regression that takes into account endogeneity and reverse causality, explaining how sensitive the results are to modification of instrument used.

## 4.2 Dataset

### 4.2.1 Description

We use a large quarterly panel data from Oslo Stock Exchange (OSE) from 2010-2017, consisting of companies that are primarily listed at the OSE. The rudimentary dataset contains 32 quarters and 7840 observations. For each point in time, we have account information, and market data for all companies in the sample gathered from Bloomberg. We complement the dataset with yearly ownership concentration measures from Centre for applied research at NHH, GICS codes from Børsdatabasen and historical information from Oslo Stock Exchange. See appendix for a description of all variables.

Furthermore, our dataset contains historical information pertaining to all insider activity on the OSE from 2010-2017 supplied by Dovre Forvaltning. This data was transformed to give us a proxy for insider liquidity, measured as the quarterly turnover on shares traded by insiders.

Since the financial statements in Norway do not have to be filed until six months after years end, it is not possible to use data from 2018 since our dataset would be incomplete due to lack of reporting. Furthermore, Bloomberg does not have data on owner identity before 2010; our dataset is therefore limited to the period 2010-2017.

The ownership concentration data from Centre for applied research at NHH only have data for firms that are primarily listed at the OSE; hence we have to remove all companies that do not

fulfil these criteria to maintain data consistency in our regressions. In addition, they don't have data for 2017, so it narrows our dataset by one year, ending up with data for 2010-2016. We then omit N/A's. Given that the N/A's are randomly distributed and uncorrelated with the idiosyncratic error in our regressions, the exclusion will not affect our econometric results (Woolridge, 2006).

We end up with a dataset that contains quarterly data for all companies listed at the OSE from 2010-2017, giving us 28 quarters and 2829 observations.

### 4.2.2 Adjustments

#### *Transforming data*

To make our yearly data regarding ownership concentration usable in our quarterly dataset, we transformed it to quarterly intervals using the Denton-Cholette method for temporal disaggregation of time series, a method often used in empirical research to disaggregate low-frequency time series to higher frequency series while still preserving movement. (Dagum and Cholette, 2006). Since there is a "stickiness" to the ownership concentration measures that make the movements match the annual benchmarks, it is rational to use this technique and does not damage our results (di Fonzo & Marini, 2012).

As our dataset is longitudinal, we have the option of using the last observation carrier forward (LOCF) method when data is missing during a period. When data is missing LOCF is the common conservative way to address this, and is deemed superior to using observed cases where only the data observed are used. Therefore we assume that the values remain constant at the last observed value and use LOCF (Xu, 2009).

#### *Data gathering*

We downloaded data from Børsprosjektet at NHH to acquire GICS codes needed to make sector dummies for the pooled OLS model. Delisted companies did not have GICS codes available for download, so these had to be gathered from OSE archives, and manually entered into the dataset.

#### *Industry sector classification*

The OSE uses the Global Industry Classification Standard (GICS) to index companies, proposed by Morgan Stanley Capital International and Standard & Poor's. The structure divides companies into sector, industry group, industry and sub-industry. We use the eleven

main sectors to maintain a high number of observations in all categories. The dataset from OSE lacked GICS; hence we gathered it from Børsprosjektet at NHH. As these sectors will operate as dummies, we will use the sectors Consumer Staples as the reference sector in our econometric models. The choice to use Consumer Staples as this sector is known for having a low, stable value for Tobin's Q due to it being a sector containing goods less sensitive to economic cycles than in other sectors. Table 2 gives an overview of the different industry sectors, along with their GICS-number.

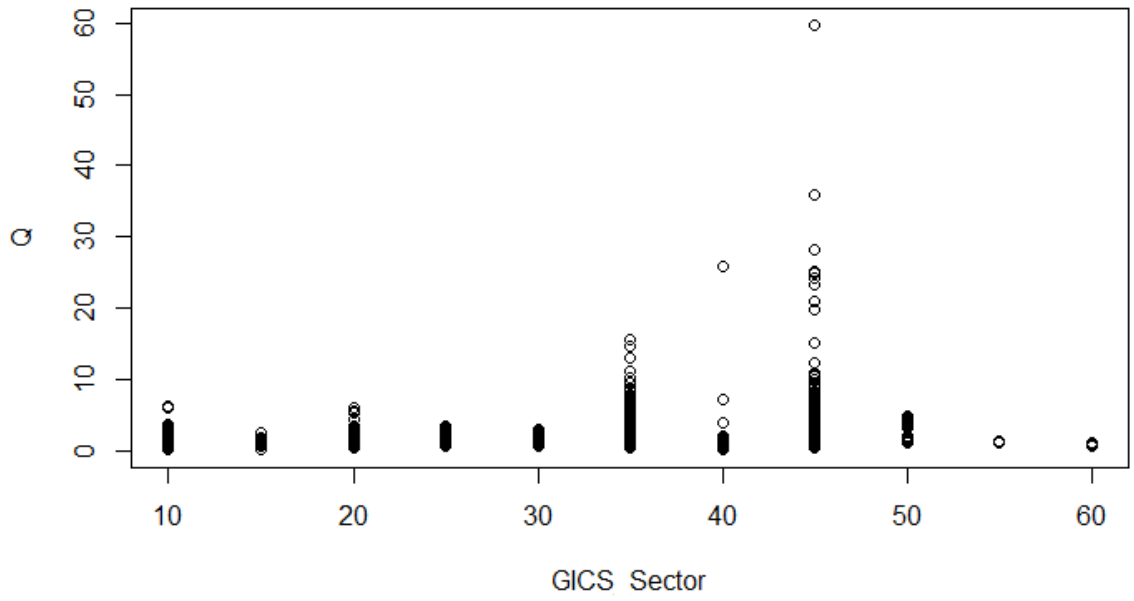
*Table 2: GICS sectors with description*

| GICS Code | Description |
|---|---|
| 10 | Energy |
| 15 | Materials |
| 20 | Industrials |
| 25 | Consumer Discretionary |
| 30 | Consumer Staples |
| 35 | Health Care |
| 40 | Financials |
| 45 | Information Technology |
| 50 | Communication Services |
| 55 | Utilities |
| 60 | Real Estate |

### *Financial companies*

Previous academic papers often remove financial firms from their sample due to their high natural leverage and heavy regulations, which might make it more challenging to see the real relationship between governance and performance when accounting for debt. Since we have a dummy for the financial sector that aims to adjust for the sector-specific trademarks and don't use key-indicators that are directly affected by liabilities, we choose to keep financial firms in our sample to maintain a high number of observations. By plotting Tobin's Q with the different industry sectors, we see that it not is skewed by the financial sector.

*Figure 1: Plot of Tobin's Q for the different industry-sectors*




### *Working with an unbalanced panel*

In our dataset, certain firms enter and leave during the period, giving us an unbalanced panel. According to Woolridge (2006), working with an unbalanced panel is no problem given the assumption that the reasons observations are missing are not systematically connected to the idiosyncratic errors. Since only including variables for companies listed the whole period would worsen the balance in the sample, we continue with the panel as is.

### *Share classifications*

Two companies were listed with both A and B shares at certain points in time. Since B shares tend to have significantly less voting power, we leave these out of the sample for the time horizon where B shares existed. These accounted for 40 of our observations.

In theory, A and B shares are typically used by family dominated shipping companies. Since they are not randomly distributed and uncorrelated with the idiosyncratic error, they might affect the validity of our results (Woolridge, 2006). Still, since the removed B-shares only accounted for such a small portion of our sample, the theoretical bias would be negligible. We do not address the removal of these 40 observations further.

## 4.3 Insider ownership

According to the Securities Trading Act, a primary insider is "*a person in the board, management or others in connection with a listed company that is subject to certain requirements related to trading and reporting*". Bloomberg shares this definition.

As mentioned in our scope and limitations, our dataset on insider holdings from Bloomberg only measures primary insider's holdings by individuals, e.g. not through holding companies. The costs of incorporating a holding company tend to be substantial such that only large corporations offer them to individual clients or wealthy individuals with sufficient utility from it create their own holding companies. Advantages with holding companies can range from reduced tax to significant non-tax related benefits such as asset protection to limit liability risks in a larger business structure.

By only looking at the primary insiders' holdings of individuals, our results allow for exciting new insights. Perhaps larger professional investors that primarily invest through holding companies are more "laissez-faire" since they have a larger portfolio, while insider shares held by individuals have a closer connection to the company and more day-to-day knowledge. One can also imagine that companies with a large percentage of insider shares in our sample more often than not consists of several individuals, which might create team-incentive to excel. As a robustness test, we checked whether there was a correlation between a high percentage of insider shares and the number of individual insider holders, but found no relationship.

Our data from Bloomberg on insider shares gives us an average primary insider fraction of 2,56%, with a standard deviation of 6,67. By doing cross-sample tests from annual reports, we find that Bloomberg consistently measures insider ownership as filed in quarterly reports correct, and does not account for holding companies.

Bøhren and Ødegaard found that insider ownership (defined as stock held by officers and directors) matters for firm performance among a wide range of single-equation models. They report an average primary insider fraction of 8,2% and a standard deviation of 19,0 with data gathered from Norwegian Central Securities Depository (VPS).

When we compare the number of insider shares from Bloomberg and VPS with international data from the US, we find that they have an average insider shares of 13,6% and that it varies largely depending on industrial sectors. The oil and gas sector has the lowest insider shares percentage of 0,16%, while shipping and marine have the highest with 27,39 %. (Damodaran, 2019).

Since the OSE are heavily reliant on the oil and gas industry, this might reduce our mean insider shares compared to other stock exchanges. During our sample period, the OSE consists of an average of 29% of firms from the energy sector. Similarly, OSE is one of the world's leading stock exchange for shipping. Hence the effect remains unclear.

Another possibility for the discrepancy between the amount insider shares is that insider ownership might accumulate in VPS data. According to the securities trading act, you only have to register when insiders make a transaction, not when they achieve or lose status as an insider. As such insiders never leave public datasets if they don't sell during their time as an insider, and the number of insider shares becomes skewed. This is present in our data from Dovre Forvaltning.

## 4.4 Insider liquidity

Insider liquidity, measured as insider turnover, is a factor with limited mentions in previous research, but it shares characteristics with the standard liquidity measure, turnover. Næs, Skjeltorp, & Ødegaard (2007) suggest that a liquidity measure together with the market index and a size index can explain returns on OSE stocks pretty well. Bøhren and Ødegaard (2001) also used liquidity, in the form of turnover, as a control measure in their paper. We want to

see if the explanatory power of liquidity sustains when used as a control variable in our pooled OLS regression, and when using it as an instrument variable in our 2SLS regression on insider shares, along with insider liquidity in the form of insider turnover.

We calculate the insider liquidity as quarterly turnover, i.e. the number of shares traded per quarter divided by total outstanding shares per quarter. Our motivation behind dividing quarterly turnover on the total number of shares instead of outstanding insider shares is to link it to the general share turnover value.

*Table 3: Description of variables*

| Variable | Description | Period |
|---|---|---|
| Insider Liquidity | $\frac{Number\ of\ insider\ shares\ traded}{Outstanding\ shares}$ | Quarterly |
| Liquidity | $\frac{Number\ of\ shares\ traded}{Outstanding\ shares}$ | Quarterly |

## 4.5 Other identity measures

In our sample, we have data for insider ownership, as well as foreign and institutional ownership. Our focus will be on insiders, but for the sake of our paper, we will perform robustness tests using the other forms of identity measures as well.

Foreign ownership is defined as the fraction of the total number of outstanding shares that are owned by foreign investors.

Institutional ownership is defined as the fraction of the total number of outstanding shares that are owned by institutional investors. By institutional investors, we refer to large financial organizations, pension funds or endowments.

## 4.6 Firm performance

We choose to use Tobin's' Q as our performance measure due to its widespread use in previous research and since it is a forward-looking market-based ratio, arguably providing a more accurate representation of the time period than backwards looking account based ratio. The alternative is backward-looking accounting based return measures, e.g. ROA and ROCE. A forward-looking market-based performance measure is arguably a more accurate tool to measure market worth than backward-looking accounting based measures since it manages to measure the market's expectations at each point in time, compared to accounting measures that fail to address this. We do, however, provide the alternate measures ROCE and ROA to test how sensitive our results are.

*Table 4: Firm performance measures*

| Variable | Description | Period |
|---|---|---|
| Tobin's Q | $\frac{Total\ market\ value\ of\ firm}{Total\ asset\ value\ of\ firm}$ | Quarterly |
| ROA | $\frac{Net\ income}{Total\ value\ of\ assets}$ | Quarterly |
| ROCE | $\frac{Earnings\ before\ interest\ and\ tax}{Capital\ employed}$ | Quarterly |

## 4.7 Pooled OLS regression

In the previous section, we arrived at three hypotheses. In this section, we will use econometric techniques in our analysis, to test these hypotheses as thoroughly as possible. In section 5, the results section, we will discuss our findings before concluding in section 6.

We start our analysis by performing separate pooled OLS regressions with ownership identity and ownership concentration on our dependent variable Tobin's Q, controlling for a range of variables. Along with the standard pooled OLS, we control for different fallacies in our sample by performing the pooled OLS regression with robust standard errors, with the help of clustering. Before conducting the actual regressions and introducing our model, we will present the fallacies of standard pooled OLS when applied to financial panel data. Then we will control for the aforementioned fallacies, and compare the results of our regressions in terms of the different variables used, and the impact of clustering.

### 4.7.1 Econometric fallacies of pooled OLS

Performing pooled OLS with financial panel data can often be inaccurate due to heteroscedasticity, multicollinearity and autocorrelation. Following is a short introduction to the different problems we encounter and how we address them. Performing pooled OLS with financial panel data could often be inaccurate due to heteroscedasticity, multicollinearity and autocorrelation. Following is a short introduction to the different problems we encounter and how we address them.

#### *Heteroskedasticity*

One of the essential assumptions in pooled OLS is homoscedasticity, which assumes that all random variables have the same finite variance. Heteroscedasticity occurs when a random collection of variables has sub-segments that vary in variability, i.e. lack of homoscedasticity. This leads to biased variance estimators and leads to invalid standard errors (Woolridge, 2006). Clustering makes the results robust for heteroscedasticity.

#### *Autocorrelation*

Another primary concern when doing pooled OLS is that firm observations are not independent over time. This might skew our results and present a higher standard deviation if they are positively correlated. If they are negatively correlated, we experience a mean reversion where we experience a lower standard deviation than if all periods were independent,

as well as observations mowing towards the average value over time. We use the Breusch-Godfrey test for autocorrelation (Woolridge, 2006). Clustering makes the results robust for autocorrelation.

### *Multicollinearity*

A high correlation between independent variables is called multicollinearity. The problem of multicollinearity is that it affects the calculations regarding independent variables and increase standard errors in the regressions. The coefficient estimates can also be sensitive to small changes in the model since they are correlated with other independent variables. Still, the predictive power of the full model remains. A partial solution might be dropping variables from the model, but that can lead to omitted variables bias if it was supposed to be there (Woolridge, 2006). Since multicollinearity not influences our predictions and only the specific independent variables, we choose not to address it since it does not affect our results.

### *Endogeneity*

When explanatory variables are correlated with the error term, they violate the assumption of exogenous explanatory variables and produce bias in the pooled OLS estimation. One way this can happen is if there is an incorrectly specified variable in the regression. Our variables are specified in accordance with previous research within the field of corporate governance, and we have no reason to believe that altering their form would improve our model. Another potential problem is the risk of omitting variables. Since corporate governance is a novel field without theoretical foundation to back a choice of variables, it is highly likely that there are several factors that we do not include that could help explain firm performance. If one of the omitted variables are affecting our explanatory variables, we will get skewed estimates. Lastly, there is the problem of simultaneity. To solve these problems, one first has to find the source of endogeneity. We will get back to this issue in fixed-effects and 2SLS estimation.

### *Robust Pooled OLS*

We control for the aforementioned fallacies by performing our pooled OLS model with robust standard errors, and by clustering the variance by firm. The output of the robust pooled OLS is in table 6.

### 4.7.2 Pooled OLS on ownership identity

We start by looking at a model for ownership identity, and its explanatory power for the dependent variable, Tobin's Q. We include some common control variables in the model in the form of firm size, stock return volatility, and turnover and sector dummies. We get the following specification for our pooled OLS model, while the output is in table 6:

*Equation I: Pooled OLS with sector dummies*

$$Q_{it} = \beta_0 + \beta_1 \text{INS\_SH} + \beta_2 \text{LOG\_MC} + \beta_3 \text{VOL} + \beta_4 \text{TRNO} + \beta_5 \text{S\_MAT} + \beta_6 \text{IND} + \beta_7 \text{CD} + \beta_8 \text{C} + \beta_9 \text{HC} + \beta_{10} \text{FIN} + \beta_{11} \text{IT} + \beta_{12} \text{COS} + \beta_{13} \text{UTI} + \beta_{14} \text{RE} + u_{it}$$

*Table 5: Description of dependent and independent variables used in pooled OLS*

| Variable Name | Description |
|---|---|
| Q | Tobin's Q measured as the ratio between the physical asset's market value and its replacement value for a company. |
| Insider Shares | Insider shares measured as the percentage of the total share capital owned by primary insiders as reported by the firms. |
| Herfindahl-Hirschman Index | Herfindahl-Hirschman index is calculated by squaring all the shareholders' percentages of shareholdings, then calculating individual owner's share of the total. |
| Firm Size | The logarithm of the total market capitalization of the firms, as measured by price per share * total number of shares. |
| Volatility | Volatility as measured by the standard deviation of daily returns * the square root of 90, where 90 is the number of days in a quarter. |

| | |
|---|---|
| Turnover | Turnover measured by the volume of shares traded the last quarter divided by the number of total shares. |
| S-* | Sector dummies for the ten sectors outlined in Table 2. We use Energy as reference for the other dummies. |
| X201* | Year dummies for the period 2011-2016. 2010 is used as a reference for the other year dummies. |

*Table 6: Pooled OLS for Tobin's Q on ownership identity, controls and sector dummies*

| Pooled OLS | | |
|---|---|---|
| | *Dependent variable:* | |
| | Q | |
| | *Iteration* | |
| | Standard | Clustered |
| Variables | (1) | (2) |
| Insider shares | 0.014** | 0.014 |
| | (0.007) | (0.017) |
| Firm size | 0.00005*** | 0.00005* |
| | (0.00000) | (0.00003) |
| Volatility | -0.001 | -0.001 |
| | (0.001) | (0.002) |
| Turnover | -0.002*** | -0.002 |
| | (0.001) | (0.001) |
| S-Energy | -0.217 | -0.217 |
| | (0.155) | (0.149) |
| S-Material | -0.185 | -0.185 |
| | (0.223) | (0.125) |
| S-Industrial | -0.019 | -0.019 |
| | (0.156) | (0.150) |
| S-Consumer discretion | 0.228 | 0.228 |
| | (0.202) | (0.256) |
| S-Health care | 2.188*** | 2.188*** |
| | (0.199) | (0.636) |
| S-Finance | -0.096 | -0.096 |
| | (0.170) | (0.118) |
| S-Information Technology | 1.699*** | 1.699* |

| | | |
|---|---|---|
| | (0.170) | (0.912) |
| S-Communication Services | 0.958*** | 0.958** |
| | (0.291) | (0.415) |
| S-Utilities | -0.010 | -0.010 |
| | (0.388) | (0.095) |
| S-Real Estate | -0.424 | -0.424*** |
| | (0.317) | (0.163) |
| Constant (S-Consumer Staples) | 1.272*** | 1.272*** |
| | (0.140) | (0.126) |
| Observations | 2,829 | |
| $R^2$ | 0.247 | |
| Adjusted $R^2$ | 0.243 | |
| Residual Std. Error | 1.927 (df = 2814) | |
| F Statistic | 65.792*** (df = 14; 2814) | |
| *Note:* | | *p**p***p<0.01 |

Table 6 shows us that the sector dummies capture the most significant effects in terms of statistical significance as well as magnitude. In terms of our explanatory variable, insider shares are positively significant for Tobin's Q, but not when using clustered robust errors and not as significant as firm size and liquidity. This is in line with earlier academic research on the relationship between said factors and Tobin's Q (Bøhren & Ødegaard, 2001).

When performing the pooled OLS regression with robust, clustered standard errors, we lose some significance in most of our variables. This is to be expected. The sector-specific effects remain, but our dependent variable, insider shares, is no longer significant. As for our control variables, firm size is still significant, albeit less so than in the standard pooled OLS model. Turnover is the only variable, aside from the sector dummies, that is very significant. Considering the sign of the coefficient, we interpret it as being negatively significant for Tobin's Q. In other words, increasing the ratio between numbers of shares traded per quarter to the total number of outstanding shares has a negative impact on Tobin's Q. This is in line with Bøhren and Ødegaard (2001) who find that turnover is significant on a one per cent level.

Next, we consider the other dimension where dummies could be significant, the time dimension. We perform the same regression as above, but instead of including sector dummies, we include year-dummies. The model is specified below, and the output is found in table 7.

*Equation II: Pooled OLS with year dummies*

$$Q_{it} = \beta_0 + \beta_1 \text{INS\_SH} + \beta_2 \text{LOG\_MC} + \beta_3 \text{VOL} + \beta_4 \text{TRNO} + \beta_5 X2011 + \beta_6 X2012 + \beta_7 X2013 + \beta_8 \text{X2014} + \beta_9 \text{X2015} + \beta_{10} X2016 + u_{it}$$

*Table 7: Pooled OLS for Tobin's Q on ownership identity, controls and year-dummies*

**Pooled OLS**

| | *Dependent variable:* | |
|---|---|---|
| | Q | |
| | *Iterations:* | |
| | Standard | Clustered |
| Variables | (1) | (2) |
| Insider shares | 0.051*** | 0.051*** |
| | (0.007) | (0.019) |
| Firm size | 0.00005*** | 0.00005 |
| | (0.00000) | (0.00003) |
| Volatility | 0.001 | 0.001 |
| | (0.001) | (0.002) |
| Turnover | -0.001* | -0.001 |
| | (0.001) | (0.002) |
| X2011 | -0.059 | -0.059 |
| | (0.139) | (0.078) |
| X2012 | -0.030 | -0.030 |
| | (0.142) | (0.087) |
| X2013 | 0.047 | 0.047 |
| | (0.144) | (0.170) |
| X2014 | -0.052 | -0.052 |
| | (0.146) | (0.128) |
| X2015 | -0.036 | -0.036 |
| | (0.148) | (0.125) |
| X2016 | -0.002 | -0.002 |
| | (0.150) | (0.169) |
| Constant (X2010) | 1.442*** | 1.442*** |
| | (0.118) | (0.143) |
| Observations | 2,829 | |
| $R^2$ | 0.126 | |
| Adjusted $R^2$ | 0.123 | |
| Residual Std. Error | 2.075 (df = 2818) | |
| F Statistic | 40.497*** (df = 10; 2818) | |
| *Note:* | | *p**p***p<0.01 |

When looking at ownership identity as the only ownership characteristic, we find that insider shares seem to be significant for Tobin's Q when replacing sector-dummies with year-dummies. Seeing as sector-specific effects are not included in this regression we interpret this as insider shares being significant due to omitted variables for sector specific effects. As sector- and firm-specific effects are controlled for in the rest of this paper, we are not going to address this further.

### 4.7.3 Pooled OLS on ownership concentration

We perform pooled OLS on ownership concentration in much the same way we did ownership identity. Above we found that insider shares are positively significant for Tobin's Q, but that this effect disappeared when controlling for heteroscedasticity and autocorrelation. Now we will perform the same analysis for ownership concentration, before combining the two. We have three factors for ownership concentration in our sample; the number of owners, fraction of the largest shareholder and the Herfindahl-Hirschman Index. We perform a correlation matrix for these three variables below, in Table 8.

*Table 8: Correlation Matrix for ownership concentration measures*

**Correlation Matrix**

| | Number of owners | HH-Index | L.S. Fraction |
|---|---|---|---|
| Number of owners | 1 | | |
| Herfindahl-Hirschman Index | -0.136 *** | 1 | |
| Largest Shareholder Fraction | -0.028 | 0.295 *** | 1 |

We see that the Herfindahl-Hirschman Index is the most correlated with the two other factors, and the only variable that has a significant correlation with both of the other variables. This factor has also been widely used in previous research (Bøhren & Ødegaard, 2001), and as such, it will be our primary ownership concentration measure. Robustness tests with the other variables are added in the appendix. Our pooled OLS model is defined below, in equation II, and the output is in Table 9.

*Equation III: Pooled OLS with sector dummies*

$$Q_{it} = \beta_0 + \beta_1 \text{HHI} + \beta_2 \text{LOG\_MC} + \beta_3 \text{VOL} + \beta_4 \text{TRNO} + \beta_5 \text{S\_MAT} + \beta_6 \text{IND} + \beta_7 \text{CD} + \beta_8 \text{C} + \beta_9 \text{HC} + \beta_{10} \text{FIN} + \beta_{11} \text{IT} + \beta_{12} \text{COS} + \beta_{13} \text{UTI} + \beta_{14} \text{RE} + u_{it}$$

*Table 9: Output of Pooled OLS for ownership concentration and controls*

**Pooled OLS**

| | *Dependent variable:* | |
|---|---|---|
| | Q | |
| | *Iteration:* | |
| | Standard | *Clustered* |
| Variables | (1) | (2) |
| Herfindahl-Hirscchman Index | -0.782*** | -0.782*** |
| | (0.177) | (0.194) |
| Volatility | 0.0002 | 0.0002 |
| | (0.001) | (0.002) |
| Turnover | -0.003*** | -0.003* |
| | (0.001) | (0.002) |
| Firm size | 0.00005*** | 0.00005* |
| | (0.00000) | (0.00003) |
| S-Consumer discretionary | 0.168 | 0.168 |
| | (0.202) | (0.222) |
| S-Communications systems | 0.843*** | 0.843** |
| | (0.291) | (0.349) |
| S-Energy | -0.288* | -0.288** |
| | (0.156) | (0.138) |
| S-Finance | -0.235 | -0.235* |
| | (0.173) | (0.120) |
| S-Health care | 2.082*** | 2.082*** |
| | (0.199) | (0.592) |
| S-Industry | -0.099 | -0.099 |
| | (0.157) | (0.135) |
| S-Information technology | 1.571*** | 1.571* |
| | (0.173) | (0.890) |
| S-Materials | -0.346 | -0.346*** |
| | (0.226) | (0.118) |
| S-Real estate | -0.483 | -0.483*** |
| | (0.315) | (0.131) |
| S-Utilities | -0.111 | -0.111 |
| | (0.388) | (0.089) |
| Constant (S-Consumer Staples) | 1.511*** | 1.511*** |
| | (0.150) | (0.126) |

| | |
|---|---|
| Observations | 2,829 |
| $R^2$ | 0.251 |
| Adjusted $R^2$ | 0.247 |
| Residual Std. Error | 1.922 (df = 2814) |
| F Statistic | 67.197*** (df = 14; 2814) |
| *Note:* | *p**p***p<0.01 |

The unadjusted pooled OLS model indicated that the same sector-dummies and control variables as in the pooled OLS model for ownership identity, are significant. This is not surprising as the only difference between this regression and the one performed on ownership identity is the replacement of insider shares with the HHI. HHI seems to be negatively significant, as well. Considering that the other variables behave the same as in the previous regressions done with insider shares, we will not comment on them. The one takeaway from this pooled OLS is the fact that HHI continues to be very negatively significant, also when controlling for autocorrelation and heteroscedasticity. The output infers that an increase in the HHI of one would decrease Tobin's Q with a value of 0.7818. This result is in line with the Berle and Means (1938) hypothesis. Next, we will use this variable as a control for our main focus in this paper, insider shares. Considering the significance of HHI, we think this will be a strong control variable that will let us control for ownership concentration in an adequate way.

### 4.7.4 Pooled OLS on ownership identity and concentration

As mentioned, when combining the two dimensions of ownership characteristics, we will use ownership identity, in the form of insider shares, as the dependent variable, and ownership concentration as a control variable. Our focus in this paper is to enlighten the subject of insiders and their impact in a corporate governance setting, and thus ownership concentration will from here on in be handled as a control variable. Our new model with both ownership dimensions is defined below. Seeing as we have already described all variables used previously, only the equation is added below, and the output is given in table 10.

*Equation IV: Pooled OLS with ownership identity and concentration*

$$Q_{it} = \beta_0 + \beta_1 \text{INS\_SH} + \beta_2 \text{HHI} + \beta_3 \text{LOG\_MC} + \beta_4 \text{VOL} + \beta_5 \text{TRNO} + \beta_6 \text{S\_ENE} + \beta_7 \text{MAT} + \beta_8 \text{CD} + \beta_9 \text{HC} + \beta_{10} \text{FIN} + \beta_{11} \text{IT} + \beta_{12} \text{COS} + \beta_{13} \text{UTI} + \beta_{14} \text{RE} + u_{it}$$

*Table 10: Pooled OLS (robust) with ownership identity and ownership concentration*

| Pooled OLS | | |
|---|---|---|
| | *Dependent variable:* | |
| | Q | |
| | *Iteration:* | |
| | Standard | Clustered |
| *Variables* | *(1)* | *(2)* |
| Insider Shares | 0.012* | 0.012 |
| | (0.007) | (0.017) |
| HHI | -0.758*** | -0.758*** |
| | (0.178) | (0.190) |
| Firm Size | 0.00005*** | 0.00005* |
| | (0.00000) | (0.00003) |
| Volatility | 0.00004 | 0.00004 |
| | (0.001) | (0.002) |
| Turnover | -0.003*** | -0.003* |
| | (0.001) | (0.001) |
| S-Energy | -0.299* | -0.299** |
| | (0.156) | (0.143) |
| S-Materials | -0.351 | -0.351*** |
| | (0.226) | (0.119) |
| S-Industrials | -0.116 | -0.116 |
| | (0.157) | (0.143) |
| S-Consumer Discretionary | 0.160 | 0.160 |
| | (0.202) | (0.223) |
| S-Health care | 2.003*** | 2.003*** |
| | (0.203) | (0.626) |
| S-Finance | -0.240 | -0.240** |
| | (0.173) | (0.119) |
| S-Information Technology | 1.528*** | 1.528* |
| | (0.174) | (0.889) |
| S-Communication Services | 0.836*** | 0.836** |
| | (0.291) | (0.344) |
| S-Utilities | -0.110 | -0.110 |
| | (0.388) | (0.090) |
| S-Real Estate | -0.551* | -0.551*** |
| | (0.317) | (0.191) |
| Constant (Consumer Staples) | 1.506*** | 1.506*** |
| | (0.150) | (0.127) |
| Observations | 2,829 | |
| $R^2$ | 0.251 | |
| Adjusted $R^2$ | 0.247 | |
| Residual Std. Error | 1.922 (df = 2813) | |
| F Statistic | 62.991*** (df = 15; 2813) | |
| *Note:* | *p**p***p<0.01 | |

The output in table 10 tells the same story as our previous regressions in this section. Insider shares do not seem to have any impact on Tobin's Q, but HHI seems to have a very negatively significant impact. As for the other variables, there seem to be quite strong sector-specific effects found in our sample. Among the other control variables, firm size and liquidity are consistently significant with a positive and negative sign, respectively.

### 4.7.5 Weaknesses of pooled OLS

OLS is considered BLUE (Best Linear Unbiased Estimator) but it does not control for the aforementioned multicollinearity. Due to this shortcoming of the pooled OLS model, we decide to move on to use an econometric approach more suited to panel data regression, fixed effects estimation.

## 4.8 Fixed effects

In this section, we will start by performing least-squared dummy variable models. This approach is a variety of the OLS model, where we control for all individual effects of all the firms in our sample, by adding a dummy variable for each of them. One of the disadvantages of using fixed effects is that all time constant variables are eliminated from the data.

Moving on to the fixed-effects framework we will be applying the last model we presented in the OLS section, regressing Tobin's Q on Insider shares whilst controlling for ownership concentration, firm size, the volatility of stock returns and share turnover. A notable difference is that we will not include our sector dummies as these would be obsolete in a fixed-effects model. Dummies are obsolete in a fixed effects framework since dummies are time invariant.

### 4.8.1 LSDV-model

We define the LSDV model in equation four below.

*Equation V: Fixed Effects Model for ownership characteristic*

$$Q_{it} = \beta_0 + \beta_1 \text{INSH\_SH} + \beta_2 \text{HHI} + \beta_3 \text{LOG\_MC} + \beta_4 \text{VOL} + \beta_5 \text{TRNO} + \epsilon_{it}$$

We observe that the ticker dummies have been added, and note that $k = N$ to ensure that all firms have a dummy in the model to pick up firm-specific effects. Running this LSDV model,

we get the output presented in Table 11. For the sake of space, we have not included the entire output in the paper, but it is available in the appendix.

*Table 11: Output of LSDV-model for ownership concentration and ownership identity*

**LSDV**

| | *Dependent variable:* |
|---|---|
| *Variables* | Q |
| Insider shares | $0.027^{***}$ |
| | (0.006) |
| Herfindahl-Hirschman Index | -0.008 |
| | (0.200) |
| Firm size | $0.00005^{***}$ |
| | (0.00000) |
| Volatility | 0.001 |
| | (0.001) |
| Turnover | $-0.002^{***}$ |
| | (0.0005) |
| Observations | 2,829 |
| $R^2$ | 0.790 |
| Adjusted $R^2$ | 0.779 |
| Residual Std. Error | 1.290 (df = 2694) |
| F Statistic | $75.038^{***}$ (df = 135; 2694) |
| *Note:* | $^{*}$p $^{**}$p $^{***}$p<0.01 |

The LSDV-model tells an entirely different story for ownership characteristics. It seems the tables have turned entirely in terms of the significance of ownership concentration and ownership identity. In the pooled OLS models, ownership concentration was the significant factor, even when using the clustered robust iteration of the model. In the LSDV model, it seems it is very insignificant. This infers that the factor HHI, for ownership concentration, contains many firm-specific effects, and thus, when we control for these effects with dummy variables, the factor becomes obsolete. As for our control variables, firm size and turnover persevere in terms of significance, and their coefficients remain the same as in the clustered pooled OLS output. Lastly, our dependent variable, insider shares, is highly significant for Tobin's Q when controlling for firm-specific effects. The coefficient infers that an increase in insider shares leads to a small increase in Tobin's Q.

### 4.8.2 Fixed effects estimation

One of the major arguments for using fixed effects is to take into account the unobserved heterogeneity. Unobserved heterogeneity creates a spurious correlation between the independent variables and firm performance. Himmelberg, Hubbard, & Palia (1999) present three sources where there likely are unobserved heterogeneity: the degree of monitoring, intangible assets and market power. Given that these factors are constant over time, one should use panel data with fixed-effects to consider this unobserved heterogeneity by making the unobserved effect disappear. We define our fixed effects model below, in equation five.

*Equation VI: Fixed Effects Model for ownership characteristics*

$$Q_{it} = \beta_0 + \beta_1 \text{INSH\_SH} + \beta_2 \text{HHI} + \beta_3 \text{LOG\_MC} + \beta_4 \text{VOL} + \beta_5 \text{TRNO} + \epsilon_{it}$$

The equation for the fixed effects model is quite similar to the LSDV-model except it does not include the firm-specific dummies. The fixed-effects option in R automatically adjusts our variables to the fixed effects estimations by using the *within* calculations for our variables. We get the following output when running our fixed effects model:

*Table 12: Output of Fixed Effects-model for ownership concentration and ownership identity*

**Fixed Effects Model**

| | *Dependent variable:* |
|---|---|
| Variables | Q |
| Insider shares | 0.038*** |
| | (0.007) |
| Herfindahl-Hirschman Index | -0.157 |
| | (0.231) |
| Firm size | -0.00001*** |
| | (0.00000) |
| Volatility | 0.005*** |
| | (0.001) |
| Turnover | -0.002*** |
| | (0.001) |
| Observations | 2,829 |
| $R^2$ | 0.034 |
| Adjusted $R^2$ | -0.016 |

| | |
|---|---|
| F Statistic | $18.233^{***}$ (df = 5; 2574) |
| *Note:* | $^{*}p^{**}p^{***}p<0.01$ |

As with the LSDV-model above, we observe the same tendencies for ownership characteristics in the fixed effects framework. Ownership concentration is not significant, while insider shares are very positively significant. In terms of the control variables, we observe some changes. Firstly, they are all significant in the fixed effects model, even volatility, positively so. Secondly, firm size is now negatively significant. This would infer that an increase in size, here measured in market capitalization, would lead to a decrease in Tobin's Q. This is in line with economic theory if we consider the SMB factor of Fama-French. Small firms perform better as they represent more risk, and they are generally low book-to-market firms as a lot of their value often is linked to future growth prospects. A low Tobin's Q would describe a company with a lower market value relative to book value, or a low book-to-market value. Firms categorized by low book-to-market are value firms. These are often larger firms with fewer growth prospects and a stabilized economic situation. Additionally, larger firms that have operated longer are often easier to price for analysts and investors, than small firms that have operated for a short time with a lot of their value related to future growth instead of current assets. As such, their market value would often be closer to the real value of the asset the company has at its disposal.

Having discussed the weaknesses of pooled OLS in the previous section, we now move on to testing econometrically if our pooled OLS model is an option for us, or if we should use our fixed effects model. To do this, we perform an F-test for individual effects in R, which compares our two existing models, pooled OLS and fixed effects. The results of the F-test tells us that the null hypothesis of no individual effects is rejected and thus, we cannot use the pooled OLS model. The output of the F-test for individual effects is in the appendix, under the test section. Also included in the appendix is the output of a random effects model and a Hausman test. The Hausman test did not reject the random effects model, but we still choose to use the fixed effects model. The reason for this is the fact that we prioritize the consistency of the fixed effects model over the efficiency of the random effects. Efficiency is nice, but consistency is essential. No matter the outcome of the Hausman test, our beta coefficients will be correct with the fixed effects model.

### 4.8.3 Robustness tests

From our pooled OLS section, we observed that our sample suffered from heteroscedasticity and autocorrelation. We need to test, and possibly, correct for these fallacies in our fixed effects model as well. In addition to these two aspects, we will also test for unit root, cross-sectional dependence and time-fixed effects. Based on these diagnostics tests, we will make the proper adjustments to our fixed effects model to be able to infer most accurately the output of our model.

#### *Time-fixed effects*

We test our sample for time-fixed effects to control for variables that are constant across variables but vary over time, to ensure that there are no quarterly effects we need to account for in our model. To test for time-fixed effects, we compare our current fixed effects model with another iteration, which has dummies for each quarter in our sample. The output of this model is included below, in table 13. For the sake of readability we only include the significant quarters in our table below. The full table is available in the appendix, under tables.

*Table 13: Output of Fixed Effects-model for ownership characteristics and time-dummies*

**Fixed Effects with time-fixed dummies**

| | *Dependent variable:* |
|---|---|
| Variables | Q |
| Insider shares | $0.038^{***}$ |
| | (0.007) |
| Herfindahl – Hirschman Index | -0.183 |
| | (0.235) |
| Firm size | $-0.00001^{***}$ |
| | (0.00000) |
| Volatility | $0.006^{***}$ |
| | (0.001) |
| Turnover | $-0.002^{***}$ |
| | (0.001) |
| Quarter 3 | $0.644^{***}$ |
| | (0.202) |
| Observations | 2,829 |
| $R^2$ | 0.046 |
| Adjusted $R^2$ | -0.014 |
| F Statistic | $3.977^{***}$ (df = 31; 2548) |
| *Note:* | $^{*}p^{**}p^{***}p<0.01$ |

Table 13 tells the same story as the normal fixed effects model in terms of our variables that are not dummies. As such, we will not discuss them in this section. As for the time-specific dummies, they are all insignificant except for one date, the third quarter of 2010. In total it does not seem as if we need to control for time-fixed dummies based on the output of this model, and this is also consistent with the year-dummies introduced in the pooled OLS section. We do, however, run an F-test for individual effects, and conclude that there are no significant effects in the time-dimension of our sample. The output of the test is found in the appendix, under tests.

### *Cross-sectional dependence*

Cross-sectional dependence in the error-terms might arise due to common shocks, unobserved components, spatial dependence and idiosyncratic pairwise dependence in the disturbances with no particular pattern of common components or spatial dependence (De Hoyos & Sarafidis, 2006). If the unobserved components are correlated with the independent variables, fixed effects- and random effects estimators will be biased and inconsistent (Pesaran, 2006). A workaround to this problem would be to use an instrument variable approach; however, finding instruments that are correlated with the independent variable and not the unobserved factors is complicated.

Cross-sectional dependence in the sample could distort the output of our model, and thus, we have to check for cross-sectional dependence in our sample. There are two commonly used tests for cross-sectional dependence; the Breusch-Pagan LM test for independence and the Pesaran CD test. We perform them both to ensure the robustness of our results. Both the tests reject our null hypothesis of no cross-sectional dependence in our sample with a p-value of 0.000. This means that we have to correct for this cross-sectional dependence in our fixed effects model to be able to perform the most accurate inference. The output of these tests is included in the appendix, under tests.

### *Autocorrelation*

As mentioned in our robustness test section, autocorrelation occurs when there is a correlation between the time observations of the independent variables. We test for autocorrelation using the Breusch-Godfrey test outlined in Woolridge (2006). The Breusch-Godfrey test rejects the null hypothesis of no autocorrelation in the idiosyncratic errors with a p-value of 0.000. This does not surprise us as we found autocorrelation in our sample when performing the pooled OLS model above as well. The presence of autocorrelation must be controlled for when

performing inference with our fixed effects model. The output of the test is in the appendix, under tests.

### *Unit root and stationarity*

Autocorrelation is closely linked to the idea of stationarity. A stationary time series has constant properties over time, while a non-stationary has properties that change value over time. To find out if a sample is non-stationary we test for the presence of a unit root. A sample with unit root is non-stationary and auto correlated, but not all correlated samples have a unit root.

The danger with non-stationary samples is that they produce spurious results, which lead to poor models. The solution is to convert non-stationary to stationary data, e.g. by removing trends. If the non-stationary process is a random walk, it is transformed by differencing. If it shows a deterministic trend, the spurious results can be fixed by de-trending. Sometimes the series contains both deterministic and stochastic trends, in that case, both differencing and de-trending shall be used. Differencing removes the trend in the variance; de-trending removes the deterministic trend.

Hence, we need to test for the presence of unit root to understand the nature of our autocorrelation. We test for unit root by performing an Augmented Dickey-Fuller test for unit root. The null hypothesis of the model, the presence of unit root, is rejected, and we conclude that our sample is stationary. The output of the Augmented Dickey-Fuller is in the appendix, under tests. We conclude that our sample is stationary, but auto correlated. Controlling for this autocorrelation is essential when performing inference with our fixed-effects model.

### *Heteroskedasticity*

One of the fundamental assumptions in OLS is homoscedasticity, which assumes that all random variables have the same finite variance. If this assumption is wronged, we have heteroscedasticity in our sample. We perform a Breusch-Pagan test and reject the null hypothesis; thus, we have heteroscedasticity in our sample. This leads to biased variance estimators and leads to invalid standard errors (Woolridge, 2006). As with autocorrelation, this does not surprise us, as the presence of heteroscedasticity was detected when performing our pooled OLS model as well. Thus, we must control for this heteroscedasticity in our fixed effects model to perform correct inference. To make our model robust to heteroscedasticity, we use clustering. The output of the test is in the appendix, under tests.

### *Summary of diagnostics tests*

The tests performed have taught us that our sample does not have unit root or time-fixed effects. It does, however, suffer from being cross-sectional dependent, auto correlated and containing heteroscedasticity. To control for these effects, we need to use robust covariance matrices and get robust standard error estimates.

One of these iterations of robust covariance estimations is the Driscoll-Kraay estimators which are robust to autocorrelation, heteroscedasticity and cross-sectional dependence. It was created in 1998 by Driscoll and Kraay and is based on the more popular Newey West estimators. Newey West estimators are robust to autocorrelation and heteroscedasticity, but not cross-sectional dependence, and thus it is not an option for us. The output of our fixed effects model using the Driscoll-Kraay robust covariance matrix is found below in Table 14.

*Table 14: Output of Fixed Effects-model robust with Driscoll Kray estimators*

**Driscoll Kray estimators**

| | *Dependent variable:* |
|---|---|
| Variables | Q |
| Insider shares | 0.036 |
| | (0.024) |
| Herfindahl-Hirschman Index | -0.127 |
| | (0.099) |
| Firm size | -0.00000 |
| | (0.00000) |
| Volatility | 0.004 |
| | (0.004) |
| Turnover | -0.001** |
| | (0.001) |
| Observations | 2,829 |
| $R^2$ | 0.030 |
| Adjusted $R^2$ | -0.018 |
| F Statistic | 16.790*** (df = 5; 2694) |
| *Note:* | *p**p***p<0.01 |

The output in table 14 is robust to all the econometric fallacies mentioned under our section for robustness tests. As such, this output should theoretically be consistent and unbiased, and

inference should be possible. Our results differ from the bare-bones fixed effects model we started this section with. Firstly, insider shares and ownership concentration is insignificant. Secondly, even though firm size and turnover are still significant, they are less significant than in our unadjusted fixed effects model. The sign of their coefficients is still the same as in our original fixed effects model, however.

### 4.8.4 Summary

When controlling for all our econometric fallacies, making our model consistent and unbiased, we observe very similar results to the ones we got when using the clustered robust pooled OLS model. Ownership characteristics seem to be insignificant for Tobin's Q. The only variables we found to be significant was two of our control variables, firm size and liquidity.

In our next econometric section, we move on to instrument variables. The reason for this is to correct for endogeneity and reverse causality in our sample. These concepts are explored further under our instrument variable section.

## 4.9 2SLS estimation

As mentioned, we deem it necessary to perform two-stage least squares fixed effects estimations using instrument variables as well. The primary motivation behind this is the potential presence of endogeneity and the potential for reverse causality. A secondary motivation is to be able to compare our results with a larger sample of similar papers on this subject.

We start this section by revisiting the nature of endogeneity before we introduce our three instrument variables. Then we perform our fixed effects estimations with our instruments and interpret our findings. Lastly, we introduce the concept of reverse causality and how we control for this concept by lagging our instrument variable.

### 4.9.1 Endogeneity

Endogeneity refers to situations in which an independent variable is correlated with the error term. Endogeneity can be caused by reverse causality, omitted variables and measurement errors, creating biases and spurious results. The solution to these challenges is simultaneous

equations since it has the potential to capture endogeneity and reverse causality with use of correct instruments (Demsetz & Villalonga, 2001).

### 4.9.2 Instruments

We will be using three different measures as potential instruments for insider shares; volatility, turnover and insider turnover. Insider turnover is calculated by taking the total value of all trades performed by insiders in a given quarter and dividing it by the total number of shares outstanding in that quarter.

#### *Volatility*

The first instrument we use is volatility, in line with Loderer & Martin (1997). Volatility has also previously been used as an instrument for ownership concentration (Bøhren & Ødegaard, 2001). We argue that volatility can be used to instrument insider shares as a change in the volatility of stock returns could deter/encourage insiders to trade seeing as they can use their status as insiders to send a sign to investors and the rest of the market about the real situation the firm finds themselves in. Increased volatility in stock returns could also make it easier for insiders to buy their shares at a discount due to the market potentially under-pricing their firm when volatility increases. A test for relevance as an instrument is added in the appendix, under tests.

#### *Turnover*

Turnover is a measure of liquidity, often defined as trading volume. Turnover has previously been used as an instrument for ownership characteristics by Bøhren & Ødegaard (2001). It has yet to be used as an instrument, for insider shares, but we believe it could be a significant one. An increase in share turnover, must be due to an increase in the number of trades being done, given that the company does not buy back shares. There is no reason to suspect that insiders would not trade in periods of high liquidity along with other investors. A correlation test confirms that there is a correlation between turnover and insider turnover. As such, we believe that turnover could be a good instrument for insider shares. A test for the relevance of the instrument and the correlation test, is added in the appendix, under tests.

#### *Insider Turnover*

Our motivation for using insider turnover as an instrument for insider shares is in many ways, the same as for the use of normal share turnover as an instrument. If normal turnover could

instrument insider shares, we believe that insider shares would be able to do the same at least as well, seeing as it ignores trades done by anyone else than the insiders themselves.

### *2SLS Instrument variable estimation*

We use a built-in function in R called IVreg when performing our instrumental variable estimation. The final output of our fixed effects estimation with insider shares instrumented by volatility, turnover and insider turnover performed with the IVreg package, is in table 15 below.

*Table 15: Output of 2SLS-model with insider shares instrumented by volatility*

**2SLS Instrument variables estimation**

| | *Dependent variable:* | | |
|---|---|---|---|
| | Q | | |
| | *Instrument:* | | |
| | Volatility | Turnover | Insider turnover |
| Variables | (1) | (2) | (3) |
| Insider shares | 0.190*** | 0.326 | -0.403 |
| | (0.063) | (1.482) | (1.288) |
| Firm size | 0.00000 | 0.00000 | 0.00000 |
| | (0.00000) | (0.00000) | (0.00002) |
| Herfindahl –Hirschman Index | 0.090 | 0.044 | -0.407 |
| | (0.191) | (0.553) | (0.729) |
| Turnover | -0.0001 | | -0.0001 |
| | (0.001) | | (0.001) |
| Volatility | | -0.003 | 0.009 |
| | | (0.028) | (0.019) |
| Observations | 2,829 | 2,829 | 2,829 |
| $R^2$ | 0.024 | 0.024 | 0.017 |
| Adjusted $R^2$ | 0.014 | 0.013 | 0.004 |
| F Statistic | 10.480** | 7.750 | 2.483 |
| *Note:* | | | *p**p***p<0.01 |

We see from the output that the instrumented insider shares is very positively significant for Tobin's Q when instrumented with volatility. In fact, in this fixed effect estimation it is the only variable that is significant for Tobin's Q. We perform Wald tests for instrument relevance

in the appendix, and they result in one variable being statistically significant as an instrument for insider shares, and that is volatility. As such, we conclude that volatility is a good and, in our case, the only instrument variable that provides a significant result for insider shares relative to Tobin's Q.

### 4.9.3 Reverse Causality

Reverse causality refers to a situation in which the dependent variable and the independent variable are correlated, but it may not be in the way the regressions present it. We, for example, find that insider shares instrumented by volatility are significant for Tobin's Q. Reverse causality concerns would be that insider shares are dependent on Tobin's Q instead of vice-versa. To control for reverse causality in our 2SLS instrumental variable estimation, we will lag the instrument variable by one time-period. The idea is that if there is a reverse causality aspect present in our estimations, then it will cause the instrument variable to change its sign, but stay significant (Shepherd, 2010). The output of our 2SLS instrument variable fixed effects estimation is found in table 16.

*Table 16: Output of 2SLS-model with INS_SH instrumented by lagged VOL*

**2SLS with lagged Volatility**

| | *Dependent variable:* |
|---|---|
| | Q |
| Insider shares | 0.374 |
| | (0.296) |
| Firm size | -0.00001 |
| | (0.00001) |
| Herfindahl-Hirschman Index | -0.547 |
| | (0.369) |
| Turnover | -0.0002 |
| | (0.001) |
| Volatility | -0.004 |
| | (0.007) |
| Observations | 2,829 |
| $R^2$ | 0.029 |
| Adjusted $R^2$ | 0.017 |
| F Statistic | 11.547** |
| *Note:* | *p**p***p<0.01 |

We see that the instrumented insider shares do not change its sign in table 16 when the instrument, volatility, is lagged. It does, however, lose its significance. As such, we get no clear result in terms of this being reverse causality or volatility being a bad instrument for insider shares. Seeing as there have been few other papers looking into this aspect of econometric theory, for primary insider shares held by individuals, we have a limited possibility to compare our results with existing research, for the instrument variables.

### 4.9.4 2SLS Instrumental variable estimation summary and weaknesses

We find it hard to infer based upon our 2SLS estimations, and the instruments we use. Our explanatory variable, primary insiders, has not been subject to instrumental estimations and thus we have a limited possibility to infer confidently. However, we note that based upon our relevance tests, and the output of the simultaneous equations, volatility seems to be a good instrument for insider shares.

# 5. Results and discussions

The theoretical framework and our analysis in the previous section is the basis for the discussion of our results. In terms of the econometric analysis, we have provided a summary table below, comparing our results from the different econometric approaches.

*Table 17: Comparison of econometric results*

**Comparison of Methods**

| | *Dependent variable:* | | |
|---|---|---|---|
| | Q | | |
| | *Econometric approach* | | |
| | OLS (clustered) | Fixed Effects (DK-robust) | 2SLS IV estimation (Volatility) |
| Variables | (1) | (2) | (3) |
| Insider shares | 0.012 | 0.037 | 0.180*** |
| | (0.017) | (0.025) | (0.060) |
| Firm size | 0.00005* | -0.00001** | -0.00000 |
| | (0.00003) | (0.00000) | (0.00000) |
| Volatility | 0.00004 | 0.004 | |
| | (0.002) | (0.004) | |
| Turnover | -0.003* | -0.001** | -0.0003 |
| | (0.001) | (0.001) | (0.001) |
| HHI | -0.758*** | -0.150 | -0.007 |
| | (0.190) | (0.094) | (0.193) |
| Observations | 2,829 | 2,829 | 2,829 |
| $R^2$ | 0.251 | 0.030 | 0.024 |
| Adjusted $R^2$ | 0.247 | -0.018 | 0.014 |
| F Statistic | 62.991*** | 16.790*** | 10.480** |
| *Note:* | | | *p**p***p<0.01 |

We can see that, when performing the robust iteration of the pooled OLS and fixed effects, we find no significant impact of insider shares on Tobin's Q. The variables that seem to matter for Tobin's Q, in these models, are firm size and turnover. In terms of the 2SLS instrument estimation, we find that insider shares are the only significant variable. However, this approach is under-researched in a corporate governance setting, and our reliance on the results of this model must therefore be limited.

## 5.1 Owner identity

In the theoretical section, we argued that since different owners differ in competence, wealth, preferences and consumers' preferences, they differ in the way they choose to exercise their rights and impact the firm (Pedersen T. & Thomsen, 1997). We approached this by looking at the following owner identities meant to capture different dimensions and opposing sides of the shareholders; insider ownership, foreign ownership and institutional ownership. Insider ownership was our main priority, while the other identity measures were used as robustness tests.

Our results from simple OLS suggested that insider shares were positively related to firm performance. It was however, no longer significant when controlling for heteroscedasticity and autocorrelation with the clustered robust iteration of the pooled OLS model. In terms of the fixed effects models, insider shares were very significant. This significance disappeared when controlling for econometrical fallacies, and the only model that produced significant results for insider shares was the 2SLS estimation. Thus, in total, we cannot reject Hypothesis 3; insider shares do not affect firm performance.

## 5.2 Ownership concentration

We started by having three measures for ownership concentration, namely the largest owners share, the number of owners and ownership concentration measured by Herfindahl-Hirschman Index. After surveying previous literature, we concluded that the theoretical relationship between ownership concentration and firm performance is unclear, deciding to research the relationship empirically. After comparing these ownership concentration measures in a correlation matrix, we found that HHI was best suited to explain firm performance, deciding to go on with that as our ownership measurement. The unadjusted pooled OLS indicated that ownership identity was significant. After clustering, the results remained significant, also in the OLS regression with both ownership characteristics.

When using LSDV estimation ownership concentration becomes very insignificant, with a p-value approaching 1.0, inferring that HHI contains many firm-specific effects. When running fixed-effects estimation ownership concentration remains insignificant, and the same goes for the 2SLS-model. We, therefore, cannot reject Hypothesis 1; ownership concentration does not affect firm performance.

## 5.3 Insider liquidity

We used insider turnover as a measure for insider liquidity and used it as an instrument in our 2SLS section of the empirical analysis. When performing our 2SLS estimation, insider turnover did not produce a significant coefficient for insider shares. In terms of instrument relevance, insider liquidity did not pass the Wald test. As such, we cannot reject Hypothesis 2; insider shares do not affect Tobin's Q when instrumented by insider liquidity.

## 5.4 Country-specific regulations

Most corporate governance research has been done in the U.S. and the U.K., and as such, most other markets have attained limited empirical evidence in this field of research. Even though there has been a surge in country-specific papers in the last decade, there is still much research to be done. In a collaborative research effort the European Corporate Governance Network (ECGN) found that the main conflict in the U.S. and the U.K. is the "owner-manager" conflict, while other markets in continental Europe was more affected by the conflict between large and small shareholders (Gugler, 2001). This finding suggests that markets are inherently different and as such there is a need to empirically test relationships across markets to see if the results are independent of the market-specific regulatory framework. Since our regressions from our pooled OLS, fixed-effects and two-stage least square estimations are in line with those of Demsetz and Lehn (2001) from the U.S. it suggests that the estimations not are dependent on the country-specific regulatory framework.

## 5.5 Limitations

The field of corporate governance research is recognized by a lack theory, which makes it challenging to know the limitations in our approach. Still, by comparing our thesis to other papers, there are several areas we would have liked to explore further:

Foremost, we would like to have access to additional data. Due to the specifications of our data, our dataset only contains firms that have a primary listing on the Oslo Stock Exchange. As such, we exclude a substantial part of the companies in our original sample. We would also like ownership data that as specifically tailored to the local Norwegian market and better

reflected the separation of powers between shareholders, i.e. the ownership concentration indices created by Døskeland and Mjøs (2008).

Secondly, the results from our econometric methods are ambiguous. Even though we have followed in line with previous theory and done pooled OLS, fixed effects and 2SLS the results cannot be interpreted in a meaningful way without comparing them to similar literature due to lack of theory about high-quality instruments.

# 6. Conclusions

## 6.1 Summary of findings

Throughout this paper, we have enriched the area of research pertaining to ownership characteristics and their impact on firm performance. By performing pooled OLS regressions, fixed effects estimations and two-stage least squares instrumental estimations, we have come to the following conclusions for our three hypotheses. We expected (1) that ownership concentration would not affect firm performance, (2) that insider shares would not affect Tobin's Q when instrumented by insider liquidity, and (3) that insider shares would not affect firm performance. Empirical support was found for all three hypotheses.

We find evidence that suggests ownership concentration is closely linked to firm-specific effects. When performing standard OLS, ownership concentration is significant, but when controlling for firm-specific effects it loses its significance. This is line with the endogenous nature of ownership structure proposed by Demsetz (1983).

We find no indication that insider liquidity is a reliable instrument for insider shares. Insider shares is not significant when instrumented by insider liquidity, and as an instrument, insider liquidity fails the Wald relevance test. As for other instruments, we find that volatility passes the Wald relevance test and produces significant results when instrumenting insider shares. This is in line with the evidence of Loderer and Martin (1997) pertaining to volatility as a strong instrument within corporate governance research. .

Based on our empirical analysis we find limited indication that insider shares is significant for firm performance. It is only significant when performing simultaneous equations, and its significance is reliant on the choice of instrument. We withhold our conclusion, until a better theory of how corporate governance mechanisms and firm performance interact, is agreed upon.

## 6.2 Suggestions for future research

The relationship between ownership characteristics and firm performance has proved to have methodological challenges, mainly endogeneity. The issue is that a better theory is required to understand corporate governance practices and effects.

In line with the suggestions of Brown, Beekes, & Verhoeven (2011), we believe that a multidisciplinary research approach to enrich the current ambiguous corporate governance theory could provide fruitful insights. The need for a theoretical framework to support the choice of instruments used in simultaneous equations is crucial to get reliable results. Areas of research that can be expanded upon is how corporate governance should be measured and indexed, in particular, how to make them fit specific markets and control for both internal and external mechanisms. Which mechanisms are substitutes and complements are still not clear and deserves more research as well. Researching specific insider actions instead of the structure, could help capture how said actions affects shareholders, and ultimately impacts firm performance.

We also believe that a study of corporate governance effects right after initial public offerings could provide valuable insights on the true relationship since this is an event where researchers do not have to deal with the stickiness of corporate governance variables that makes reaching conclusions difficult.

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# Appendix:

*Description of variables:*

| Variable Name | Description | Period |
|---|---|---|
| Q | Tobin's Q measured as the ratio between the physical asset's market value and its replacement value for a company. $$\frac{Total\ market\ value\ of\ firm}{Total\ asset\ value\ of\ firm}$$ | Quarterly |
| Insider shares | Insider Shares measured as the percentage of the total share capital owned by primary insiders as reported by the firms. | Quarterly |
| Foreign ownership | Fraction of shares owned by foreign investors as reported by Bloomberg. Includes individuals and companies. | |
| Institutional ownership | Fraction of shares owned by institutional owners as reported by Bloomberg. | Quarterly |
| Herfindahl-Hirschman index | Herfindahl-Hirschman index is calculated by squaring all the shareholders' percentages of shareholdings, then calculating individual owner's share of the total. | Quarterly following temporal disaggregation (see section 4.2.2) |
| Number of owners | The number of owners of shares in the firm, as reported by the firm. | Quarterly following temporal |

| | | |
|---|---|---|
| | | disaggregation (see section 4.2.2) |
| Largest shareholder fraction | The fraction of the total amount of shares held by the single largest owner. | Quarterly following temporal disaggregation (see section 4.2.2) |
| Firm Size | The logarithm of the total market capitalization of the firms, as measured by price per share * total number of shares. | Quarterly |
| Volatility | Volatility as measured by the standard deviation of daily returns * the square root of 90, where 90 is the number of days in a quarter. | Quarterly |
| Turnover | Turnover measured by the volume of shares traded the last quarter divided by the number of total shares. | Quarterly |
| S-* | Sector dummies for the ten sectors outlined in section Table 2. We use Energy as reference for the other dummies. | Annual |
| X201* | Year dummies for the period 2011-2016. 2010 is used as a reference for the other year dummies. | Annual |
| Insider Liquidity | $\frac{Number\ of\ insider\ shares\ traded}{Outstanding\ shares}$ | Quarterly |

| | | |
|---|---|---|
| Liquidity | $\frac{Number\ of\ shares\ traded}{Outstanding\ shares}$ | Quarterly |
| ROA | $\frac{Net\ income}{Total\ value\ of\ assets}$ | Quarterly |
| ROCE | $\frac{Earnings\ before\ interest\ and\ tax}{Capital\ employed}$ | Quarterly |

# *Tables:*

*Table 18: Pooled OLS for ownership identity (institutional holdings)*

**Pooled OLS with Institutional Holdings**

| | *Dependent variable:* | |
|---|---|---|
| | Q | |
| | *Iteration:* | |
| | *Standard* | *Clustered* |
| Variables | (1) | (2) |
| Institutional shares | 0.004*** | 0.004 |
| | (0.001) | (0.003) |
| Firm size | 0.0001*** | 0.0001* |
| | (0.00000) | (0.00004) |
| Volatility | -0.003*** | -0.003* |
| | (0.001) | (0.002) |
| Turnover | 0.0005 | 0.0004 |
| | (0.0004) | (0.002) |
| S-Consumer Discretionary | 0.749*** | 0.649* |
| | (0.152) | (0.349) |
| S-Communications Systems | 1.779*** | 1.667*** |
| | (0.240) | (0.121) |
| S-Finance | 0.188 | 0.110 |
| | (0.127) | (0.181) |
| S-Health care | 2.651*** | 2.577*** |
| | (0.178) | (0.920) |
| S-Industry | 0.438*** | 0.384*** |
| | (0.096) | (0.134) |
| S-Information Technology | 1.151*** | 1.078 |
| | (0.118) | (0.810) |
| S-Materials | 0.029 | -0.064 |
| | (0.167) | (0.130) |
| Constant (S-Consumer Staples) | 0.922*** | 1.052*** |
| | (0.118) | (0.250) |

*Note: S-Energy, S-Utility and S-Real estate were NA due to lack of observations.* *p **p ***p<0.01

*Table 19: Pooled OLS for ownership identity (foreign holdings)*

**Pooled OLS with Foreign Holdings**

| | *Dependent variable:* | |
|---|---|---|
| | Q | |
| | *Iteration:* | |
| | *Standard* | *Clustered* |
| Variables | (1) | (2) |
| Foreign shares | 0.005*** | 0.005 |
| | (0.002) | (0.004) |
| Firm size | 0.0001*** | 0.0001* |
| | (0.00000) | (0.00004) |
| Volatility | -0.003*** | -0.003* |
| | (0.001) | (0.002) |
| Turnover | 0.0004 | 0.0004 |
| | (0.0004) | (0.002) |
| S-Consumer discretionary | 0.569*** | 0.569 |
| | (0.161) | (0.355) |
| S-Communications systems | 1.556*** | 1.556*** |
| | (0.245) | (0.120) |
| S-Finance | 0.063 | 0.063 |
| | (0.132) | (0.180) |
| S-Health care | 2.482*** | 2.482*** |
| | (0.183) | (0.878) |
| S-Industry | 0.328*** | 0.328** |
| | (0.101) | (0.142) |
| S-Information technology | 1.005*** | 1.005 |
| | (0.124) | (0.833) |
| S-Materials | -0.087 | -0.087 |
| | (0.172) | (0.134) |
| Constant (S-Consumer Staples) | 1.165*** | 1.165*** |
| | (0.103) | (0.151) |
| *Note: S-Energy, S-Utilities and S-Real estate were NA due to lack of observations* | | *p**p***p<0.01 |

*Table 20: Pooled OLS for ownership identity (foreign holdings) and time-tickers.*

**Pooled OLS with Foreign Holdings**

| | *Dependent variable:* | |
|---|---|---|
| | Q | |
| | *Iteration* | |
| | *Standard* | *Clustered* |
| Variables | (1) | (2) |
| Foreign shares | 0.012*** | 0.012** |
| | (0.002) | (0.005) |
| Firm size | 0.0001*** | 0.0001* |
| | (0.00001) | (0.00004) |
| Volatility | -0.002 | -0.002 |
| | (0.001) | (0.002) |
| Turnover | 0.002*** | 0.002 |
| | (0.0005) | (0.002) |
| X2011 | -0.105 | -0.105 |
| | (0.146) | (0.126) |
| X2012 | 0.075 | 0.075 |
| | (0.146) | (0.162) |
| X2013 | -0.080 | -0.080 |
| | (0.144) | (0.157) |
| X2014 | -0.070 | -0.070 |
| | (0.146) | (0.160) |
| X2015 | -0.123 | -0.123 |
| | (0.149) | (0.136) |
| X2016 | -0.175 | -0.175 |
| | (0.152) | (0.140) |
| Constant (X2010) | 1.356*** | 1.356*** |
| | (0.126) | (0.229) |
| *Note:* | | *p**p***p<0.01 |

*Table 21: Pooled OLS for ownership identity (institutional holdings) and time-tickers.*

**Pooled OLS with Institutional Holdings**

| | *Dependent variable:* | |
|---|---|---|
| | Q | |
| | *Iteration* | |
| | *Standard* | *Clustered* |
| Variables | (1) | (2) |
| Institutional holdings | 0.005*** | 0.005 |
| | (0.002) | (0.004) |
| Firm size | 0.0001*** | 0.0001* |
| | (0.00001) | (0.00004) |
| Volatility | -0.003** | -0.003 |
| | (0.001) | (0.002) |
| Turnover | 0.002*** | 0.002 |
| | (0.0005) | (0.002) |
| X2011 | -0.120 | -0.120 |
| | (0.148) | (0.126) |
| X2012 | 0.077 | 0.077 |
| | (0.149) | (0.172) |
| X2013 | -0.112 | -0.112 |
| | (0.148) | (0.174) |
| X2014 | -0.082 | -0.082 |
| | (0.150) | (0.178) |
| X2015 | -0.110 | -0.110 |
| | (0.152) | (0.159) |
| X2016 | -0.130 | -0.130 |
| | (0.155) | (0.145) |
| Constant (X2010) | 1.436*** | 1.436*** |
| | (0.148) | (0.270) |
| *Note:* | | *p**p***p<0.01 |

*Table 22: Pooled OLS for ownership identity (institutional) and ownership concentration*

**Pooled OLS with Institutional Holdings**

| | *Dependent variable:* | |
|---|---|---|
| | Q | |
| | *Iteration:* | |
| | *Standard* | *Clustered* |
| Variables | (1) | (2) |
| Institutional Holdings | 0.004*** | 0.004 |
| | (0.001) | (0.003) |
| Firm size | 0.0001*** | 0.0001* |
| | (0.00000) | (0.00004) |
| Volatility | -0.003*** | -0.003* |
| | (0.001) | (0.002) |
| Turnover | 0.0004 | 0.0004 |
| | (0.0004) | (0.002) |
| Herfindahl-Hirschman Index | -0.421** | -0.421 |
| | (0.187) | (0.348) |
| S-Consumer discretionary | 0.649*** | 0.649* |
| | (0.158) | (0.349) |
| S-Communications system | 1.667*** | 1.667*** |
| | (0.244) | (0.121) |
| S-Finance | 0.110 | 0.110 |
| | (0.132) | (0.181) |
| S-Health care | 2.577*** | 2.577*** |
| | (0.181) | (0.920) |
| S-Industry | 0.384*** | 0.384*** |
| | (0.099) | (0.134) |
| S-Information technology | 1.078*** | 1.078 |
| | (0.123) | (0.810) |
| S-Materials | -0.064 | -0.064 |
| | (0.172) | (0.130) |
| Constant (S-Consumer staples) | 1.052*** | 1.052*** |
| | (0.131) | (0.250) |

*Note: S-Energy, S-Utility and S-Real estate were NA due to lack of observations* *p**p***p<0.01

*Table 23: Pooled OLS for ownership identity (foreign) and ownership concentration*

**Pooled OLS with Foreign Holdings**

| | *Dependent variable:* | |
|---|---|---|
| | Q | |
| | *Iteration* | |
| | *Standard* | *Clustered* |
| Variables | (1) | (2) |
| Foreign shares | 0.005*** | 0.005 |
| | (0.002) | (0.004) |
| Firm size | 0.0001*** | 0.0001* |
| | (0.00000) | (0.00004) |
| Volatility | -0.003*** | -0.003* |
| | (0.001) | (0.002) |
| Turnover | 0.0004 | 0.0004 |
| | (0.0004) | (0.002) |
| Herfindahl-Hirschman Index | -0.383** | -0.383 |
| | (0.187) | (0.329) |
| S-Consumer discretionary | 0.569*** | 0.569 |
| | (0.161) | (0.355) |
| S-Communications system | 1.556*** | 1.556*** |
| | (0.245) | (0.120) |
| S-Finance | 0.063 | 0.063 |
| | (0.132) | (0.180) |
| S-Health care | 2.482*** | 2.482*** |
| | (0.183) | (0.878) |
| S-Industry | 0.328*** | 0.328** |
| | (0.101) | (0.142) |
| S-Information technology | 1.005*** | 1.005 |
| | (0.124) | (0.833) |
| S-Materials | -0.087 | -0.087 |
| | (0.172) | (0.134) |
| Constant (S-Consumer staples) | 1.165*** | 1.165*** |
| | (0.103) | (0.151) |
| *Note: S-Energy, S-Utility and S-Real estate were NA due to lack of observations* | | *p**p***p<0.01 |

*Table 24: Pooled OLS for other firm measures*

**Pooled OLS on other firm measures**

| | *Dependent variable:* | | |
|---|---|---|---|
| | Q | ROA | ROCE |
| Variables | (1) | (2) | (3) |
| Insider shares | 0.014** | 0.225*** | 0.764*** |
| | (0.007) | (0.086) | (0.154) |
| Herfindahl-Hirschman Index | -0.757*** | 8.605*** | 4.795 |
| | (0.183) | (2.316) | (4.121) |
| Firm size | 0.00005*** | -0.001*** | -0.001*** |
| | (0.00000) | (0.00003) | (0.0001) |
| Volatility | -0.0002 | -0.100*** | -0.290*** |
| | (0.001) | (0.014) | (0.025) |
| Turnover | -0.002*** | 0.004 | -0.057*** |
| | (0.001) | (0.008) | (0.015) |
| S-Energy | -0.309* | -10.065*** | -26.321*** |
| | (0.161) | (2.040) | (3.629) |
| S-Materials | -0.361 | -11.806*** | -22.283*** |
| | (0.234) | (2.952) | (5.252) |
| S-Industry | -0.117 | -4.037** | -14.992*** |
| | (0.163) | (2.054) | (3.656) |
| S-Consumer discretionary | 0.147 | -1.383 | -5.410 |
| | (0.209) | (2.638) | (4.694) |
| S-Health care | 1.988*** | -17.928*** | -31.329*** |
| | (0.210) | (2.659) | (4.731) |
| S-Finance | -0.248 | -3.164 | -1.920 |
| | (0.180) | (2.269) | (4.037) |
| S-Information technology | 1.530*** | -10.241*** | -22.682*** |
| | (0.181) | (2.283) | (4.063) |
| S-Communications systems | 0.808*** | 0.169 | 12.018* |
| | (0.301) | (3.799) | (6.759) |
| S-Utilities | -0.119 | -2.651 | -8.025 |
| | (0.400) | (5.055) | (8.994) |
| S-Real estate | -0.575* | -6.538 | -21.531*** |
| | (0.332) | (4.191) | (7.458) |
| Constant (S-Consumer staples) | 1.518*** | 7.902*** | 25.643*** |
| | (0.155) | (1.960) | (3.488) |
| *Note:* | | | *p**p***p<0.01 |

*Table 25: Full LSDV model*

**LSDV**

| | *Dependent variable:* |
|---|---|
| Variables | Q |
| INS_SH | 0.027*** |
| | (0.006) |
| HHI | 0.017 |
| | (0.207) |
| LOG_MC | 0.00005*** |
| | (0.00000) |
| VOL | 0.001 |
| | (0.001) |
| TRNO | -0.002*** |
| | (0.001) |
| AFG | 1.883*** |
| | (0.254) |
| AFK | 1.188*** |
| | (0.256) |
| AIK | 0.917** |
| | (0.444) |
| AKA | 1.208*** |
| | (0.259) |
| AKBM | 1.144** |
| | (0.520) |
| AKER | 0.996*** |
| | (0.269) |
| AKERBP | 1.347*** |
| | (0.259) |
| AKFP | -0.954* |
| | (0.515) |
| AKVA | 0.921*** |
| | (0.270) |
| ALGETA | 8.969*** |
| | (0.339) |
| AMSC | 0.928*** |
| | (0.262) |
| APP | 1.232*** |
| | (0.271) |
| ASC | 1.230*** |
| | (0.274) |
| ATEA | 1.099*** |
| | (0.256) |

| | |
|---|---|
| AUSS | 0.990*** |
| | (0.261) |
| BEL | 0.647** |
| | (0.266) |
| BIOTEC | 5.111*** |
| | (0.260) |
| BMA | 0.784*** |
| | (0.266) |
| BON | 0.867*** |
| | (0.255) |
| BOR | 0.851*** |
| | (0.254) |
| BOUVET | 2.449*** |
| | (0.258) |
| BRG | 1.483*** |
| | (0.494) |
| BRIDGE | 0.771** |
| | (0.373) |
| CEQ | 1.137*** |
| | (0.312) |
| COMROD | 0.962*** |
| | (0.309) |
| DAT | 1.303*** |
| | (0.255) |
| DNB | 0.979*** |
| | (0.254) |
| DNO | 1.962*** |
| | (0.278) |
| DOF | 0.793*** |
| | (0.262) |
| EIOF | 0.724*** |
| | (0.270) |
| EKO | 1.870*** |
| | (0.254) |
| ELE | 1.047*** |
| | (0.266) |
| EMGS | 1.825*** |
| | (0.260) |
| EMS | 0.638** |
| | (0.324) |
| FAKTOR | 0.641 |
| | (0.757) |
| FAR | 0.744*** |

| | |
|---|---|
| | (0.257) |
| FARA | 1.998*** |
| | (0.400) |
| FOP | 0.761** |
| | (0.348) |
| GGG | 1.307** |
| | (0.604) |
| GJF | 1.234*** |
| | (0.284) |
| GOD | 0.783*** |
| | (0.256) |
| GRO | 0.776*** |
| | (0.285) |
| GSF | 1.058*** |
| | (0.260) |
| GYL | 0.882*** |
| | (0.295) |
| HAVI | 0.717*** |
| | (0.262) |
| HEX | 2.423*** |
| | (0.257) |
| HFISK | 0.953*** |
| | (0.296) |
| HIDDN | 1.734*** |
| | (0.264) |
| HJE | -0.420 |
| | (0.808) |
| HRG | 0.983*** |
| | (0.309) |
| IDEX | 14.089*** |
| | (0.264) |
| IGNIS | 1.724** |
| | (0.687) |
| IMAREX | 1.158*** |
| | (0.348) |
| IMSK | 0.831*** |
| | (0.258) |
| INC | 0.819*** |
| | (0.262) |
| INFRA | 1.328*** |
| | (0.320) |
| INM | 1.251** |
| | (0.495) |

| | |
|---|---|
| INSR | 0.656 |
| | (1.313) |
| IOX | -1.211** |
| | (0.479) |
| ITE | 1.601*** |
| | (0.261) |
| JSHIP | 0.974*** |
| | (0.365) |
| KIT | 0.886*** |
| | (0.256) |
| KOA | 0.996*** |
| | (0.254) |
| KOG | 1.516*** |
| | (0.258) |
| KVAER | 1.014*** |
| | (0.296) |
| KVE | 1.043** |
| | (0.466) |
| LINK | 1.321 |
| | (0.927) |
| LSG | 1.302*** |
| | (0.265) |
| MEDI | 3.228*** |
| | (0.260) |
| MORPOL | 0.994** |
| | (0.392) |
| NAS | 1.158*** |
| | (0.256) |
| NEAS | 0.791* |
| | (0.467) |
| NEC | -1.650*** |
| | (0.431) |
| NEL | 2.189*** |
| | (0.265) |
| NEXT | 3.222*** |
| | (0.757) |
| NGT | 2.659*** |
| | (0.253) |
| NHY | 0.935*** |
| | (0.254) |
| NOCC | 0.832*** |
| | (0.322) |
| NOD | 6.266*** |

| | |
|---|---|
| | (0.258) |
| NOR | 0.772*** |
| | (0.265) |
| NORD | 0.382 |
| | (0.362) |
| NPEL | 0.762** |
| | (0.347) |
| NPRO | 0.929*** |
| | (0.254) |
| NRC | 0.777*** |
| | (0.274) |
| NRS | 1.513*** |
| | (0.288) |
| NTS | 0.619** |
| | (0.280) |
| OCY | 1.042 |
| | (0.662) |
| OLT | 1.038*** |
| | (0.267) |
| ORK | 1.384*** |
| | (0.252) |
| OTS | 0.564** |
| | (0.265) |
| PARB | 0.718 |
| | (0.655) |
| PEN | 0.681** |
| | (0.265) |
| PGS | 1.162*** |
| | (0.256) |
| PHO | 2.320*** |
| | (0.254) |
| POL | 1.025*** |
| | (0.283) |
| PROTCT | 1.255*** |
| | (0.253) |
| QFR | 1.349*** |
| | (0.256) |
| REACH | 1.218*** |
| | (0.279) |
| REC | 0.780*** |
| | (0.282) |
| RISH | 0.726*** |
| | (0.276) |

| | |
|---|---|
| RXT | 0.611 |
| | (0.520) |
| SALM | 1.675*** |
| | (0.261) |
| SBO | 0.945*** |
| | (0.333) |
| SCHA | 2.503*** |
| | (0.253) |
| SEVDR | 0.562 |
| | (0.559) |
| SFR | 1.221** |
| | (0.597) |
| SIMTRO | 1.104** |
| | (0.510) |
| SINO | 0.748* |
| | (0.400) |
| SOFF | 0.573** |
| | (0.262) |
| SOLON | 2.058*** |
| | (0.335) |
| SOLV | 0.601** |
| | (0.260) |
| SPU | 1.209*** |
| | (0.257) |
| SRBANK | 0.951*** |
| | (0.253) |
| STB | 0.978*** |
| | (0.254) |
| STORM | 0.512* |
| | (0.277) |
| STRONG | 0.962*** |
| | (0.256) |
| TECH | 1.396*** |
| | (0.270) |
| TECO | 0.640 |
| | (0.469) |
| TEL | 1.616*** |
| | (0.258) |
| TGS | 1.848*** |
| | (0.254) |
| THIN | 7.299*** |
| | (0.497) |
| TIDE | 0.871*** |

| | |
|---|---|
| | (0.283) |
| TOM | 2.036*** |
| | (0.253) |
| TTS | 0.830*** |
| | (0.256) |
| UNISON | 0.705 |
| | (0.804) |
| VEI | 1.472*** |
| | (0.252) |
| VIZ | 1.694** |
| | (0.685) |
| VVL | 0.822*** |
| | (0.254) |
| WEIFA | 2.936*** |
| | (0.269) |
| WILS | 0.761** |
| | (0.313) |
| *Note:* | *p**p***p<0.01 |

*Table 26: Full fixed effects model with time-dummies*

**Fixed Effects with time-fixed dummies**

| | *Dependent variable:* |
|---|---|
| Variables | Q |
| Insider shares | 0.038*** |
| | (0.007) |
| Herfindahl – Hirschman Index | -0.183 |
| | (0.235) |
| Firm size | -0.00001*** |
| | (0.00000) |
| Volatility | 0.006*** |
| | (0.001) |
| Turnover | -0.002*** |
| | (0.001) |
| Quarter 1 | 0.142 |
| | (0.202) |
| Quarter 2 | 0.308 |
| | (0.202) |
| Quarter 3 | 0.644*** |
| | (0.202) |
| Quarter 4 | 0.193 |
| | (0.201) |
| Quarter 5 | -0.123 |
| | (0.203) |
| Quarter 6 | -0.002 |
| | (0.198) |
| Quarter 7 | 0.275 |
| | (0.206) |
| Quarter 8 | 0.136 |
| | (0.210) |
| Quarter 9 | 0.234 |
| | (0.213) |
| Quarter 10 | 0.052 |
| | (0.202) |
| Quarter 11 | 0.156 |
| | (0.198) |
| Quarter 12 | 0.262 |
| | (0.199) |
| Quarter 13 | 0.146 |
| | (0.202) |
| Quarter 14 | 0.207 |

| | |
|---|---|
| | (0.207) |
| Quarter 15 | 0.319 |
| | (0.210) |
| Quarter 16 | 0.322 |
| | (0.203) |
| Quarter 17 | 0.268 |
| | (0.213) |
| Quarter 18 | 0.083 |
| | (0.199) |
| Quarter 19 | 0.071 |
| | (0.214) |
| Quarter 20 | 0.046 |
| | (0.201) |
| Quarter 21 | 0.048 |
| | (0.206) |
| Quarter 22 | 0.004 |
| | (0.211) |
| Quarter 23 | -0.048 |
| | (0.213) |
| Quarter 24 | 0.010 |
| | (0.201) |
| Quarter 25 | -0.064 |
| | (0.202) |
| Quarter 26 | 0.036 |
| | (0.202) |
| Quarter 27 | 0.091 |
| | (0.206) |
| Quarter 28 | 0.333 |
| | (0.210) |
| Observations | 2,829 |
| $R^2$ | 0.046 |
| Adjusted $R^2$ | -0.014 |
| F Statistic | $3.977^{***}$ (df = 31; 2548) |
| *Note:* | $^{*}p^{**}p^{***}p<0.01$ |

*Table 27: Random effects model with ownership characteristics on Tobin's Q*

**Random effects model**

| | *Dependent variable:* |
|---|---|
| Variables | Q |
| Insider shares | 0.037*** |
| | (0.006) |
| Herfindahl-Hirschman Index | -0.293 |
| | (0.210) |
| Firm size | -0.00001*** |
| | (0.00000) |
| Volatility | 0.004*** |
| | (0.001) |
| Turnover | -0.001*** |
| | (0.001) |
| Constant | 1.394*** |
| | (0.162) |
| Observations | 2,829 |
| $R^2$ | 0.031 |
| Adjusted $R^2$ | 0.029 |
| F Statistic | 90.938*** |
| *Note:* | *p**p***p<0.01 |

*Table 28: Instrument Relevance tests (Wald)*

**Wald test**

**Instrument: Volatility*****

| Statistic | N | Mean | St. Dev. | Min | Pctl(25) | Pctl(75) | Max |
|---|---|---|---|---|---|---|---|
| Res.Df | 2 | 2,824.500 | 0.707 | 2,824 | 2,824.2 | 2,824.8 | 2,825 |
| Df | 1 | -1.000 | | -1.000 | -1.000 | -1.000 | -1.000 |
| F | 1 | 11.330 | | 11.330 | 11.330 | 11.330 | 11.330 |
| Pr(> F) | 1 | 0.001 | | 0.001 | 0.001 | 0.001 | 0.001 |

**Instrument: Turnover**

| Statistic | N | Mean | St. Dev. | Min | Pctl(25) | Pctl(75) | Max |
|---|---|---|---|---|---|---|---|
| Res.Df | 2 | 2,824.500 | 0.707 | 2,824 | 2,824.2 | 2,824.8 | 2,825 |
| Df | 1 | -1.000 | | -1.000 | -1.000 | -1.000 | -1.000 |
| F | 1 | 1.457 | | 1.457 | 1.457 | 1.457 | 1.457 |
| Pr(> F) | 1 | 0.228 | | 0.228 | 0.228 | 0.228 | 0.228 |

**Instrument: Insider Turnover**

| Statistic | N | Mean | St. Dev. | Min | Pctl(25) | Pctl(75) | Max |
|---|---|---|---|---|---|---|---|
| Res.Df | 2 | 2,824.500 | 0.707 | 2,824 | 2,824.2 | 2,824.8 | 2,825 |
| Df | 1 | -1.000 | | -1.000 | -1.000 | -1.000 | -1.000 |
| F | 1 | 1.820 | | 1.820 | 1.820 | 1.820 | 1.820 |
| Pr(> F) | 1 | 0.177 | | 0.177 | 0.177 | 0.177 | 0.177 |

## *Statistical tests:*

*Output 1: F-test for fixed effects versus pooled OLS model fit*

F test for individual effects

Data: Q ~ INS_SH + HHI + LOG_MC + VOL + TRNO
F = 19.723, df1 = 119, df2 = 2694, p-value < 2.2e-16
Alternative hypothesis: significant effects

*Output 2: Haussmann test for random and fixed effects*

Hausman Test

Data: Q ~ INS_SH + HHI + LOG_MC + VOL + TRNO
Chi-square = 6.9347, df = 5, p-value = 0.2255
Alternative hypothesis: one model is inconsistent

*Output 3: F-test for time-fixed effects in the fixed effects model*

F test for individual effects

Data: Q ~ INS_SH + HHI + LOG_MC + VOL + TRNO + S_ENE + S_MAT + S_IND + S_CD + S_COS + S_FIN + S_HC + S_IT + S_RE + S_UTI
F = 1.1616, df1 = 27, df2 = 2667, p-value = 0.2579
Alternative hypothesis: significant effects

*Output 4: Test for cross-sectional dependence (1/2)*

Breusch-Pagan LM test for cross-sectional dependence in panels

Data: Q ~ INS_SH + HHI + LOG_MC + VOL + TRNO
Chi-square = 26269, df = 8038, p-value < 2.2e-16
Alternative hypothesis: cross-sectional dependence

*Output 5: Test for cross-sectional dependence (2/2)*

Pesaran CD test for cross-sectional dependence in panels

Data: Q ~ INS_SH + HHI + LOG_MC + VOL + TRNO
z = 10.733, p-value < 2.2e-16
Alternative hypothesis: cross-sectional dependence

*Output 6: Test for cross-sectional dependence (2/2)*

Breusch-Godfrey/Wooldridge test for serial correlation in panel models

Data: Q ~ INS_SH + HHI + LOG_MC + VOL + TRNO
Chi-square = 324.8, df = 2, p-value < 2.2e-16
Alternative hypothesis: serial correlation in idiosyncratic errors

*Output 7: Test for unit root in panel set*

Augmented Dickey-Fuller Test

Data: panel.set$TOBIN_Q_RATIO
Dickey-Fuller = -15.491, Lag order = 2, p-value = < 0.01
Alternative hypothesis: stationary

*Output 8: Test for heteroscedasticity*

Breusch-Pagan test

Data: Q ~ INS_SH + HHI + LOG_MC + VOL + TRNO + factor (Ticker)
BP = 107770, df = 134, p-value < 2.2e-16

*Output 9: Test for correlation between insider turnover and share turnover*

Pearson's product-moment correlation

Data: INS_TRNO and TRNO
t = 5.1949, df = 2375, p-value = 2.222e-07
Alternative hypothesis: true correlation is not equal to 0