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Insider sales

The effect of selling owners on underpricing in Swedish IPOs

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Abstract

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Key words: Selling owners, IPO, underpricing, analyst coverage, quiet period

Purpose: The purpose of this thesis is to investigate if insider sales in initial public offerings affects the level of underpricing in the Swedish stock market. We further aim to evaluate if prestigious underwriters with affiliated high-quality analysts have a moderating effect on the relationship between insider sales and underpricing. Finally, we aim to investigate if the number of analysts has a moderating effect on the same relationship.

Methodology: The methodology is based on a cross-sectional data set which is used for the OLS regressions. Further, an instrumental variable approach is used to account for endogeneity problems. Interaction terms are also included in order to control for the moderating effect. Lastly, robustness checks are done by gradually controlling for different limits for the dummy variables used in interaction terms.

Theoretical perspectives: The theories used for the hypotheses development and analysis are information asymmetry, signaling theory, agency theory, the winner's curse hypothesis, the bandwagon hypothesis, the investment banker's monopsony power hypothesis and the entrepreneurial losses model.

Empirical foundation: This thesis uses a final sample of 448 IPOs in the Swedish stock market during the period of 2010-2022.

Conclusions: We find that insider sales affect the level of underpricing in a positive direction. However, we do not find evidence that prestigious underwriters with affiliated high-quality analysts have a moderating effect on the relationship between insider sales and underpricing. It is instead the number of analysts that has a moderating negative effect on insider sales and underpricing.

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1. Introduction

This chapter begins with a presentation of the background followed by a problematization and motivation. The purpose and research questions are then stated, and the chapter ends with our main findings, contribution, limitation as well as a description of how the rest of the paper is structured.

1.1 Background

Initial public offering (IPO) is an important step for a growing company since it introduces the firm to public equity and gives owners the opportunity to diversify as the shares are publicly traded (Ljungqvist, 2007). Going public is also beneficial because investors will not demand compensation for the illiquidity that exists in a privately held company (Ritter, 1998). Other reasons for going public include the ability to introduce a stock-based compensation program, increased publicity, and expansion (Ritter & Welch, 2002). In 2021, the number of initial public offerings globally increased by 64% compared to the year before (EY, 2022a). After a decrease in 2022, an increase is expected in 2023 (EY, 2022b). In an IPO, the issuing firm hires one or a syndicate of investment banks, i.e. underwriters, to carry out the transaction. The underwriters that participate in the IPO process offer a range of services such as valuation, advising, pricing, marketing, and underwriting. The most common method used in an IPO, called firm-commitment, is when underwriters buy all shares in advance from the issuer and sell them directly to the public (Ritter, 1998; Stowell, 2017).

While an IPO is one way to raise capital it usually comes with costs such as underpricing. It is common to refer to underpricing as "leaving money on the table" because it causes existing shareholders and the company going public to miss out on capital (Ljungqvist, 2007). The phenomenon of underpricing is considered to occur in all stock markets, but the level of underpricing differs (Ritter, 1998). For example, during 1980 to 1994 the average IPO in Sweden was underpriced by 34,1% while Denmark, a similar country, experienced underpricing of 7,7% between 1989 and 1997 (Ritter, 1998). Abrahamson and De Ridder (2015) found, on average, 7,7% underpricing in the Swedish stock market between 1996 to 2011. A more up to date study shows that during the last 40 years, the average IPO in Sweden has been underpriced by 28,2% (Loughran, Ritter & Rydqvist, 2023). Underpricing is costly for selling owners and is therefore something they want to avoid (Ljungqvist, 2007). During the years 2020-2022, $19,8 billion in total was left on the table in American IPOs (Ritter, 2023).

Underpricing can be explained in several ways, many of which are based on information asymmetry (Ljungqvist, 2007). Pre-IPO shareholders, i.e insiders, are one group that have more information than outsiders and are the ones who can exit when the company goes public. Alternatively, they can retain ownership after the IPO, increase, or sell a part of their ownership. However, post-IPO trading by incumbent shareholders is sometimes regulated by a lock-up agreement, usually between 90-180 days, which makes the IPO the only chance to sell shares before this period (Arthurs, Busenitz, Hoskisson & Johnson, 2009). Sweden is one of the most successful entrepreneurial countries in the world, with the second highest number of unicorns per capita (Bloomberg, 2021). One of the mentioned driving factors for this success is impactful owners. In addition, the number of owners' exits through IPOs accounted for more than 60% of the total exits during 2020-2021 in the Nordic countries (Pitchbook, 2023). The fraction of insider sales, which is the amount of secondary shares incumbent shareholders sell in the IPO, can have an effect on first-day return because of information asymmetry between parties and the negative signal it sends to investors in the IPO (Habib & Ljungqvist, 2001; Kennedy, Sivakumar & Vetzal, 2006; Ang and Brau, 2003). However, Brau, Li and Shi (2007) argue that insider sales has no relationship with underpricing. This contradicts the information asymmetry explanations and leaves the insider sales effect on underpricing open for discussion.

1.2 Problem discussion and motivation

There is evidence of both negative and non-existing relationships between insider sales in IPOs and first-day returns (Habib & Ljungqvist, 2001; Kennedy, Sivakumar & Vetzal, 2006; Ang & Brau, 2003; Brau, Li & Shi, 2007; Chua & Nasser, 2016; Ljungqvist & Wilhelm, 2003). Insiders sell shares for different reasons such as liquidity needs or the presence of a lock-up agreement, forcing existing owners to sell at the IPO instead of post-IPO (Ang & Brau, 2003; Chua & Nasser, 2016). Habib and Ljunqvist (2001) further explain that selling owners of a company going public can affect underpricing, depending on which underwriter they hire. Moreover, they argue that, to what extent the underwriter affects underpricing, depends on its reputation. Because of the inverse relationship between high-quality underwriters and underpricing, owners spend more money on top-tier underwriters when they sell secondary shares in order to decrease uncertainty, avoid underpricing, and maximize personal wealth (Habib & Ljungqvist, 2001). Prior research on insider sales in IPOs and how it affects underpricing mainly focuses on the American stock markets which makes their conclusions limited to the U.S. (Habib & Ljungqvist, 2001; Kennedy, Sivakumar & Vetzal, 2006; Ang & Brau, 2003; Brau, Li & Shi, 2007; Chua & Nasser, 2016; Ljungqvist & Wilhelm, 2003). One

major difference between the Swedish and the American stock market is the presence of a quiet period in the U.S. from the day when the IPO is announced until 40 days post-IPO (SEC, 2023; Ritter, 2003). The quiet period applies to all parties participating in the IPO, e.g. underwriters and analysts that are affiliated with the underwriter (Ritter, 2003). The parties involved are prohibited from disclosing information that is not in the initial filing and that could influence the IPO or the stock price. The purpose of the quiet period is to hinder issuers from manipulating the demand and offer price while also giving the SEC time to review the offering and prospectus (SEC, 2023).

The absence of a quiet period in Sweden could potentially lead to insider sales being perceived differently in Sweden compared to the American setting. Without a quiet period, both biased analysts that are affiliated with the underwriter and unbiased analysts are allowed to write reports on the IPO. Ritter (2003) argues that high-quality analysts are crucial for underwriters since it affects to what extent they compete with other underwriters on new IPO deals. The reason for this is the high reputational analysts' ability to publish impactful recommendations and reports on a stock (Ritter, 2003). Some literature has even shown that the demand from issuing companies on high-quality analysts is so strong that top-tier underwriters can leave more money on the table, and yet maintain significant market shares for IPO underwriting (Dunbar, 2000; Krigman, Shaw, & Womack, 2001). Therefore, it is possible in Sweden that selling owners hire top-tier underwriters to allow their high-quality analysts to produce biased reports on the IPO. However, seen from another perspective, since the market for underwriters is smaller in Sweden compared to the U.S. it could be that the reputation of the underwriter and the quality of affiliated analysts is not as decisive. With less underwriters there is a possibility that many of the investment banks and analysts are already well known and the reputation, per se, has no effect on the relationship between insider sales and underpricing. Also, on a smaller market, high-quality analysts could potentially have a longer reach as there is lower competition and a smaller market to address. Therefore, it could be the actual number of analysts covering IPOs in Sweden that has an effect on how the signaling effect of insider sales is perceived by the market.

In the Swedish context without a quiet period there is a possibility for selling owners to increase the demand through biased analyst reporting. This could allow insiders to be able to sell more secondary shares or the same amount of shares at a higher offer price in the IPO, i.e. more insider selling could decrease underpricing in Sweden. This potential finding is also in line

with the arguments of Habib and Ljungqvist (2001) that selling owners hire top-tier underwriters to certify the IPO and maximize their personal wealth. Alternatively, both unbiased and biased analyst reporting could simply accelerate the uncertainty around IPOs in Sweden due to more noise. This in addition to insider selling could increase the uncertainty even more and reinforce the negative signal associated with selling owners. Thus, issuers will be forced to set a lower offer price which could increase underpricing instead. In summary, the different setting in the Swedish stock market makes insider sales effect on underpricing, the potential moderating effect of prestigious underwriters with affiliated analysts, and the number of analysts important to investigate.

1.3 Purpose and Research question

The purpose of this thesis is to investigate if insider sales in initial public offerings affects the level of underpricing in the Swedish stock market. This paper further aims to study if prestigious underwriters with affiliated high-quality analysts have a moderating effect on the relationship between insider sales and underpricing. Lastly, the paper also investigates if the number of analysts has a moderating effect on this relationship. The research questions (RQ) that will be investigated in this thesis are:

(RQ1) - Does insider sales affect the level of underpricing?
(RQ2) - Do prestigious underwriters with affiliated high-quality analysts have a moderating effect on the relationship between insider sales and underpricing?
(RQ3) - Does the number of analysts have a moderating effect on the relationship between insider selling and underpricing?

1.4 Main findings

This thesis uses a sample of 448 IPOs in the Swedish stock market between 2010-2022. The relationship between insider sales and underpricing is investigated with an OLS regression and using an instrument variable approach to account for endogeneity bias. We find evidence for a positive statistical relationship between insider sales and underpricing where a 10 percentage units increase in insider sales corresponds to, on average, 1,3 percentage units more underpricing. We do not find evidence for prestigious underwriters with affiliated high-quality analysts having a moderating effect on the relationship between insider sales and underpricing. However, the number of analysts around a certain IPO does have a moderating effect on insider sales and underpricing. A high number of analysts allows insiders to increase the amount of

secondary shares by 10 percentage units which, on average, leads to 1,8 percentage units lower underpricing compared to having a low number of analysts. Our findings are also robust when using an instrumental variable approach.

1.5 Contribution

The relationship between insider sales and underpricing has been studied before, however the vast majority of these studies are on the U.S. stock market with the presence of a quiet period. These studies either find a negative or a non-significant relationship whereas we find a positive relationship that could be explained with information asymmetry, signaling and impactful Swedish owners. This contributes with new insights to this field of research where investors could use our findings to detect underpriced IPOs through the amount of secondary shares filed and thus earn a positive first-day return. Furthermore, no one has investigated the moderating effect of underwriter reputation and analyst coverage on insider sales and underpricing in a setting without a quiet period. Therefore, our findings contribute to the literature with evidence on how selling owners could form a strategy for how to use analyst coverage to minimize underpricing and maximize personal wealth in a setting with both biased and unbiased analyst reporting.

1.6 Limitations

The main limitations of this thesis are a relatively small sample size and that we see selling owners as a homogeneous group. Since the Swedish IPO market is relatively small compared to the U.S. market it does not allow us to have a large sample size which could potentially affect the precision of our results and conclusion. Furthermore, it could be that different types of selling owners have a dissimilar effect on underpricing due to various importance for the firm. The founder selling shares or an institutional owner selling shares could send different signals to the market and thus potentially affect underpricing differently.

1.7 Structure of the paper

The rest of this paper is structured as follows: section 2 presents theories and hypotheses about underpricing followed by an empirical literature review in section 3. The hypotheses are developed in section 4, and section 5 presents the methodology. In section 6 the data is described followed by a presentation and interpretation of the results in section 7. Lastly, analysis and conclusion are found in section 8 and 9.

2. Theoretical framework

This chapter starts with a description of theories often used in the IPO literature such as information asymmetry, signaling- and agency theory, followed by different hypotheses that tries to explain underpricing, and ending with a presentation of the entrepreneurial losses model.

2.1 Information asymmetry

Akerlof (1970) is the founder of the information asymmetry theory and named it *The Market for Lemons*. It is based on the fact that there are different levels of information among parties in the market. There are good quality products on the market and there are *Lemons*. Which products that are lemons are hard to detect for the buyers and puts the sellers in a superior position in regards to information (Akerlof, 1970). This information asymmetry forces the buyer to only be willing to pay the average price on the market, in order to avoid the risk of paying a high price for a lemon (Akerlof, 1970). Rock (1986) further explains how information asymmetry acts in the context of IPOs. If the price of IPOs does not reflect the demand, informed investors are able to invest in undervalued IPOs and earn a high first-day return. If this is the case, informed investors will try to only invest in underpriced IPOs. Rock (1986) further explains that because of the information asymmetry, uninformed investors do not know the true value of the IPO and are therefore unaware of whether informed investors will invest. Uninformed investors will therefore be forced to invest blindly without knowing the true value and will therefore demand a lower price (Rock, 1986). When a lower offer price is set, underpricing is created. Further, in the context of insider sales, information asymmetry could both increase and decrease underpricing. Selling owners could be forced to lower the offer price as a compensation for the uncertainty associated with insider sales, creating a positive relationship. However, it could also have a negative effect on underpricing since increased information asymmetry as a result of insider sales could create a lower demand in the IPO, which in turn decreases first-day return.

2.2 Signaling theory

Spence (1978) is explaining the concept of signaling by arguing that sellers can mitigate the problems associated with information asymmetry by increasing information available to uninformed individuals. By signaling and certifying the quality of a product to the market, buyers will be willing to pay a higher price for quality products. Signaling theory can also

explain underpricing in IPOs as a way for existing superior owners to send a positive signal to outsiders (Allen & Faulhaber, 1989; Grinblatt & Hwang, 1989). If the owners go public while underpricing the IPO and retaining ownership, it sends a positive signal to the market that the firm is of good quality. The positive signal is based on the faith of a positive future outlook and high long-term performance for the firm that will regenerate the initial loss of capital that underpricing creates. Existing owners can in this way stand out from firms with bad long-term performance. Owners of firms with negative expected long-term performance cannot take the risk of underpricing and retaining ownership (Grinblatt & Hwang, 1989).

Furthermore, Leland and Pyle (1977) derive a model in their paper and show that the entrepreneurs' willingness to invest in their own projects can serve as a quality signal. The authors conclude that the market interprets higher entrepreneurial ownership as a signal of a more favorable project. Furthermore, entrepreneurs are also more motivated to retain a higher fraction of equity in beneficial projects (Leland & Pyle, 1977). With this as background, if insiders sell a higher fraction of their ownership in the IPO it serves as a negative signal. This could potentially lead to new investors demanding more underpricing as compensation for the increased risk, by setting a lower offer price than the valuation implies, leading to a positive relationship between insider selling and underpricing.

2.3 Agency theory

Jensen and Meckling (1976) explains agency theory as the relationship between an agent and a principal. This relationship includes a contract between the two parties where the principal delegates the agent to act in the principal's interest (Jensen & Meckling, 1976). The agency problem arises when the agent acts in its own interest instead of the principal's (Fama & Jensen, 1983). Moreover, the agent does not usually possess any ownership and is not individually penalized in the form of wealth losses while this is usually the case for the principal (Fama & Jensen, 1983). The agent-principal problem partially arises because of moral hazard issues. Moral hazard occurs when the agent engages in a risky activity while recognizing that it is protected from the risk and that the principal will bear the expense. Moral hazard occurs when the actors involved only have partial knowledge of each other (Arrow, 1984).

In the context of IPOs, there is an agent-principal relationship between the issuing firm and the underwriter of the IPO (Loughran & Ritter, 2004). In this situation, the issuing firm is the principal while the underwriter is the agent (Loughran & Ritter, 2004). Issuers want to

minimize underpricing and underwriter reputation generally has a negative relationship with underpricing. However, in some situations, underwriters can benefit more from underpricing by promoting underpriced shares to investors that are future potential customers (Ljungqvist, 2007). The agent-principal dilemma can also be applied to selling owners and new investors due to less alignment of interest between the two parties after the IPO. This could both create a positive and negative relationship between insider sales and underpricing where new investors are either compensated by more underpricing or the dilemma creates a lower demand which decreases first-day return.

2.4 Explanations of underpricing

2.4.1 Winner's curse hypothesis

The Winner's curse hypothesis is built on information asymmetry theory (Akerlof, 1970; Rock, 1986) and suggest that informed investors possess information advantages relative to uninformed investors. Hence, informed investors are more likely to buy shares from IPOs that are more underpriced. If demand exceeds supply, rationing will occur since usually a fixed number of shares are sold at a predetermined offer price. If uninformed investors receive the desired number of shares in an IPO, it implicitly means that supply exceeded demand and the offering has been avoided by informed investors, resulting in a first-day return that is either low or negative. Hence the name *winner's curse*. Uninformed investors are aware of this adverse selection problem and demand, on average, underpriced issues to participate in the IPO market (Ritter, 1998).

2.4.2 The bandwagon hypothesis

According to the bandwagon hypothesis, underpricing is explained by the issuers' incentive to set the IPO price lower to attract initial investors. When initial investors submit a purchase order for the IPO, there is a possibility that a bandwagon effect is created, i.e more investors want to participate in the offering regardless of their own information (Ritter, 1998). This is a classic example of herd behavior, a psychological phenomenon that frequently occurs in several advanced European financial markets (Chiang & Zheng, 2010) and is commonly referred to as the fear of missing out, also called FOMO (Forbes, 2021).

2.4.3 The investment banker’s monopsony power hypothesis

Underpricing, according to the investment banker's monopsony power hypothesis, arises because it allows the investment bank to benefit buy-side clients and spend less time on marketing efforts. The investment bank can enhance customer relationships with long-term profitable clients by underpricing the IPO with the help of its extensive market expertise, allowing, for instance, institutional clients to buy shares at a lower offer price than the valuation implies (Ritter, 1998; Ljungqvist, 2007).

2.5 The Entrepreneurial Losses Model

Habib and Ljungqvist (2001) introduced the entrepreneurial losses model, which is an extension of the information asymmetry model by Rock (1986). Habib and Ljungqvist (2001) argue that selling owners can affect the level of underpricing by the choices they make in promoting the IPO to minimize their wealth loss. Owners can hire a high-quality underwriter, at a higher expense, and through the investment bank certification effect lower the uncertainty and information asymmetry around the IPO. Issuers can also choose to hire auditors and lawyers with a higher reputation or disclose more voluntary information about the IPO and the firm to decrease adverse selection and thus underpricing. The decision between listing shares on NASDAQ, at a higher listing fee, or a smaller stock exchange, at a lower listing fee, can also affect the uncertainty level around the offering. However, the level of incurring promoting costs depends on, to what extent, owners participate in the IPO. Insiders care about underpricing to the extent they stand to lose from it. Owners who only sell a small fraction of their holding suffer marginally from underpricing while a larger fraction creates incentives to decrease underpricing by increasing the offer price. Thus, the amount of secondary shares insiders sell will influence how much they spend on promotion costs to decrease information asymmetry and underpricing (Habib & Ljungqvist, 2001).

3. Empirical literature review

The chapter begins with a literature overview of the relationship between insider selling and underpricing and ends with an overview of underwriter reputation and analyst coverage literature.

3.1 Insider sales and underpricing

3.1.1 Negative relationship

There is previous empirical literature that reports a negative relationship between insider selling and underpricing (Habib & Ljungqvist, 2001; Kennedy, Sivakumar & Vetzal, 2006; Ang & Brau, 2003). Habib and Ljungqvist (2001) study 1357 IPOs between 1991 and 1995 on NASDAQ U.S and define insider selling as the fraction of secondary shares sold in the IPO divided by the number of preflotation shares. They find a negative relationship at the 5% significance level between insider selling and underpricing. The authors also find that promotion costs increase the more shares being offered and that higher promotion costs are associated with less underpricing. This is in line with the entrepreneurial losses model and the authors state that this is the reason why underpricing is lower the larger the amount of secondary shares insiders sell in the IPO (Habib & Ljungqvist, 2001). The entrepreneurial losses model is supported by another study made by Kennedy, Sivakumar and Vetzal (2006) who study a sample of 2381 IPOs in the U.S. between 1991 to 1998. They define insider sales the same way as Habib & Ljungqvist (2001). The authors find that the fraction of insider shareholdings sold is negatively correlated with underpricing at the 10% significance level with the same motivation that insiders care about underpricing to the extent that they suffer from it. A higher fraction of secondary shares in the offering incentivizes owners to decrease underpricing through promotion to minimize their wealth loss (Kennedy, Sivakumar & Vetzal, 2006).

Ang and Brau (2003) explore the relationship between underpricing and insider selling by analyzing 1619 IPOs between 1980 and 1997 in the U.S. and find a negative relationship between insider selling and underpricing at the 1% significance level. The authors define insider sales as secondary shares initially filed divided by total shares initially filed in the prospectus. They argue that selling owners adopt different strategies to mitigate the negative signal associated with insider selling. Outside investors see insider selling as a negative signal since the alignment of interest between insiders and investors are reduced, which can create

problems regarding moral hazard. It further creates more information asymmetry in a setting where information asymmetry is already prominent. To mitigate the negative signal associated with secondary shares offered, insiders underreport the intended number of shares they plan to sell in the initial prospectus (form S-1). The remaining secondary shares are later filed in an amendment that is closer to the IPO date. The rationale behind this is that insiders hope that the later amendment is unnoticed or that the hype around the initial prospectus and the road show will overshadow the negative aspect of increasing the number of secondary shares in a later stage. By initially underreporting the intended number of secondary shares to sell and committing to longer lock-up periods, insiders mitigate the negative signal and allow selling owners to maximize their personal wealth (Ang and Brau, 2003).

3.1.2 Insignificant relationship

While some literature reports a negative relationship between insider selling and underpricing, others show a non-significant relationship (Brau, Li & Shi, 2007; Chua & Nasser, 2016; Ljungqvist & Wilhelm, 2003). Brau, Li and Shi (2007) investigate 3155 IPOs between 1980 and 2001 on NYSE, NASDAQ, and Amex in the U.S. The authors define insider sales as the number of secondary shares sold, divided by the total number of shares sold in the IPO. They further make a distinction between secondary shares sold in general and secondary shares offered by only officers and directors. The authors do not find a significant relationship between insider selling and underpricing. They argue that incumbent shareholders sell secondary shares due to portfolio diversification issues or liquidity needs instead of opportunistically unloading overpriced shares. Since incumbent shareholders are typically restricted with lock-up agreements in the aftermarket, holding restricted shares generally decreases portfolio value and increases the overall portfolio risk, which motivates selling of secondary shares in the IPO instead. The authors further argue that the insignificant result could be explained by underwriters' market stabilization activity and price support in the aftermarket that could skew short term share prices (Brau, Li & Shi, 2007).

Chua and Nasser (2016) investigate insider selling and the effect on underpricing in the U.S stock market between 1997 and 2010 with a sample of 1502 IPOs. The authors define insider selling as secondary shares sold by executives and directors divided by total ownership prior to the IPO. They do not find a significant relationship between insider selling and underpricing and argue that insider selling, per se, does not affect underpricing. However, if insider sales is regressed on six liquidity variables in a 2SLS regression they find a negative relationship

between insider selling and underpricing at the 1% significance level. They argue that the result supports the idea that investors react negatively to insider selling, due to liquidity reasons, since first-day return decreases as insider selling increases. The main reasons for the negative reaction from the market is the lack of alignment between the interest of pre-IPO shareholders and new shareholders supported by agency theory. Liquidity needs are an important factor, and if not the primary reasons for insider selling in IPOs (Chua & Nasser, 2016).

Ljungqvist and Wilhelm (2003) examine a sample of 2175 IPOs pre- and during the Dot-com bubble in the U.S. between 1996 and 2000. The authors define insider sales as the fraction of secondary shares sold in the IPO divided by the number of preflotation shares. They find, in one regression, that insider selling is inversely related to underpricing at the 5% level with the same motivation as Habib and Ljungqvist (2001), i.e underpricing is higher when insiders are less exposed to the offer price. In two other regressions they find no statistically significant result between insider selling and underpricing. The authors conclude that insider holding decreased while offer prices rose between 1996 and 2000. Overall, this resulted in a rise in the dollar worth of insider holdings, measured at the offer price during the studied period. This implies that insiders' expected utility from bargaining over the offer price more forcefully may have marginally decreased with their increasing wealth (Ljungqvist & Wilhelm, 2003). The authors do not explicitly state that this is the reason for the insignificant relationship. However, both Carter & Manaster (1990) and Logue (1973) suggest that the variable *insider sales* is a proxy for the negotiation power of selling owners in relation to underwriters regarding offer price. If offer prices increased in general, due to the market climate during the Dot-com bubble, insiders do not have to bargain over the offer price to the same extent as before and the insider variable, per se, has no effect on first-day returns.

3.2 Underwriter and Analyst coverage

3.2.1 Underwriter reputation

Underwriter reputation and its impact on underpricing is a well-studied subject (Beatty & Welch, 1996; Carter & Manaster, 1990; Carter, Dark & Singh, 1998; Michaely & Shaw, 1994; Logue, Rogalski, Seward & Foster-Johnson, 2002; Chua, 2014). These studies either measure underwriter reputation as the investment banks' relative market share or use the tombstone ranking developed by Carter & Manaster (1990). Some researchers find a negative relationship between underwriter reputation and underpricing and argue that high-quality investment banks

introduce larger and more mature companies that are considered less risky. Another argument is that top-tier underwriters offer a greater amount of high-quality information that reduces information asymmetry and thus underpricing (Carter & Manaster, 1990; Carter, Dark & Singh, 1998; Michaely & Shaw, 1994). Other researchers find a positive relationship between underwriter reputation and underpricing (Beatty and Welch, 1996; Chua, 2014). The positive relationship is explained with the motivation that underwriters with a higher reputation introduce a greater number of IPOs with larger proceeds. Due to their greater reputational concerns, top-tier underwriters price bids to maximize future businesses rather than to maximize present return from the IPO. For example, top-tier underwriters underprice more to mitigate long-run underperformance by not publicly listing the company with a strained valuation. Underwriters with a lower reputation introduce a smaller amount of capital, have no reputational concerns, and want to maximize their own return by not leaving money on the table (Chua, 2014).

3.2.2 Analyst Coverage

Loughran and Ritter (2004) find support for the analyst lust hypothesis when studying a sample of 6391 IPOs between 1980-2003 in the U.S. They proxy for high-quality analysts with prestigious underwriters and argue that the highest rated analysts are employed at these investment banks. The analyst lust hypothesis states that issuers have become more aware of analyst coverage and thus hire top-tier underwriters with high quality analysts. The desire is so strong for high quality analyst coverage that underwriters associated with top-tier analysts are able to underprice more to favor buy-side clients, and still maintain significant market share for underwriting. Furthermore, the IPO syndicate that is in charge of the underwriting process has increased over time since the demand for analyst coverage has increased. One of the driving factors for the increased demand is the internet that allows for greater visibility of analyst recommendation and reports that could increase the demand for a certain stock. The authors find that top-tier underwriters leave more money on the table compared to less prestigious underwriters, in line with the analyst lust hypothesis. Issuers do not pay for analyst coverage directly since underwriters do not charge direct fees for this service. However, issuers pay indirectly with more underpricing. Other literature supporting the analyst lust hypothesis is Dunbar (2000) who find that underwriters with high quality analysts increased their market share during a ten-year period. Hong and Kubik (2003) find that bullish analysts are more likely to get an offer from high quality underwriters and that analysts publishing less optimistic forecasts are more likely to get fired.

4. Hypothesis development

Some of the literature finds a negative relationship between insider sales and underpricing (Habib & Ljungqvist, 2001; Kennedy, Sivakumar & Vetzal, 2006; Ang & Brau, 2003). Information asymmetry can be mitigated by signaling (Spence, 1978), which is partly the explanation for the negative relationship through promotion of the IPO (Habib & Ljungqvist, 2001; Kennedy, Sivakumar & Vetzal, 2006). The negative relationship could also arise as selling owners try to mitigate the negative signal that investors in an IPO experience (Ang & Brau, 2003). Other authors do not find a statistically significant relationship (Brau, Li & Shi, 2007; Chua & Nasser, 2016; Ljungqvist & Wilhelm, 2003). However, there could also occur a positive relationship as more underpricing is needed as compensation when insiders sell shares because of the negative signal associated with selling owners (Leland & Pyle, 1977). Since Sweden is one of the most successful entrepreneurial countries in the world where impactful owners are one of the driving factors of this success, the negative signal with selling owners could be reinforced in the Swedish context. This could create more information asymmetry and thus more underpricing (Rock, 1986). Furthermore, in line with the bandwagon hypothesis, when insiders sell shares, they want to attract initial investors (Ritter, 1998). Potentially, the offer price is set lower when a larger fraction is being sold by existing owners to create a bandwagon effect. Agency theory could also explain a positive relationship between insider sales and underpricing. If incumbent shareholders sell a significant part of their shares there is less alignment of interest between old- and new shareholders (Chua & Nasser, 2016; Jensen & Meckling, 1976; Fama & Jensen, 1983). Hence, new shareholders could demand shares at discount due to the risk for opportunistic behavior from selling owners still active within the firm.

There are several papers and theories that argue that insider selling should have an effect on underpricing. No matter the direction of the relationship, the signal that insider sales send to the market is likely to affect underpricing. Hence, the following hypotheses are formulated:

H0a: *Insider sales does not affect the level of underpricing*

H1a: *Insider sales affects the level of underpricing*

Habib and Ljungqvist (2001) argue that the degree to which selling owners incur promotion costs, such as hiring top-tier underwriters, depends on the level owners stand to lose from underpricing. However, underwriter reputation literature has shown both a positive and a negative correlation with underpricing (Beatty & Welch, 1996; Carter & Manaster, 1990; Carter, Dark & Singh, 1998; Michaely & Shaw, 1994; Chua, 2014). There are reasons to assume that prestigious underwriters with affiliated high-quality analysts could have a moderating effect on the relationship between insider sales and underpricing. To the best of our knowledge, no previous literature has investigated this in combination with insider sales and its impact on underpricing in a setting without a quiet period. One potential effect is that when insiders sell secondary shares, they could hire top-tier underwriters, at a higher expense, to certify the quality of the firm (Habib & Ljungqvist, 2001; Carter & Manaster, 1990; Carter, Dark & Singh, 1998; Michaely & Shaw, 1994). High reputation for investment banks, per se, could decrease information asymmetry and uncertainty in IPOs resulting in higher offer prices and lower underpricing, allowing selling owners to maximize personal wealth. It could also be that insiders hire prestigious underwriters with high quality analysts to demand biased analyst reporting during the IPO process (Loughran & Ritter, 2004; Hong & Kubik, 2003). Since this is possible without a quiet period in Sweden, high quality analyst coverage could create a bandwagon effect in the opposite direction. Hence, the offer price instead increases and creates lower underpricing, allowing selling owners to maximize personal wealth.

It could also be that high-quality underwriters, even though hired at the expense of selling owners, favor buy-side clients with more underpricing to benefit themselves with long-term customer relationships (Ritter, 1998; Chua, 2014; Ljungqvist, 2007). This is also in line with the agency problem between underwriters and issuers (Loughran & Ritter, 2004) as well as the investment banker's monopsony power hypothesis (Ritter, 1998). In summary, the different perspectives of underwriter reputation's role in IPOs and the quality of the affiliated analysts suggests that this could have a moderating effect on insiders' relationship with underpricing. Hence, the following hypotheses are formulated:

H0b: *Prestigious underwriters with affiliated high-quality analysts do not have a moderating effect on the relationship between insider sales and underpricing.*

H1b: *Prestigious underwriters with affiliated high-quality analysts have a moderating effect on the relationship between insider sales and underpricing.*

Even though prestigious underwriters with high-quality analysts are argued to have a moderating effect on the relationship between insider sales and underpricing, there is a possibility that the number of analysts has this role instead. As aforementioned, in the Swedish market setting, the absence of a quiet period could potentially accelerate the effect of analyst coverage. Hence, there is a possibility that because of the smaller market size in Sweden compared to the U.S, the number of analysts itself is important for selling owners. The presence of biased analysts in Sweden increases the possibility for selling owners to mitigate the negative signal of insider sales by promotion through more biased analyst coverage and not necessarily higher quality of the coverage. This is in line with the mitigation of information asymmetry by increasing the amount of information available (Rock, 1986). Further, Loughran and Ritter (2004) argue that the number of underwriters in the syndicate is larger when there is a higher demand for more analyst coverage. The number of analysts could therefore have a moderating effect on the relationship between insider sales and underpricing. Therefore, the following hypothesis is formulated:

H0c: *The number of analysts in an IPO does not have a moderating effect on the relationship between insider sales and underpricing.*

H1c: *The number of analysts in an IPO has a moderating effect on the relationship between insider sales and underpricing.*

Hypothesis H0b and H0c could both be rejected but could also be somewhat contradictory to each other which leaves this as an empirical question to answer in this thesis.

5. Methodology

This chapter starts with an overall description of the methodology, followed by an explanation of the univariate tests as well as regressions and heteroskedasticity tests. The chapter ends with a discussion about endogeneity, presentation of interaction terms, and how the results will be robustness tested.

5.1 Introduction to methodology

The methodology of this paper is based on prior research within the research area of insider sales (Habib & Ljungqvist, 2001; Kennedy, Sivakumar & Vetzal, 2006; Ang & Brau, 2003; Brau, Li & Shi, 2007). The methodology is quantitative and is based on a deductive approach, in order to explain the relationship between insider sales and underpricing. Hence, prior literature and theories are taken into consideration for the hypothesis formulation. Furthermore, the threshold for rejection of hypotheses in this thesis is at the 5% significance level.

5.2 Econometric methodology

5.2.1 Univariate test

In order to thoroughly analyze the variables included in the regression models, we start with univariate tests. These are executed by dividing the sample into IPOs with insider sales and IPOs with no insider sales. Since selling owners are suggested to have a signaling effect (Ang & Brau, 2003), the sample is divided by the distinction between IPO with only primary shares and IPOs containing either a combination of secondary- and primary shares or only secondary shares.

5.2.2 Regression

In econometric research it is important to choose the right model for the study and there are different models that can be considered. In this paper, we use a cross-sectional data set since IPOs are one-time events which makes the time aspect of the data irrelevant. Hence, we use an OLS regression model which is in line with prior papers and is argued to be the best model for regressions on underpricing (Habib & Ljungqvist, 2001; Kennedy, Sivakumar & Vetzal, 2006; Ang & Brau, 2003; Brau, Li & Shi, 2007). Furthermore, we control for time by the usage of a time period dummy variable for each year. We also control for different industries to eliminate this effect in all regressions. The industries are divided by SIC-codes and can be found in

Appendix 1. The following model is the main model used to test hypothesis H0a. Definitions of all the variables can be found in section 6.2 as well as in Appendix 2.

OLS for hypothesis H0a:

$$First\text{-}day\ return_i = \beta_0 + \beta_1 Insider\ sales_i + \beta_2 Controls_i + \beta_3 Year_i + \beta_4 Industry_i + \varepsilon_i \quad (1)$$

5.3 Heteroskedasticity

Heteroskedasticity is present when the variance of the residuals is not constant. This means that when the explanatory variable assumes different values, the variance of the residuals will differ. If heteroskedasticity is present, the standard errors will be invalid, and it is not possible to correctly interpret the results. In order to test if heteroscedasticity appears in the models, a White test is used. The test is performed by studying the residuals and using the square residuals as dependent variable in another model. If we reject the null hypothesis that the model is homoscedastic, heteroskedasticity is present. If there is heteroskedasticity in the models, robust standard errors will be used. The test is performed for Model 1, Model 4, as well as Model 6, and the results are presented in part 7.2.

5.4 Endogeneity

There is a risk of endogeneity bias being present in the models, more specifically the risk for reverse causality in the main explanatory variable *Insider sales*. This is due to how underpricing is created during the first day of trading. Underpricing is created as a result of the offer price, since if the offer price is set low in relation to the demand for the shares, a positive first-day return is likely to occur. Hence, the risk of reverse causality arises as existing owners get knowledge of the demand and therefore the risk of underpricing. They can in this situation adjust the number of shares they sell in the IPO, depending on how much underpricing they predict (Ang & Brau, 2003). However, there is evidence that liquidity needs are the main reason for existing owners to sell shares in an IPO and they do not opportunistically unload overpriced shares (Chua & Nasser, 2016; Brau, Li & Shi, 2007), which would mitigate the risk for reverse causality. Also, incumbent shareholders can never in advance know the true demand and thus neither the expected underpricing.

One way to deal with the endogeneity problem is to use an instrumental variable as prior research does (Ljungqvist & Wilhelm, 2003). The purpose of using an instrumental variable is

to use an exogenous explanatory variable instead of an endogenous. In order for a variable to be suitable as an instrument, three criteria must be fulfilled (Wooldridge, 2016). Firstly, the instrument should be correlated with the endogenous variable. Secondly, the instrument needs to not have a direct effect on the dependent variable in the model. Lastly, the instrument is exogenous if it is uncorrelated with the error term. To proceed with this method, a 2SLS-regression is used to solve the problems associated with reverse causality.

The 2SLS-regression method starts with a first-stage least square regression where the endogenous variable is the dependent variable and the instrument is the independent variable. Secondly, in the next step, the endogenous variable in the main model is replaced by the instrument and the original dependent variable is regressed on the instrument and control variables (Wooldridge, 2016). The instrument used to replace *Insider sales* is a dummy variable if secondary shares were originally filed in the IPO prospectus. This instrumental variable is called *SecFil* and measures if sales of secondary shares is initially planned before existing owners get knowledge of the demand for their shares. The instrument is valid since it does not have a direct effect on underpricing but has an effect on the actual sales of secondary shares which in turn has an effect on underpricing. We also interpret the F-test in the first-stage regression as an indication for the strength of the instrument. If the F-test result is larger than ten, the instrument is considered strong (Wooldridge, 2016). Hence, by using this variable, the problem associated with reverse causality is mitigated.

First-stage least square for hypothesis H0a:

$$Insider\ sales_i = \alpha_0 + \alpha_1 SecFil_i + \alpha_2 Controls_i + \alpha_3 Year_i + \alpha_4 Industry_i + \varepsilon_i \quad (2)$$

2SLS for hypothesis H0a:

$$First\text{-}day\ return_i = \beta_0 + \beta_1 \widehat{Insider\ sales}_i + \beta_2 Controls_i + \beta_3 Year_i + \beta_4 Industry_i + \varepsilon_i \quad (3)$$

5.5 Interaction terms

Interaction terms can be used to test if one variable has a moderating effect on a relationship between two other variables (Wooldridge, 2016). The analysis can be deepened by including an interaction term in a regression since the partial effect can be tested. To build on the main model and be able to test hypothesis H0b, an interaction term between *Insider sales* and *High-*

rep is generated. In this way, it is possible to test if insider sales effect on underpricing is dependent on prestigious underwriters with affiliated high-quality analysts.

OLS for hypothesis H0b:

$$First\text{-}day\ return = \beta_0 + \beta_1 Insider\ sales_i + \beta_2 Controls_i + \beta_3 High\text{-}rep_i + \beta_4 High\text{-}rep\ X\ Insider\ sales_i + \beta_5 Year_i + \beta_6 Industry_i + \varepsilon_i \quad (4)$$

Further, to test hypotheses H0c, an interaction term between insider sales and the number of analysts is also generated. This is performed by multiplying *Insider sales* with *Analyst coverage*.

OLS for hypothesis H0c:

$$First\text{-}day\ return_i = \beta_0 + \beta_1 Insider\ sales_i + \beta_2 Controls_i + \beta_3 Analyst\ coverage_i + \beta_4 Analyst\ Coverage\ X\ Insider\ Sales_i + \beta_5 Year_i + \beta_6 Industry_i + \varepsilon_i \quad (5)$$

5.6 Robustness tests

In order to make sure that the inference of our results is not affected by the choices we have made, two different robustness tests will be performed. We will use different limits in the *High-rep* and *Analyst coverage* dummy to make sure that it does not interfere with our result. For the variable *High-rep* the limit is raised to the 90th percentile, 4,14% market share, and the variable is then called *High-rep (2)*. For *Analyst coverage*, the limit is raised to three or more underwriters hired by the firm and the variable is then called *Analyst coverage (2)*.

6. Data description

This chapter starts with a presentation on how the final data sample was derived, followed by a definition of the variables used in the regression, ending with a presentation of summary statistics and correlation discussion.

6.1 Sample universe

6.1.1 Sample construction

The sample in this thesis has been collected from Bloomberg Terminal, except from *Total assets* in the regression due to the monthly quota limit for Bloomberg. For this variable, Capital IQ was used instead. When certain IPOs lacked specific data, we supplemented it with information from the prospectus or the company's website. The advantage of using Bloomberg Terminal is that it does not exclude firms that have been delisted and this is especially important for encountering survivorship bias.

The data sample is limited to the Swedish stock market, motivated in section 1.2, and includes the following stock exchanges: NASDAQ OMX Stockholm, First North, Spotlight Stock Market and Nordic Growth Market (NGM). The data was further limited to the timeframe of 2010-01-01 to 2022-12-31 due to various reasons. Firstly, the data is lacking before 2010, especially for which underwriters the issuing companies used in the IPO. Limited data regarding underwriters was something we also encountered within our sample and was solved by manually collecting these by studying the prospectus of each IPO. Secondly, restricted data regarding other variables beside underwriters and a limited time frame of this paper are other aspects that we accounted for. Furthermore, the global financial crisis between 2008-2009 and its severe impact on the global financial market could potentially skew our data and thus our analysis and conclusion. Lastly, we wanted to increase the timeliness by contributing with an up-to-date study, hence not going too far back in history.

The initial sample, after filtering for Sweden and the time period, resulted in 514 IPOs. As shown by Figure 1, the sample consists of 458 IPOs after excluding preference shares, units offerings, ADRs and financial institutions, in line with previous literature (Habib & Ljungqvist, 2001; Ljungqvist & Wilhelm, 2003; Chua & Nasser, 2016; Kennedy, Sivakumar & Vetzal, 2006; Ang and Brau, 2003). Financial institutions are based on Bloomberg's classification of financial firms. After a manual review of the sample, we noticed that four IPOs were incorrectly

classified as a listing on a Swedish stock exchange. These firms had either been listed on Oslo Børs or Nasdaq Copenhagen and were therefore excluded. Finally, since Special Purpose Acquisition Company (SPAC) is a relatively new phenomenon in Sweden, they are not included in the final data. These shell companies going public differs a lot from the typical issuing firm and the benefits of excluding these six shell companies are outweighed by the increased uncertainty that comes with including SPACs in the sample. The final sample consists of 448 initial public offerings. All these exclusions could cause selection bias. However, the initial sample includes all IPOs in Sweden during the studied period and should therefore be representative for Swedish IPOs. Furthermore, it is standard practice within this field of study to exclude IPOs based on the above criteria. Lastly, as can be seen in Figure 2, the number of IPOs per year can differ quite substantially from year to year since IPOs are partially driven by macroeconomics factors.

Figure 1: Deriving the final sample

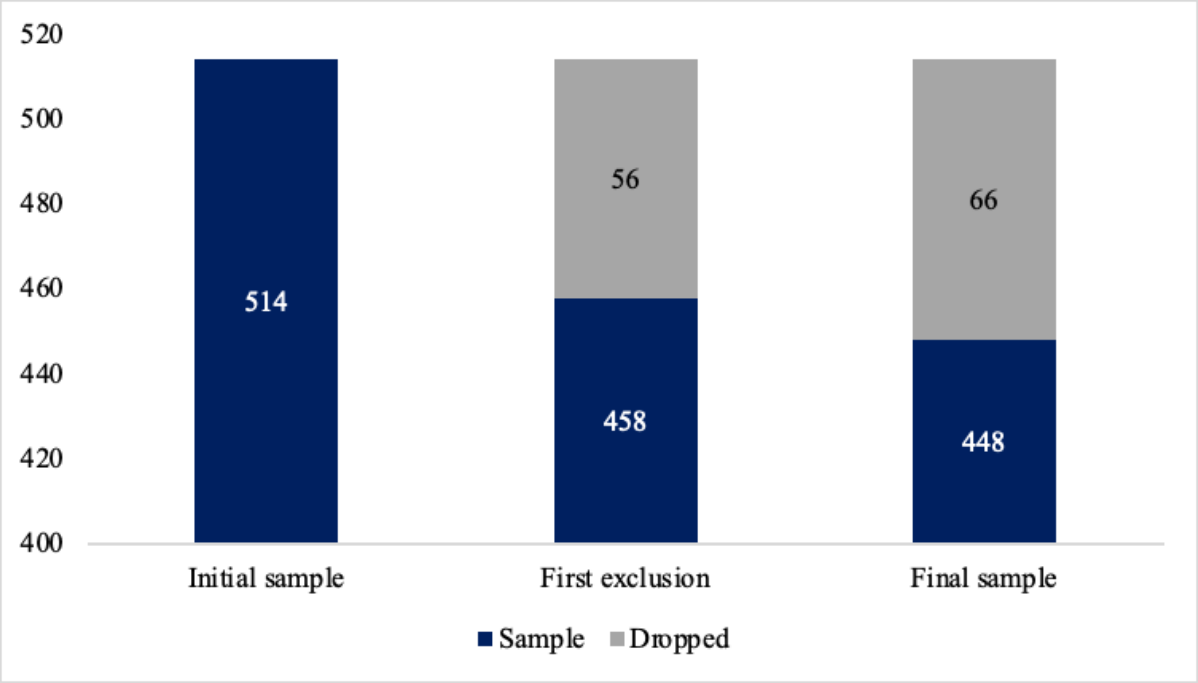
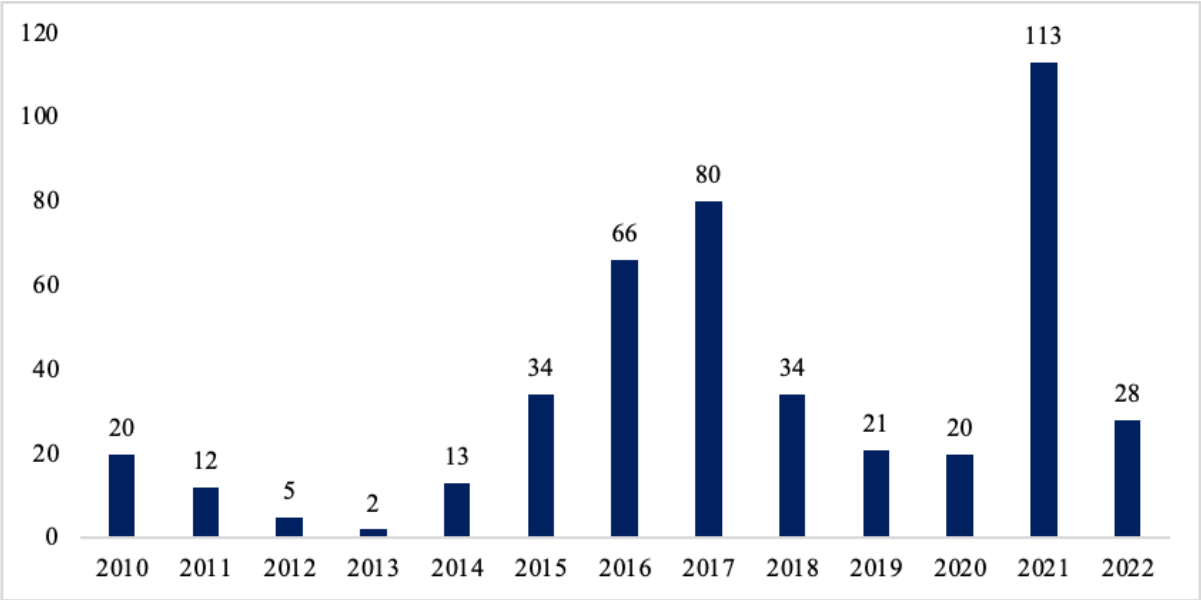


Figure 2: Number of IPOs per year



6.1.2 Limitations with the Swedish stock market

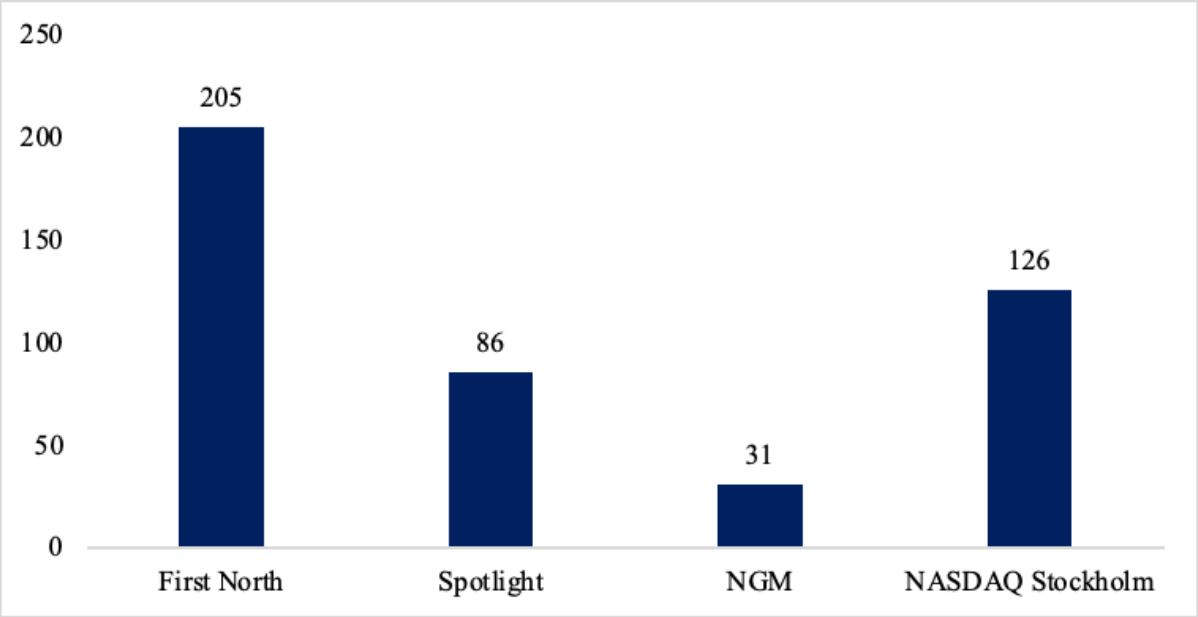
At first glance, a sample of 448 IPOs can be considered a low number of observations. Putting 448 observations in relation to prior studies on insider sales that have a sample of 1357 to 3155 observations can question our ability to make statistically reliable conclusions. However, the market for IPOs in the U.S. where previous research on this topic has been conducted is in terms of size very different compared to the Swedish IPO market. Between 2010 to 2022, 1689 firms went public in the U.S. stock market (Ritter, 2023), which allows researchers studying this market to retrieve a larger sample. Furthermore, Rydqvist (1997) who also studied the Swedish stock market and IPO underpricing between 1980 to 1994 had a sample of 251 observations. Despite this, his study was recognized and published in *Journal of Banking & Finance* and has been cited by other well-known researchers such as Ritter (1998). Therefore, we deem our sample of 448 IPOs not to be a problem.

6.1.3 Sample representativeness

The overall Swedish stock market is composed of different stock exchanges such as regulated exchanges including NASDAQ Stockholm and NGM as well as less regulated multilateral trading facilities (MTF) including First North and Spotlight. Both regulated stock exchanges and MTFs demand high standards from the issuing company. However, the latter ones are less constrained in terms of disclosure of information but could demand the same as regulated exchanges (Nasdaq, N.d; Advokatfirman Lindahl, 2020). As seen by Figure 3, our sample is

skewed towards MTF platforms. Therefore, it is possible that our findings yield less representative economic significance towards regulated stock exchanges.

Figure 3: Distribution of stock exchange



6.2 Variables

6.2.1 Dependent variable

The dependent variable in this thesis is *First-day return*, i.e. underpricing if the first-day return is positive. The variable is calculated by subtracting first-day closing price (P0) from the offer price (P1), divided by the offer price (P0), in line with previous studies (Habib & Ljungqvist, 2001; Ljungqvist & Wilhelm, 2003; Chua & Nasser, 2016; Kennedy, Sivakumar & Vetzal, 2006; Ang and Brau, 2003; Brau, Li & Shi, 2007).

$$First\text{-}day\ return\ = \frac{P1\ -\ P0}{P0}$$

6.2.2 Explanatory variable

The main explanatory variable in this thesis is *Insider sales* and is defined as secondary shares offered in the IPO divided by total shares offered, in line with previous literature (Brau, Li & Shi, 2007). The variable is a fraction restricted to the range of zero to one where zero is a

situation where the IPO only contains primary shares, i.e newly printed shares, and one when the offering only contains secondary shares, i.e. old shares sold by incumbent shareholders[1].

$$Insider\ sales\ = \frac{Secondary\ shares}{Total\ shares\ in\ IPO}$$

6.2.3 Control variables

The control variables used in this thesis are based on the variables used in previous literature. *Firm age* is used as a control variable since it has been shown to reduce information asymmetry and, consequently, underpricing. Older companies are assumed to possess more available information and a proven track record compared to younger companies with less information and higher risk. *Firm age* is calculated as the year of the IPO subtracted by the year the firm was founded (Habib & Ljungqvist, 2001; Brau, Li & Shi, 2007; Chua & Nasser; 2016; Ljungqvist & Wilhelm, 2003; Carter & Manaster, 1990). Furthermore, venture capital-backed IPOs have shown an inverse relationship with underpricing due to the VCs certifying effect and is therefore used as another control variable. The variable *VC* is constructed as a dummy variable equal to one if the IPO is VC-backed and zero otherwise, in line with previous literature (Ang & Brau, 2003; Brau, Li & Shi, 2007; Chua & Nasser; 2016; Megginson & Weiss, 1991). Another control variable used is *High-tech*, which is a dummy equal to one if the firm is present in a technology intensive industry and zero otherwise (Chua & Nasser, 2016; Ljungqvist & Wilhelm, 2003; Kennedy, Sivakumar & Vetzal, 2006; Brau, Li & Shi, 2007). The variable is included to accommodate for potential increased uncertainty, and thus increased underpricing, for technology intensive industries. This thesis uses an updated classification of high-tech firms, such as software technology, scientific R&D and computer and electronic products (Galindo-Rueda & Verger, 2016).

Furthermore, prior research has found that lock-up agreements can be seen as a positive signal and thus lower underpricing compared to those IPOs without a lock-up agreement. Also, firms with higher underpricing, on average, have shorter lock-up periods. The variable *Lock-up* is measured as the number of days incumbent shareholders are restricted from selling secondary shares in the aftermarket (Huang, Chao & Lioa, 2010; Ang and Brau, 2003). Another control

[1] This paper does not distinguish secondary shares sold in general from secondary shares offered by only officers and directors as some empirical literature do. This is because we are interested in how secondary shares as a whole could potentially affect underpricing.

variable used is *Offer size* which is defined as total amount of capital raised in the IPO, in line with previous literature (Kennedy, Sivakumar & Vetzal, 2006; Habib & Ljungqvist, 2001). The expected relationship with underpricing is negative since larger IPOs in terms of gross proceeds are generally executed by mature firms considered less risky. The last variable used in the regression is *Total asset* and will control for size (Chua & Nasser, 2016; Ljungqvist & Wilhelm, 2003). The variable is defined as total book value of assets for a specific firm the year prior to the IPO (Chua & Nasser, 2016). The arguments are in line with those of the variable *Firm age*, i.e larger firms are assumed to be less risky compared to smaller firms.

6.2.4 Underwriter reputation and number of analysts

The variable used to investigate the moderating effect for hypothesis H0b is *High-rep* which is a proxy for if an IPO has prestigious underwriters with affiliated high-quality analysts, in line with Loughran and Ritter (2004). We define this variable as the investment bank's relative market share, in line with previous studies (Carter, Dark & Singh, 1998; Megginson & Weiss, 1991; Ang & Brau, 2003; Brau, Li & Shi, 2007). *High-rep* is calculated as introduced capital by the investment bank, in relation to total introduced capital in Sweden by all banks. In this definition, a higher market share refers to a better reputation relative to a lower market share which instead reflects a worse reputation. Data on underwriters' relative market share in Sweden is obtained from Bloomberg Terminal. This data is based on our sample of IPOs between the period 2010-01-01 and 2022-12-31. There are sometimes several underwriters involved in the underwriting process and in our sample 119 firms used more than one underwriter in their IPO. In these situations, an average is calculated for the sum of the investment banks' relative market share. Lastly, the variable is constructed as a dummy variable equal to one if the market share is equal or higher than the 75th percentile (1,53%) and zero otherwise. The variable *High-rep* includes underwriters such as Carnegie, which is the number one ranked underwriter in Sweden during our studied period, and others like SEB, Goldman Sachs, Nordea and JP Morgan as can be seen in Appendix 3.

To test H0c, we control for the number of underwriters as a proxy for the number of analysts with the variable *Analyst coverage* to investigate its moderating effect on the relationship between insider sales and underpricing. The fundamentals behind the variable are in line with the arguments of Loughran and Ritter (2004) that larger syndicates of underwriters enable more analyst coverage for the issuer. The variable is constructed as a dummy equal to one if there are two or more underwriters involved in the IPO and zero otherwise.

6.2.5 Implication of reputation and analyst coverage

One potential drawback to discuss is the average calculations when an IPO is carried out with more than one underwriter. The *High-rep* variable in these situations, which is an evenly weighted average of the market shares of the participating investment banks, may be distorted as a result of this methodology. Ideally would be to determine a weighted average based on the number of shares each underwriter receives within its underwriting mandate. For example, an IPO with a prestigious underwriter responsible for 90% of the shares and a less prestigious underwriter responsible for 10% would have obtained a higher reputation compared to now with an equally weighted average. However, this information was not accessible via Bloomberg, Capital IQ or the prospectus, most likely due to a high level of confidentiality.

Another important aspect to discuss is the limits chosen for the dummy variables *High-rep* and *Analyst coverage*. For *High-rep*, using the 75th percentile (1,53%) as limit allows us to proxy for prestigious underwriters with a reputation above the average- and median reputation. Using the average (0,97%) or the median (0,03%) as a limit between high and low reputation is not reasonable since these limits could not be seen as a feasible limit for high reputation. Regarding *Analyst coverage*, the limit for the dummy variable is set at two or more underwriters in an IPO. This is because the average number of underwriters in an IPO in our sample is 1,48. Hence, when the dummy variable assumes the number 1 for an observation, that specific IPO has a higher number of underwriters than the majority. However, we will control for both these limits by assigning another limit for high reputation and analyst coverage as a robustness test.

6.3 Descriptive statistics

The following section will discuss and analyze the summary statistics in Table 1. Since the variable *First-day return* had outliers that could affect the efficiency of the regression we have winsorized the variable at the 1st and 99th percentile to control for extreme values, in line with prior research (Abrahamson & De Ridder, 2015). Furthermore, we have used the natural logarithm of *Total assets* and *Offer size* in the regression models to mitigate the skewness in the variables, in line with previous literature (Ljungqvist & Wilhelm, 2003; Chua & Nasser, 2016; Kennedy, Sivakumar & Vetzal, 2006).

Initial public offerings in the Swedish stock market are, on average, underpriced with 7,00% according to the mean value of *First-day return*. 7,00% underpricing in the Swedish stock market during the last 12 years is quite interesting since Ritter (1998) finds 34,1% underpricing

in Sweden during 1980-1994 while Loughran, Ritter and Rydqvist (2023) reports 28,2% underpricing during the last 40 years. However, our result is in line with Abrahamson and De Ridder's (2015) finding of 7,68% underpricing in Sweden between 1996-2011. The variable further indicates that first-day return can differ quite substantially with a maximum value of 133,33% and a minimum value of -62,22%, even though the variable is winsorized. The independent variable *Insider sales* shows that, on average, 20,28% of the offers consists of secondary shares while the median is 0,00%, indicating that *Insider sales* is slightly skewed. On average 20,28% secondary shares in the offering is slightly higher than the findings of Brau, Li and Shi (2007) who find that, on average, 12% of the offers consist of secondary shares with a median of 0%. Furthermore, the maximum value shows that some IPOs only consist of secondary shares and in total 46 firms went public by only offering secondary shares. The instrument *SecFil* shows that 31,03% of the total sample initially filed for secondary shares in the prospectus.

Furthermore, 8,71% of the firms who went public were VC-backed and 27,01% of the firms are in a technology intensive industry. *Lock-up* shows that the average lock-up period in the Swedish stock market is 180 days, both mean and median, in line with the most common period to use (Arthurs, Busenitz, Hoskisson & Johnson, 2009). However, two firms that went public used a lock-up period of 3 years while 162 firms did not use one. The average firm age going public is 17 years and the median firm age is 10 years. However, some firms went public straight away while some waited 152 years according to the maximum and minimum values. As stated before, *Total assets* and *Offer size* are affected by outliers. *Total assets* has a mean of 1600,63 MSEK while the median is only 42,82 MSEK. The skewness is also shown by the maximum value of 262,31 billion SEK in total assets, which is Volvo Cars. This also applies for *Offer size* with a mean of 530,32 MSEK while the median is only 50,00 MSEK. The smallest IPO raised a total amount of 2,05 MSEK while the largest IPO raised approximately 20 billion SEK. Moreover, 35,49% of the firms in our sample hired a high-quality underwriter and 26,56% hired two or more analysts. The highest number of analysts used was 7 in the IPOs of Ahlsell AB and Volvo Cars.

Table 1: Summary statistics

Variable	Mean	Median	SD	Min	Max	N
First-day return[1]	0.070	0.029	0.312	-0.622	1.333	448
Insider sales	0.203	0.000	0.353	0.000	1.000	448
SecFil[2]	0.310	0	0.463	0	1	448
VC[2]	0.087	0	0.282	0	1	448
Lock-up	179.879	180.000	169.713	0.000	1095.000	448
High-tech[2]	0.270	0	0.445	0	1	448
Firm age	16.790	10.000	22.742	0.000	152.000	448
Total assets (MSEK)	1600.631	42.816	12696.895	0.049	262312.000	448
Offer Size (MSEK)	530.321	50.000	1466.608	2.047	19999.975	448
High-rep[2]	0.355	0	0.479	0	1	448
Analyst coverage[2]	0.266	0	0.442	0	1	448

Note: The variables included in the table are (1) **First-day return** (first-day closing price - offer price/offer price) (2**) Insider sales** (secondary shares sold/total shares sold in IPO) (3) **SecFil** (dummy variable equal to 1 if secondary shares was initially filed in the prospectus, and 0 otherwise) (4) **VC** (dummy variable equal to 1 if the IPO is VC-backed, and 0 otherwise) (5) **Lock-up** (number of days incumbent shareholders are restricted from selling shares in the aftermarket) (6) **High-tech** (dummy variable equal to 1 if the company is in a high-tech industry, and 0 otherwise) (7) **Firm age** (year of the IPO minus the year the firm was founded) (8) **Total assets** MSEK (pre-IPO total assets) (9) **Offer Size** MSEK (total amount of capital raised in IPO) (10) **High-rep** (dummy variable equal to 1 if the underwriter is equal or higher than the 75th percentile, and 0 otherwise) (11) **Analyst coverage** (dummy variable equal to 1 if the IPO has 2 or more underwriters, and 0 otherwise)

[1]Winsorized at the 1st and 99th percentile
[2]Dummy variable

6.4 Correlation table

The Pearson's correlation matrix in Table 2 presents the correlation for all variables used in the regressions. *Insider sales, SecFil, VC, Offer size, High-rep, and Analyst coverage* are significantly correlated with *First-day return*. *VC* is negatively correlated with *First-day return,* meaning that underpricing tends to move in the opposite direction as VC-backing. *Insider sales, SecFil, Offer size, High-rep* and *Analyst coverage* are positively correlated with *First-day return*. When insider selling increases, underpricing tends to go in the same direction, which is interesting and motivates further research. The variables *SecFil* and *Insider sales* are highly significantly correlated with each other, thus fulfilling the first criteria of an instrument. The correlation of 0,142 between *SecFil* and *First-day return* is considered low which makes the second criteria of an instrument fulfilled.

The positive correlation between the number of analysts and first-day return suggests that more analyst coverage tends to go in the same direction as underpricing. As anticipated, *Analyst coverage* and *Insider sales* are significantly correlated and the positive direction suggests that when the number of analysts are high, insiders tend to sell more secondary shares. The highest correlation between two variables used in the same regression are *SecFil* and *High-rep* with a coefficient of 0,723. This is considered to be a high correlation that could give rise to the problem of multicollinearity. However, they are in the same model once when controlling for endogeneity and we deem it not to be a problem. High correlation is also present between *High-rep* and *Analyst coverage* with a coefficient of 0,695. However, these two variables are never used in the same regression. The correlation between *Insider sales* and *High-rep* with a coefficient of 0,622 is not considered a high correlation that could give rise to the problem with multicollinearity.

Table 2: Pearson's correlation matrix

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) First-day return	1.000										
(2) Insider sales	0.138***	1.000									
(3) SecFil	0.142***	0.858***	1.000								
(4) VC	-0.084*	-0.027	-0.036	1.000							
(5) Lock-up	0.067	-0.102**	-0.111**	0.210***	1.000						
(6) High-tech	-0.046	-0.043	-0.028	0.044	0.049	1.000					
(7) Firm age	0.047	0.449***	0.387***	-0.085*	-0.116**	-0.138***	1.000				
(8) Total assets (MSEK)	0.034	0.057	0.052	-0.036	-0.030	-0.057	0.229***	1.000			
(9) Offer Size (MSEK)	0.076*	-0.032	-0.032	-0.017	0.087*	-0.010	-0.046	-0.004	1.000		
(10) High-rep	0.132***	0.622***	0.723***	0.003	-0.200***	-0.104**	0.398***	0.161***	0.016	1.000	
(11) Analyst Coverage	0.151***	0.551***	0.591***	0.011	-0.149***	-0.093**	0.353***	0.184***	0.037	0.695***	1.000

Note: The variables included in the table are (1**) First-day return** (first-day closing price - offer price/offer price) (2) **Insider sales** (secondary shares sold/total shares sold in IPO) (3) **SecFil** (dummy variable equal to 1 if secondary shares was initially filed in the prospectus, and 0 otherwise) (4) **VC** (dummy variable equal to 1 if the IPO is VC-backed, and 0 otherwise) (5) **Lock-up** (number of days incumbent shareholders are restricted from selling shares in the aftermarket) (6) **High-tech** (dummy variable equal to 1 if the company is in a high-tech industry, and 0 otherwise) (7) **Firm age** (year of the IPO minus the year the firm was founded) (8) **Total assets** MSEK (pre-IPO total assets) (9) **Offer Size** MSEK (total amount of capital raised in IPO) (10) **High-rep** (dummy variable equal to 1 if the underwriter is equal or higher than the 75th percentile, and 0 otherwise) (11) **Analyst coverage** (dummy variable equal to 1 if the IPO has 2 or more underwriters, and 0 otherwise)

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

7. Empirical results

This chapter begins with the results of the univariate tests followed by the result from the White tests. The rest of the chapter contains results for the eleven regression models.

7.1 Univariate tests

In order to present a full picture of how the variables differ between groups of insider sales and non-insider sales, we start by performing univariate tests. In Table 3, univariate tests are used to investigate if the variables differ between IPOs containing secondary shares and IPOs with only primary shares. There are 309 IPOs with only primary shares and 139 IPOs containing either a combination of primary- and secondary shares or only secondary shares. The former group has a mean of 4,1% underpricing while the latter group has a mean of 13,6%, shown by the variable *First-day return.* The difference in means is highly statistically significant between insider sales and non-insider sales IPOs. This is in line with the prior correlation discussion where insider selling is positively correlated with underpricing. Moreover, it can be observed that *SecFil* has a mean of 1 among the insider sales-group while it is 0 for the non-insider sales group and the difference is highly significant. Hence, there are no firms that initially filed secondary shares followed by not selling any at the IPO.

Further, with an average of 11 years among non-insider sales companies the group has a highly significantly lower *Firm age* than the insider sales group with an average of 30 years. As shown by *High-rep*, within the insider sales group 87,1% of the firms hired prestigious underwriters with high-quality analysts compared to 12,3% in the non-insider sales group. This is highly significant and in line with Habib and Ljungqvist (2001) since selling owners are expected to hire high-rated underwriters. Additionally, within the insider sales group, 65,4% of the firms hired two or more underwriters to get more analyst coverage while for the non-insider group it is 9,0%. This difference is highly significant and emphasizes that when existing owners sell shares, they increase the number of analysts covering the firm. *VC*, *High-tech*, *Total assets* and, *Offer size* do not have a statistically significant difference in means between the groups.

Table 3: Differences in means

	No insider sales		Insider sales			
Variables	N	Mean	N	Mean	Difference	p-value
First day-return	309	0.041	139	0.136	-0.096	0.003***
SecFil	309	0.000	139	1	0	0.000***
VC	309	0.094	139	0.072	.022	0.448
Lock-up	309	192.514	139	151.792	40.723	0.018**
High-tech	309	0.279	139	0.252	0.026	0.559
Firm age	309	10.890	139	29.907	-19.017	0.000***
Total Assets	309	1160.056	139	2580.038	-1419.982	0.274
Offer Size	309	561.584	139	460.820	100.764	0.502
High-rep	309	0.123	139	0.871	-0.748	0.000***
Analyst coverage	309	0.090	139	0.654	-0.564	0.000***

The table displays univariate tests for the differences in means between IPOs containing secondary shares and IPOs only containing primary shares. The numbers of observations are 309 IPOs for only primary shares and 139 IPOs containing either a combination of primary- and secondary shares or only secondary shares.

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

7.2 Result from White tests

In Appendix 4, the results for the White tests are presented. Model 1, Model 4, and Model 6 are tested for if heteroskedasticity is present in the regressions. As can be observed by the p-value for Model 1, we fail to reject the null hypothesis which means that homoskedasticity is present in the model. Further, for Model 4 and Model 6, we also fail to reject the null hypothesis of homoscedasticity. This means that in all models, homoscedasticity is present and robust standard errors are not needed since the standard errors are valid.

7.3 Insider sales' effect on first-day return

Model 1 in Table 4 aims to test hypothesis H0a whether *Insider sales* has an effect on underpricing in IPOs. *Insider sales* has a positive effect on *First-day return* and it is significant at the five-percent level. This means that on average, if *Insider sales* increase by 10 percentage units, *First-day return* is expected to increase by approximately 1,3 percentage units, ceteris paribus. Hence, hypothesis H0a is rejected which further means that for an average firm going public, when more secondary shares are sold, it will lead to more underpricing. Regarding the control variables in Model 1, *VC* is statistically significant while the other control variables are not. *VC* has a negative significant effect on *First-day return* which means that if an IPO is VC-backed it is expected, on average, to have 11,3 percentage units lower underpricing compared to non VC-backed IPOs. The results for Model 2-3 are discussed in section 7.6 where the rest of the 2SLS results are presented.

Table 4: Regression results for Model 1-3

	Model 1 OLS	Model 2 First-stage	Model 3 2SLS
Dependent variable	First-day return	Insider sales	First-day return
Insider sales	0.126**		0.169**
	(0.056)		(0.071)
SecFil		0.605***	
		(0.025)	
VC	-0.113**	0.026	-0.115**
	(0.056)	(0.032)	(0.055)
Lock-up	0.000	-0.000	0.000*
	(0.000)	(0.000)	(0.000)
High-tech	-0.064	-0.021	-0.064*
	(0.040)	(0.023)	(0.039)
Firm age	-0.000	0.002***	-0.001
	(0.001)	(0.000)	(0.001)
Total Assets (Log)	0.003	0.004	0.000
	(0.009)	(0.005)	(0.009)
Offer size (Log)	0.011	0.001	0.011
	(0.008)	(0.005)	(0.008)
Constant	-0.174	-0.032	-0.307
	(0.348)	(0.199)	(0.227)
Industry controls	Yes	Yes	Yes
Years controls	Yes	Yes	Yes
R-squared	0.088	0.766	0.087
Observations	448	448	448

Table 4 displays Model 1-3 which are an OLS models, a First-stage least square model and a Two-stage least square model. For Model 1 the dependent variable is **First-day return.** For Model 2, the dependent variable is **Insider sales** and the independent variable is **SecFil**. Model 3 is a Two-stage least square model where the reported result for **Insider sales** is when the variable is substituted with the instrumental variable **SecFil**. The variables included in the table are (1) **First-day return** (first-day closing price - offer price/offer price) (2) **Insider sales** (secondary shares sold/total shares sold in IPO) (3) **SecFil** (dummy variable equal to 1 if secondary shares was initially filed in the prospectus, and 0 otherwise) (4) **VC** (dummy variable equal to 1 if the IPO is VC-backed, and 0 otherwise) (5) **Lock-up** (number of days incumbent shareholders are restricted from selling shares in the aftermarket) (6) **High-tech** (dummy variable equal to 1 if the company is in a high-tech industry, and 0 otherwise) (7) **Firm age** (year of the IPO minus the year the firm was founded) (8) **Total assets (Log)** (pre-IPO total assets in MSEK) (9) **Offer size (Log)** (Total amount of capital raised in IPO in MSEK).

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

7.4 The effect of quality

In Table 5, the results for Model 4 are presented which is used to test hypothesis H0b. The variables of interest here are *Insider sales, High-rep,* and more importantly the interaction term between the two. The interaction term is weakly statistically significant which means that we fail to reject hypothesis H0b since our threshold of hypothesis rejection is 5%. This means that we do not find evidence that prestigious underwriters with affiliated high-quality analysts have a moderating effect on the relationship between *Insider sales* and *First-day return*. In Model 5, the same model is regressed with a higher limit, 90th percentile instead of the 75th, for the *High-rep* variable as a robustness check. In this case the interaction term is insignificant.

Additionally, in Model 4, *Insider sales* has a positive statistically significant effect on *First-day return,* which is in line with the Model 1. Further, the variable *High-rep* also has a positive statistically significant effect on *First-day return.* This means that IPOs with prestigious underwriters with affiliated high-quality analysts has 12,3 percentage units higher underpricing, on average, compared to IPOs with less prestigious underwriters. However, in Model 5 *High-rep* is insignificant which indicates that the variable is sensitive to the choice of limit while *Insider sales* is weakly significant. Regarding the control variables in both Model 4 and Model 5, *VC* is significant and *Lock-up* is weakly significant while the rest of the variables are insignificant. *VC* has a negative effect on *First-day return* while *Lock-up* has a positive effect. The positive relationship between *Lock-up* and *First-day return* is interesting since previous literature suggests a negative correlation. However, the coefficient is close to zero which indicates that the variable does not have a major effect on the dependent variable.

7.5 The number of analysts

In Table 5, the results for Model 6 are presented which are used to test hypothesis H0c. In this model, *Insider sales*, *Analyst coverage* and the interaction term between the two variables are of interest. In Model 6, the interaction term between *Analyst coverage* and *Insider sales* has a negative statistically significant effect on *First-day return*. For an average IPO with a high number of analysts, by increasing *Insider sales* by 10 percentage units, *First-day return* is expected to be 1,8 percentage units lower compared to an IPO with low number of analysts, ceteris paribus. Hence, hypothesis H0c is rejected, and we find evidence for the number of analysts having a moderating effect on the relationship between *Insider sales* and *First-day return*. As a robustness check, Model 7 is the same model but with a higher limit, three or more

analysts, for the *Analyst coverage* variable. With a higher limit the interaction term is no longer statistically significant. This could be explained by the low number of IPOs with three or more underwriters as a proxy for a high number of analysts. There are 119 IPOs with two or more analysts while there are 48 IPOs with three or more analysts. This could imply a lower variance for the variable which impairs the possibility for precision in the parameter.

Additionally, in Model 6, *Insider sales* is statistically significant and have a positive effect on *First-day return*, in line with the other models. *Analyst coverage* has a positive highly significant effect on *First-day return*. This means that for an average firm, by having a high number of analysts covering an IPO, *First-day return* is expected to be 20,4 percentage units higher compared to an IPO with a low number of analysts, ceteris paribus. However, in Model 7 *Analyst Coverage* is insignificant and *Insider sales* is highly significant. Lastly, the control variables in Model 6 are similar in magnitude and have the same significance level as Model 4-5. In Model 7 the significance level for the control variables is the same as Model 4-6 except for *Lock-up* which is insignificant.

Table 5: Regression result for Model 4-7

Dependent variable	Model 4 OLS First-day return	Model 5 OLS First-day return	Model 6 OLS First-day return	Model 7 OLS First-day return
Insider sales	0.243**	0.154*	0.161**	0.149***
	(0.107)	(0.086)	(0.063)	(0.057)
VC	-0.116**	-0.120**	-0.115**	-0.118**
	(0.056)	(0.057)	(0.056)	(0.056)
Lock-up	0.000*	0.000*	0.000*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
High-tech	-0.064	-0.062	-0.059	-0.062
	(0.040)	(0.040)	(0.040)	(0.040)
Firm age	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Total assets (Log)	-0.008	-0.006	-0.007	0.003
	(0.011)	(0.011)	(0.010)	(0.010)
Offer size (Log)	0.011	0.010	0.009	0.010
	(0.008)	(0.008)	(0.008)	(0.008)
High-rep (1)	0.123**			
	(0.056)			
High-rep (1) X Insider sales	-0.208*			
	(0.123)			
High-rep (2)		0.097		
		(0.060)		
High-rep (2) X Insider sales		-0.089		
		(0.110)		
Analyst coverage (1)			0.204***	
			(0.066)	
Analyst coverage (1) X Insider sales			-0.176**	
			(0.079)	
Analyst coverage (2)				0.177
				(0.134)
Analyst coverage (2) X Insider sales				-0.233
				(0.142)
Constant	-0.250	-0.135	-0.137	-0.184
	(0.347)	(0.348)	(0.345)	(0.348)
Industry controls	Yes	Yes	Yes	Yes
Years controls	Yes	Yes	Yes	Yes
R-squared	0.101	0.094	0.109	0.095
Observations	448	448	448	448

Table 5 displays Model 4-7 which are four OLS models. For Model 4-7, the dependent variable is **First-day return** and the independent variable is **Insider sales**. Model 4 includes an interaction term between **Insider sales** and **High-rep (1)** while Model 5 includes an interaction term between **Insider sales** and **High-rep (2)**. Model 6 includes an interaction term between **Insider sales** and **Analyst coverage (1)** while Model 7 includes an interaction term between **Insider sales** and **Analyst coverage (2)**. The variables included in the table are (1) **First-day return** (first-day closing price - offer price/offer price) (2) **Insider sales** (secondary shares sold/total shares sold in IPO) (3) **VC** (dummy variable equal to 1 if the IPO is VC-backed, and 0 otherwise) (4) **Lock-up** (number of days incumbent shareholders are restricted from selling shares in the aftermarket) (5) **High-tech** (dummy variable equal to 1 if the company is in a high-tech industry, and 0 otherwise) (6) **Firm age** (year of the IPO minus the year the firm was founded) (7) **Total assets (Log)** (pre-IPO total assets in MSEK) (8) **Offer Size (Log)** (Total amount of capital raised in IPO in MSEK) (9) **High-rep (1)** (dummy variable equal to 1 if the underwriter is equal or higher than the 75th percentile, and 0 otherwise) (10) **High-rep (1) X Insider sales** (Interaction term between High-rep (1) and Insider sales) (11) **High-rep (2)** (dummy variable equal to 1 if the underwriter is equal or higher than the 90th percentile, and 0 otherwise) (12) **High-rep (2) X Insider sales** (Interaction term between High-rep (2) and Insider sales) (13) **Analyst coverage (1)** (dummy variable equal to 1 if the IPO has 2 or more underwriters, and 0 otherwise) (14) **Analyst coverage (1) X Insider sales** (Interaction term between Analyst coverage (1) and Insider sales) (15) **Analyst coverage (2)** (dummy variable equal to 1 if the IPO has 3 or more underwriters, and 0 otherwise) (16) **Analyst coverage (2) X Insider sales** (Interaction term between Analyst coverage (2) and Insider sales).

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

7.6 Instrumental variable approach

Model 2 in Table 4 is a first-stage least square model where *SecFil* is highly statistically significant with a F-test result of 569,56 which is above the limit of 10 for a strong instrument, as can be seen in Appendix 5. This indicates that *SecFil* is an adequate instrumental variable for *Insider sales.* Further, Model 3 is presented which is a two-stage least square model, where *Insider sales* is substituted with *SecFil*. The results show that if an average firm sells secondary shares, it will lead to more underpricing which is statistically significant. Hence, this is in line with the results in Model 1. Additionally, in Model 3, the control variable *High-tech* is now weakly statistically significant with a negative effect on *First-day return*. This is also the opposite direction anticipated with the arguments from prior literature. One potential explanation could be that Swedish technology companies are considered less risky compared to other countries and thus the anticipated relationship should be negative in the Swedish context. It is also only significant in one out of eleven models, indicating that there is no strong relationship with underpricing.

Model 8-11 are presented in Appendix 6 which are the same as Model 4-7 but with an instrumental variable approach using two-stage least square models. All of the F-tests for the first-stage for Model 8-11 are presented in Appendix 5 and are all above the critical limit of 10. When *Insider sales* is substituted with *SecFil*, the interaction terms for *High-rep* and *Analyst Coverage* still have the same effect on *First-day return*, and the coefficients are similar in magnitude. Furthermore, the interaction term between *Insider sales* and *Analyst coverage* in Model 10 is highly significant compared to Model 6 where it is significant at the 5% level. In summary, this shows that when taking the endogeneity problem regarding reverse causality into account, the results are robust, and we still fail to reject H0b and reject H0c.

8. Analysis

This chapter is divided into three parts where the first section analyzes insider sales effect on underpricing, section two evaluates the moderating effect of prestigious underwriters, and the last section focuses on the number of analysts.

8.1 Insider sales' effect on first-day return

As previously shown, insider sales has a positive effect on underpricing and is robust throughout all models. If the fraction of secondary shares is increased with 10 percentage units, underpricing is, on average, increased with 1,3-2,4 percentage units in the Swedish stock market. This is in contradiction to prior research finding negative or non-significant relationships (Habib & Ljungqvist, 2001; Ljungqvist & Wilhelm, 2003; Chua & Nasser, 2016; Kennedy, Sivakumar & Vetzal, 2006; Ang and Brau, 2003; Brau, Li & Shi, 2007). However, our finding could be explained by the arguments of information asymmetry (Akerlof, 1970; Rock, 1986). Insiders are typically a group who possesses more information about the company going public compared to less informed investors. Since incumbent shareholders have an information advantage and know more about the future for the company, the amount of secondary shares in the offer can be seen as a negative signal (Leland & Pyle, 1977; Ang & Brau; 2003; Chua & Nasser, 2016). Outside investors could interpret this signal as the selling owners with more information do not believe in the future of the company. Therefore, a higher fraction of insider selling could explain the positive effect on underpricing, since in order to attract less informed investors they need to be compensated for the increased uncertainty with more underpricing. Without this compensation uninformed individuals will not participate in the IPO in line with the winner's curse hypothesis (Ritter, 1998).

Our results could also be motivated by an agency dilemma between selling owners who sell a significant part of their shares and new investors. Old shareholders are the agent, and the new shareholders are the principal and since pre-IPO shareholders decrease their equity stake there is less alignment of interest between these two groups. Due to this, old shareholders could increase their risk-taking after the IPO since they have less equity at stake, creating a moral hazard issue where new shareholders bear the expenses. In these situations, with a higher risk for opportunistic behavior, investors in IPOs will not purchase shares without a discount which in turn creates a positive first-day return.

The positive relationship between insider sales and underpricing in the results of this thesis could also be explained with the arguments from the bandwagon hypothesis (Ritter, 1998). When insiders sell shares, they could at their own expense underprice the offer to create a bandwagon effect. A sense of FOMO is needed to mitigate the negative signal of selling owners which can be achieved by offering shares at a discount, creating more underpricing. Another reason for the positive relationship in the results could be impactful owners in Sweden. As mentioned before, Sweden is one of the most successful entrepreneurial countries in the world with the second highest unicorns per capita where one driving factor is the important owners. Our results indicate that selling owners are not effective in decreasing information asymmetry by voluntarily disclosing more information to mitigate the negative signal associated with insider sales. This means that we cannot find support for the entrepreneurial losses model (Habib & Ljungqvist, 2001; Kennedy, Sivakumar & Vetzal, 2006) as well as the concept of signaling to mitigate information asymmetry by increasing the amount of information available (Spence, 1978). The negative signal associated with selling owners in the Swedish context could be so strong that even an increase in information is not able to decrease the uncertainty and thus underpricing.

In summary, different factors such as information asymmetry, the negative signal associated with selling owners and impactful Swedish owners could all be used to explain why we in the Swedish setting find evidence that insider sales has a positive effect on underpricing.

8.2 The effect of quality

As previously stated, we do not find support for prestigious underwriters with affiliated high-quality analysts having a moderating effect on the relationship between insider sales and underpricing in Sweden. This means that selling owners do not succeed in certifying the IPO, decrease information asymmetry and thus underpricing, by hiring prestigious underwriters. Hence, we do not find support for the entrepreneurial losses model in the Swedish context and prestigious underwriters do not allow insiders to maximize their personal wealth. Therefore, the quality of the analyst coverage does not have an important role for insider sales' effect on underpricing. Our results suggest that, even in the Swedish setting with both biased and unbiased reporting as well as analysts being able to produce biased recommendations on IPOs, the quality of the analysts do not affect the relationship between insider sales and underpricing.

As can be seen by the *High-rep* variable in Model 4, prestigious underwriters with affiliated high-quality analysts, per se, in the Swedish stock market leave more money on the table compared to low quality investment banks. Thus, we find support for the analyst lust hypothesis which means that high-quality analysts affiliated with top-tier underwriters leads to more underpricing (Loughran & Ritter, 2004). Without a quiet period in Sweden, the demand for biased high-quality analysts could be so strong that issuers are willing to accept some underpricing in order to get favorable high-quality analyst coverage during the IPO process to increase the demand. More underpricing associated with prestigious underwriters could be explained by the fact that these investment banks want to favor buy-side clients. Offering shares at a discount could benefit themselves with long term customer relationships, supported by the investment banker monopsony hypothesis (Ritter, 1998; Ljungqvist, 2007). Our results highlight the agency-principal dilemma between underwriters and issuers where the underwriter must account for both the interest of the issuing firm and investors. Issuers want minimal underpricing whereas investors want maximal underpricing, which is visible in our results where issuers bear this cost in favor for investors.

To summarize, even though prestigious underwriters with affiliated high-quality analysts, per se, have a positive effect on underpricing in Sweden, they cannot mitigate the negative signal associated with selling owners. Since the IPO market is smaller in Sweden compared to the U.S. and thus allowing analysts to have a longer reach with their publications and recommendations, it is instead the number of analysts that has an effect on the relationship between insider sales and underpricing in Swedish IPOs, which will be further discussed.

8.3 The number of analysts

Our results in Model 6 show that a high number of analysts has a moderating effect on the relationship between insider sales and underpricing. If the analyst coverage is high around a certain IPO, insiders are allowed to sell 10 percentage units more secondary shares with, on average, 1,8 percentage units lower underpricing compared to an IPO with a low number of analysts. This means that in the Swedish context without a quiet period, selling owners could be able to benefit from biased analyst reporting during the IPO process. Since a high number of analysts combined with insider sales have a negative effect on underpricing compared to having a low number of analysts, it is possible that selling owners hire a syndicate of underwriters to allow for more analyst coverage to decrease underpricing. Due to the fact that analysts are allowed to write publications during the IPO process in Sweden, insiders could

hire more analysts and demand optimistic forecasts and recommendations which leads to less information asymmetry. This will not only benefit selling owners since optimistic forecasts by analysts decrease the possibility of them getting fired, in line with Hong and Kubik (2003). This in turn would allow insiders to sell secondary shares at a higher offer price which decreases underpricing.

The number of analysts, per se, covering an IPO has a positive effect on underpricing in the Swedish stock market. An IPO with a high number of analysts is expected to have 20,4 percentage units higher underpricing compared to an IPO with a low number of analysts. This finding is in line with the arguments of Loughran and Ritter (2004) and we thus find support for the analyst lust hypothesis with a different interpretation that the actual number of analysts has an effect on underpricing in a positive direction. The increase in first-day return, or underpricing, with more analyst coverage can be an effect of the excitement around the IPO, creating a fear of missing out if the publications from analysts are bullish. However, it could also be seen as a negative effect due to the biased and unbiased analyst setting in Sweden. If underpricing is higher with more analyst coverage it could be interpreted as the uncertainty is higher at the time of the IPO because of a lot of noise from both biased analysts affiliated with the IPO and unbiased analysts without any connections to the public offering. Thus, investors demand more underpricing when the noise from both biased and unbiased analysts are higher.

In summary, the number of analysts has a positive effect on underpricing that could be explained with absence of a quiet period creating noise. However, when the partial effect is evaluated, we find the opposite direction and underpricing instead decreases. This means that selling owners, with incentives to decrease underpricing, can use more analyst coverage during the IPO process to decrease information asymmetry and thus the compensation needed for the negative signal. This means that we find evidence for selling owners exploiting the absence of a quiet period to benefit themselves and maximize personal wealth.

9. Conclusion

How the negative signal of selling secondary shares is perceived and how it plays out during the first day of trading is dependent on the interaction between selling owners and investors entering a company. In Sweden, due to the absence of a quiet period, this interaction differs from the U.S. This stresses the importance of finding out if this negative signal affects underpricing and how it can be mitigated through underwriters and analyst coverage. Hence, this study investigates if there is a relationship between insider sales and underpricing as well as if prestigious underwriters with high-quality analysts and the number of analysts have an effect on this relationship. The sample contains 448 IPOs on the Swedish stock market between 2010-2022 and includes all the IPOs in Sweden during these years except for excluded observations in line with prior studies. In order to test the hypotheses, we have used OLS regressions combined with 2SLS models to account for endogeneity problems. We find evidence for insider sales having a statistically significant positive effect on first-day return explained by information asymmetry, signaling and impactful Swedish owners. This finding is in contradiction to the vast majority of prior research which indicates that there is a negative signal associated with insider sales which is compensated for by increased underpricing. Moreover, this study do not find evidence for that prestigious underwriters with affiliated high-quality analysts have a moderating effect on insider sales' effect on first-day return. Hence, the quality of the bank and analysts cannot mitigate the negative signal of insider sales. However, we find evidence that the number of analysts has a moderating effect on the relationship between insider sales and first-day return. This finding emphasizes the unique setting in the Swedish market where the absence of a quiet period enables selling owners to hire more analysts in order to mitigate the negative signal and affect investors by using biased analyst reporting.

This research and its findings could be insightful for both selling owners as well as investors investing in IPOs. By taking these findings into account, selling owners could form a strategy on how to use analyst coverage to minimize underpricing and maximize personal wealth. At the same time, investors could use this information to detect underpriced IPOs through the fraction of secondary shares filed. These findings also provide stakeholders with specific information about the Swedish market due to both the size of the market and the absence of a quiet period. However, the conclusions could also be applicable to other European countries without a quiet period.

There are limitations with this thesis which are connected to the measurement of insider sales and a small sample size. Firstly, the conclusions about insider sales' effect on underpricing are based on the fact that all types of selling owners are seen as a homogeneous group. We control for if secondary shares are sold but not how various types of selling owners could have different effects on underpricing. Secondly, due to the Swedish IPO market being small in comparison to the U.S, the sample in this thesis is smaller than prior literature which could decrease the precision of the results.

In order to further investigate how the negative signal of insider sales is perceived by investors, it would be interesting if future research would separate different types of selling owners. In small markets without a quiet period, the signal from various selling owners could potentially be perceived differently depending on the type of owner. Additionally, this could also lead to other conclusions about how to best mitigate this negative signal. Another aspect to consider could be to control for media coverage of an IPO. Media's effect on how insider sales affect underpricing could bring more knowledge to selling owners on how to minimize underpricing through different kinds of information channels. Lastly, it would be valuable to perform similar studies on other markets without a quiet period to find out if analyst coverage has the same important role as in Sweden.

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Appendices

Appendix 1: Industry classification by SIC-codes

SIC Code Industry	SIC Codes, Groups	Number of firms
Agriculture, Forestry, And Fishing	01-09	1
Mining	10-14	4
Construction	15-17	22
Manufacturing	20-39	148
Transportation & public utilities	40-49	26
Wholesale trade	50-51	154
Retail trade	52-59	9
Finance, Insurance, Real estate	60-67	27
Services	70-89	55
Public Administration	91-99	2

Appendix 2: Variable definition

Variable	Description	Source
First-day return (%)	The return of a company's first day of trading. Calculated as: (first day closing price - offer price) / offer price	Bloomberg
Insider sales (%)	Secondary shares sold/Total shares offered in IPO	Bloomberg
SecFil (1/0)	A dummy variable, equal to 1 if secondary shares was filed in the prospectus and 0 otherwise	Prospectus
Lock-up (days)	Number of days incumbent shareholders are restricted from selling shares in the aftermarket	Bloomberg
VC (1/0)	A dummy variable, equal to 1 if the IPO is VC-backed and 0 otherwise	Bloomberg
Firm age (years)	Year of the IPO minus year founded	Company website; Bloomberg
High-tech (1/0)	A dummy variable, equal to 1 if the company is in a high-tech industry and 0 otherwise	Bloomberg
Total assets (MSEK)	Pre-IPO total assets	Capital IQ
Offer size (MSEK)	Total amount of capital raised in the IPO	Bloomberg
High-rep (1/0)	A dummy variable, equal to 1 if the underwriter is equal or higher than the 75th percentile and 0 otherwise	Bloomberg; Prospectus
Analyst coverage	A dummy variable, equal to 1 if the IPO has 2 or more underwriters and 0 otherwise	Bloomberg; Prospectus

Appendix 3: Top 50 underwriters in Sweden between 2010-01-01 to 2022-12-31

Rank	Underwriter	Market Share (%)
1	Carnegie	18,27%
2	SEB	14,13%
3	Nordea	8,98%
4	ABG Sundal Collier Asa	8,19%
5	Morgan Stanley	6,17%
6	Danske Bank	4,82%
7	JP Morgan	4,33%
8	Goldman Sachs	3,86%
9	Svenska Handelsbanken	3,50%
10	DNB ASA	2,86%
11	Swedbank	2,81%
12	Pareto Securities	2,65%
13	Citi	2,34%
14	BNP Paribas	2,29%
15	Jefferies	2,25%
16	UBS	1,76%
17	Barclays	1,53%
18	HSBC	1,01%
19	Avanza AB	1,00%
20	Deutsche Bank	0,99%
21	Joh Berenberg Gossler & Co KG	0,98%
22	BofA Securities	0,58%
23	RBC Capital Markets	0,49%
24	Credit Suisse	0,49%
25	Piper Sandler & Co	0,49%
26	SVB Financial Group	0,36%
27	Sparbank Sverige AB	0,25%
28	Stifel	0,23%
29	Drexel Hamilton LLC	0,15%
30	I-Bankers Securities Inc	0,15%
31	Eminova Fondkommission AB	0,15%
32	Numis	0,14%
33	Redeye AB	0,13%
34	Erik Penser Bankaktiebolag	0,12%
35	Vator Securities AB	0,12%
36	Naventus Corporate Finance AB	0,11%
37	CITIC Securities	0,11%
38	G&W Kapitalforvaltning AB	0,11%
39	Sedermera Fondkommission AB	0,11%
40	Partner Fondkommission AB	0,11%
41	Mangold AB	0,09%
42	Bryan Garnier & Company Ltd	0,09%
43	SpareBank 1 SMN	0,08%
44	Vastra Hamnen Fondkommission AB	0,08%
45	Catella AB	0,07%
46	Vator Holding AB	0,06%
47	FNCA Sweden AB	0,04%
48	Augment Partners AB	0,04%
49	Nordnet AB	0,04%
50	SpareBank 1 Markets AS	0,04%
51-65	The rest of banks	0,22%

Appendix 4: White test

White test	H0	Chi2	P-value	Decision	Heteroskedasticity?
Model 1 -Stata test (Chi-Squared)	Homoskedasticity	166.850	0.973	Fail to reject	No
Model 4 -Stata test (Chi-Squared)	Homoskedasticity	200.090	0.977	Fail to reject	No
Model 6 -Stata test (Chi-Squared)	Homoskedasticity	184.310	0.999	Fail to reject	No

Appendix 5: Strength of instrument

First-stage summary statistics	R-squared	Adj. R-squared	Partial R-squared	F(1,419)	Prob > F
Model 2	0.766	0.751	0.576	569.557	0.000
Model 8	0.767	0.750	0.307	184.582	0.000
Model 9	0.767	0.750	0.390	266.928	0.000
Model 10	0.769	0.752	0.449	339.702	0.000
Model 11	0.767	0.750	0.553	515.187	0.000

Appendix 6: Model 8-11

Dependent variable	Model 8 2SLS First-day return	Model 9 2SLS First-day return	Model 10 2SLS First-day return	Model 11 2SLS First-day return
Insider sales	0.284**	0.237**	0.268***	0.208***
	(0.124)	(0.103)	(0.091)	(0.074)
VC	-0.128**	-0.127**	-0.115**	-0.121**
	(0.055)	(0.055)	(0.054)	(0.055)
Lock-up	0.000*	0.000*	0.000*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
High-tech	-0.055	-0.058	-0.061	-0.062
	(0.039)	(0.039)	(0.038)	(0.038)
Age	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Total assets (Log)	-0.010	-0.009	-0.011	-0.001
	(0.011)	(0.011)	(0.010)	(0.010)
Offer size (Log)	0.011	0.010	0.010	0.010
	(0.008)	(0.008)	(0.008)	(0.008)
High-rep (1)	0.145**			
	(0.063)			
High-rep (1) X Insider sales	-0.172*			
	(0.094)			
High-rep (2)		0.141**		
		(0.070)		
High-rep (2) X Insider sales		-0.146		
		(0.091)		
Analyst coverage (1)			0.222***	
			(0.065)	
Analyst coverage (1) X Insider sales			-0.236***	
			(0.085)	
Analyst coverage (2)				0.202
				(0.131)
Analyst coverage (2) X Insider sales				-0.267*
				(0.140)
Constant	-0.287	-0.287	-0.273	-0.306
	(0.228)	(0.228)	(0.226)	(0.228)
Industry controls	Yes	Yes	Yes	Yes
Years controls	Yes	Yes	Yes	Yes
R-squared	0.088	0.090	0.103	0.092
Observations	448	448	448	448

Appendix 6 displays Model 8-11 which are four 2SLS models. For Model 8-11, the dependent variable is **First-day return** and the results reported for **Insider sales** is with the usage of the instrument variable **SecFil**. Model 4 includes an interaction term between **Insider sales** and **High-rep (1)** while Model 5 includes an interaction term between **Insider sales** and **High-rep (2)**. Model 6 includes an interaction term between **Insider sales** and **Analyst coverage (1)** while Model 7 includes an interaction term between **Insider sales** and **Analyst coverage (2)**. The variables included are: (1) **First-day return** (first-day closing price - offer price/offer price) (2) **Insider sales** (secondary shares sold/total shares sold in IPO) (3) **VC** (dummy variable equal to 1 if the IPO is VC-backed, and 0 otherwise) (4) **Lock-up** (number of days incumbent shareholders are restricted from selling shares in the aftermarket) (5) **High-tech** (dummy variable equal to 1 if the company is in a high-tech industry, and 0 otherwise) (6) **Firm age** (year of the IPO minus the year the firm was founded) (7) **(Log) Total assets** (pre-IPO total assets in MSEK) (8) **Offer Size (Log)** (Total amount of capital raised in IPO in MSEK) (9) **High-rep (1)** (dummy variable equal to 1 if the underwriter is equal or higher than the 75th percentile, and 0 otherwise) (10) **High-rep (1) X Insider sales** (Interaction term between High-rep (1) and Insider sales) (11) **High-rep (2)** (dummy variable equal to 1 if the underwriter is equal or higher than the 90th percentile, and 0 otherwise) (12) **High-rep (2) X Insider sales** (Interaction term between High-rep (2) and Insider sales) (13) **Analyst coverage (1)** (dummy variable equal to 1 if the IPO has 2 or more underwriters, and 0 otherwise) (14) **Analyst coverage (1) X Insider sales** (Interaction term between Analyst coverage (1) and Insider sales) (15) **Analyst coverage (2)** (dummy variable equal to 1 if the IPO has 3 or more underwriters, and 0 otherwise) (16) **Analyst coverage (2) X Insider sales** (Interaction term between Analyst coverage (2) and Insider sales).

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