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IS THE DESIRE OF FUTURE M&A INVOLVEMENT PRICED IN A FIRM ITS IPO?

Name student: J.E. Verkaart

Student ID number: 410837

Supervisor: A. Yang

Second Assessor: N.L. van der Sar

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ABSTRACT

This paper applies the ex-ante valuation uncertainty theory to investigate whether post-IPO M&A activity could be a factor of uncertainty that can explain deviations in IPO underpricing. Consistent with previous IPO literature, I document that a substantial number of IPO firms engage in subsequent company transactions on the buy or sell side. In my observations, acquirers have on average higher underpricing than non-acquiring companies. Including multiple factors in a regression model provides a different perspective on the level of underpricing in my observations. The multivariate results suggests that the first-day returns is only significantly influenced by the acquisition characteristic for firms that acquire within one year after their IPO. Firms that belong in other categories of M&A activity do not indicate to affect the level of underpricing. An inversed relationship between IPO underpricing and subsequent M&A activity described in previous literature provides only little explanation for the insignificant regression coefficients.

Keywords: Initial public offering, underpricing, valuation uncertainty, merger and acquisition activity

Table of Contents

1. Introduction

In the period between 2003 and 2016, the United States (US) had 1,594 Initial Public Offerings (IPOs) which approximately left 51 billion US dollars of proceeds on table due to underpricing (Ritter, 2019). Underpricing is the difference between the offer price and the share price of the firm at the end of the first trading day. This means that initial shareholders and firms could have received an exceptionally higher amount of money through the firms' IPO if they had set a higher offer price than they currently did. While this observation may look like an anomaly in the market of IPOs due to its inefficiency, issuers have missed out on huge amounts of money prior to this period as well (Ritter, 2019).

In the current literature of IPO underpricing, there are four main theories that explain high first-day return observations: ownership and control, institutional explanations, behavioural factors and information asymmetry (Ljungqvist, 2007). Within these theoretical mainframes, there is an abundance of papers focussing on particular aspects that could influence underpricing. Examples of prior papers include Lowry and Shu (2002) who focus on potential litigation risks as an institutional explanation and Hoberg (2007) who concentrate on the influence of the underwriter in the IPO process as part of the theoretical body of information asymmetry. In this paper, I investigate the potential impact of future M&A activity on first-day returns, which is a relatively unexplored topic in the frame of information asymmetry in prior literature.

The desire to acquire other firms is for many firms a reason to go public through an IPO. Brau and Fawcett (2006) show this with a survey as chief financial officers (CFOs) identify the facilitation of financial sources to acquire other companies as the major objective of an IPO. This motivation for an IPO is also supported by the statistics of Celikyurt, Sevilir and Shivdasani (2010), who reveal that 72% of the firms acquire other companies within three years after being public. In addition, firms are also more often acquired after their IPO. Gao, Ritter and Zhu (2013) observe that 11% of the IPO firms get acquired within three years of the IPO.

The central idea in this paper is that M&A activity has an impact on the level of ex-ante valuation uncertainty in an IPO. Ex-ante valuation uncertainty is the doubt that investors possess concerning the true valuation of the firm before the IPO date. This uncertainty is driven by a gap of information and is often referred to as information asymmetry between the investor and the firm. In general, investors lack detailed knowledge on the future M&A plans of a firm. Yet, an acquisition or a takeover shortly after the IPO can have a major effect on the valuation of the firm. This makes it difficult for investors to accurately estimate the value of the firm, if investors expect that the firm will be involved in M&A activity.

Linked to this problem, Beatty and Ritter (1986) argue that ex-ante valuation uncertainty is positively related to the level of underpricing. That is, if investors are less certain about the correctness of their valuation of the company due to a lack of information provided by the company, then they

demand a buffer in the form of underpricing to prevent potential losses. If this is applicable, then it should hold that an IPO firm experiences more underpricing when investors have reason to think that the firm is more likely to commit acquisition activity after their IPO. With this idea in mind, I devote this paper to answer the following research question:

> *To what extent is post-IPO M&A activity capitalized in the level of IPO underpricing in the US IPO market?*

I analyse IPO underpricing data from 1,016 firms in the period between 2003 and 2016. Firms experience in this period on average 16.6% underpricing, whereas especially in the years 2012 to 2015 a high level of underpricing is observable. Also, approximately 75% of the IPO firms experience non-negative underpricing returns in the period of interest. Apart from IPO data, I examine subsequent M&A activity data. In a consecutive period of up to three years after their IPO, 412 firms completed at least one acquisition and 128 firms were sold. From this M&A activity, the highest recorded monthly number of acquisitions occur after only 6 months of being public, while most firms are sold in the third year after their IPO.

I classify M&A activity for firms as either being on the buying side or on the selling side of a firm transaction. Initially, I focus on the group of acquirers as post-IPO acquisitions occur more frequently than selling a controlling interest stake after the IPO. Also, more elaboration about the group of acquirers is possible. Within the acquirer group, I examine whether different implications regarding underpricing occur when considering the duration before the first acquisition is completed and the number of acquisitions a firm completes. For the post-IPO target group, there is a lower fundament to explore the effect of duration as the lock-up period regulates the beginning period after an IPO. In addition, target frequency is not applicable to test as the initial shareholders can sell the controlling interest only once.

Another variable that gains attention in this paper and is closely related to the post-IPO M&A activity is the documentation in the prospectus of the intention to use the proceeds of an IPO on future acquisitions. In the use of proceed section, firms provide details about how the firm intends to use the funds that will be obtained in their IPO. As such, IPO firms can express their desire to acquire other firms in the near future to investors.

I conduct several tests to generate insight into the impact of post-IPO M&A activity on underpricing. At the start of these tests lays the intuition whether underpricing is on average different between the different groups of firms that commit subsequent M&A activity. Afterwards, I test whether the M&A activity can explain variation in the observed levels of underpricing when controlling for other factors. An extension to this test is that I explore whether a potential endogeneity concern may affect findings in the test results.

The results in this paper show that post-IPO acquirers tend to have higher underpricing than firms that do no acquire other firms after their IPO. Nonetheless, this higher underpricing is not caused by the acquisition characteristic. Concerning the different classes of acquirers, I observe approximately no difference in terms of average underpricing based on duration or frequency. This is also applicable for targets compared to non-targets. An interesting result in this paper is that the acquirer characteristic significantly explains variation in the level of underpricing for firms that make an acquisition within one year of being public. The direction of this variation is depending on the inclusion of future acquisitions in the prospectus. This finding shows that there is evidence to suggest the existence of a relationship between post-IPO M&A activity and underpricing for at least this type of acquirer.

This paper is an addition to other similar works that investigate the relation between future M&A activity and IPO underpricing. In related literature, Bessler and Zimmermann (2011) examine with European data how firm performance varies among IPO firms that are involved in M&A activity. One of their findings is that acquirers have on average higher underpricing compared to other IPO firms. My paper complements their paper by using a different regional location, which allows me to investigate the relation under a different legal system with stronger investor protection. In addition, I include tests to investigate the influence of acquisition duration and I adress with the potential concern of endogeneity, whereas they do not. Through testing for endogeneity, this paper also relates to works that test for the reversed relationship between future M&A activity and IPO underpricing as proposed in this paper. Works that assumes this causality in their tests include Arikan and Stulz (2016), Celikyurt et al. (2010) and Hovakimian and Hutton (2010).

The findings in this paper contribute to the understanding of IPO underpricing through exploring the relatively unresearched effect of future M&A activity. Whereas in previous literature it is recognized that IPOs facilitate more future M&A activity, the relation towards IPO underpricing of this occurrence is barely examined. I build this bridge by arguing that post-IPO M&A activity influence the ex-ante valuation uncertainty among investors and hence extend the applications of this theory. The results in my paper offer a fundament on the area of IPO underpricing as there is an indication of the existence of a relation with short-term acquirers in the expected direction of the ex-ante uncertainty theory. Further research can elaborate on my findings with the aim of finding an additional explanatory factor that can help understand the puzzling phenomenon of underpricing.

The organization of the remaining sections of this paper is as follows. Section 2 examines the outcomes of previous literature regarding M&A based IPO motives and subsequent IPO underpricing. Based on this information, I formulate hypotheses for relationships between the different M&A variables and the level of underpricing. In section 3, I explain the data collection process and afterwards I discuss the methodology for the variable selection and empirical tests in section 4. In section 5, I show

the test results and subsequently discuss them. At the end of the section I include a discussion concerning the robustness of my test findings. Lastly, I provide concluding remarks in section 6. In that section I conclude the findings of this research and make suggestions of how further research can extend this paper.

2. Literature Review

In 2018, 134 IPOs were executed in the US (Ritter, 2019). This number represents only a tiny fraction of the millions of firms that are active in the US (United States Census Bureau, 2018). However, the decision to go public is for most companies one of the most important decisions in their corporate life. Not only is the decision to go public going to create a wide dispersity of ownership within the firm, it also brings along substantial costs to the existing shareholders. Ritter (1987), Chen and Ritter (2000) and Abrahamson, Jenkinson, and Jones (2011) document that the prevalent costs to underwriter in US IPOs amount to 7% of the proceeds to become listed. Including the indirect costs of underpricing and other costs related to meeting transparency standards of public firms (Ljungqvist, 2007), the benefits associated with such offerings should be substantial to outweigh these costs.

Brau (2012) lists twelve theories that could motivate a private entrepreneur to desire an IPO. Two of those theories relate to the role of facilitating future M&A activity. This motive is a key element in this research and is therefore the solely discussed motive in this paper. In section 2.1, I explore through prior findings from other papers the benefits of an IPO regarding future acquisitions. In section 2.2, I draw a connection between IPO underpricing and the desire to participate in M&A activity. In section 2.3, I briefly summarize the arguments of section 2.2 and state my hypotheses afterwards.

2.1 IPO Motive: Future M&A Activity

2.1.1 Post-IPO Acquirer

In the research of Celikyurt, Sevilir and Shivdasani (2010), it becomes clear that post-IPO firms have an appetite to acquire other firms. 72% of the firms in their sample make at least one acquisition in the subsequent three years after the IPO date. Interested by this finding, Maksimovic, Philipps and Yang (2013) and Gao, Ritter and Zhu (2013) compare the acquisition activity between public and private firms and conclude that public firms complete more often acquisitions. In addition, Brau and Fawcett (2006) discover that facilitating financial resources to make company acquisitions belong to the top motives of firms to become public through an IPO. These observations suggest that an IPO contributes in a positive way to the ability of firms to complete an acquisition.

Pagano, Panetta, and Zingales (1998) argue that the biggest benefit for firms to go public is creating access to a source of finance other than venture capital or banks. That is, public companies have the opportunity to utilize public markets for funds when sources of financing are required for investment projects. One way in which an IPO can provide a firm with a capital infusion is through the

offering of primary shares (Celikyurt et al., 2010). If a company offers only secondary shares during an IPO, the company does not receive any additional cash that can be used for M&A activity. In such share offering, there is only a partial transfer of ownership between the pre-IPO owners and the new shareholders. Nevertheless, the IPO firm could still benefit from having additional acquisition funds available as it can use stocks of the company as acquisition currency. An advantage of using stocks in this manner is that an acquirer can effectively reduce acquisition costs by timing the market. In such occasion, the firm can use them directly as a method of payment when they are overvalued, which results in a lower payment for the target (Hovakimian & Hutton, 2010). The findings of Rhodes–Kropf, Robinson and Viswanathan (2005) support this motivation as they observe that firms which exhibit higher positive misvaluation acquire relatively less overvalued firms and do so predominantly using stocks as transaction payment. Moreover, even if a firm offers only secondary shares in its IPO, being public creates the opportunity for firms to obtain cash funds through seasoned equity offerings at a later point in time. The last factor that increases the acquisition funds of IPO firms is the argument that firms have a higher bargaining power towards banks. As a result, they are likely to have lower cost of credit and have a larger borrowing capacity for cash-based acquisitions (Pagano et al.,1998). Thus, an IPO establishes a source of liquidity that can be used to finance cash and stock-based acquisitions.

Another advantage that IPO firms have in the acquisition process, relative to private firms, is the reduction in valuation uncertainty. Hsieh, Lyanders and Zhdanov (2011) develop a model that links the decision of a firm to go public with their acquisition strategy based on this uncertainty. They argue that a private firm is unable to make optimal takeover decisions if it does not know the precise value of its assets. When investors initiate an IPO, the firm gains knowledge about their valuation as a feedback mechanism of the capital market. Not only will this reduce the valuation uncertainty of the IPO firm, but it also allows a potential target or bidder to observe the true valuation[1] of the firm. As a result, firms can optimally exercise potential restructuring options leading to value-maximizing transactions. Therefore, the feedback mechanism of the capital market helps public firms to engage in more M&A activity, whereas private firms cannot benefit from this feedback mechanism.

2.1.2 Post-IPO Target

Going public through an IPO can also have an advantage for firms that are planning to sell the firm. Pagano et al. (1998) find in their research that 14 percent of their Italian[2] IPO sample sells the

[1] The model is based on the assumptions of rational investors and efficient markets. These assumptions might be too strong given famous behavioural finance papers like Barberis and Thaler (2003) and Lamont and Thaler (2003). However, the implications can still be very useful as people use reference points as a rule of thumb in valuation processes (Baker, Pan, & Wurgler, 2012).

[2] Pagano et al. (1998) chose to study Italian firms as data to implement their approach was generally not easily available in that time. Yet, they were able to get access to a unique dataset containing information about both privately and publicly held Italian firms.

controlling stake of the firm within three years after the IPO date. Furthermore, they reject the hypothesis that private firms have the same level of control block transfers as recent IPO firms at the 1 percent level of significance. This finding is similarly observable in US data. Gao et al. (2013) observe that 11% of the IPO firms get acquired within three years of the IPO, which is significantly higher than its private peer group.

Zingales (1995) describes that if initial owners of private firms have the intention to divest their company, then they can profit from selling the controlling stake of the firm after an IPO. He argues that by doing this, the initial owners can potentially maximize the proceeds of the sale of their company. The intuition of this theory relies on the argument that the market for cash flow rights and control rights is very different in nature. Whereas the market for cash flow right is fully competitive, the market for control rights is not. As such, the initial owner will not be able to extract the full benefits of cash flow rights through direct negotiations over the private firm. Therefore, Zingales (1995) argues that the two value components are best sold through different mechanisms. The cash flow rights should be offered to dispersed shareholders in an IPO and benefits of control should be sold through direct negotiation. The results of Brau, Francis and Kohers (2003) give partial support to this theory. They find that insiders who sell shares in an IPO tend to receive a 22% higher takeover premium in comparison to direct negation takeover premiums.

2.2 IPO Underpricing

Since the 1980s, Ritter (2019) shows that the US IPO market has seen underpricing discounts of on average 18%, fluctuating substantially in different time cohorts. Ljungqvist (2007) and Loughran and Ritter (2004) indicate that the level of underpricing is time dependent. An observation that seems important for the current time frame is the need of firms to grow fast in order to establish economies of scale or scope (Gao et al., 2013). This urgency is motivated by the idea that larger firms are better to seize profitable growth opportunities, which are established by the relatively high speed of the current technological innovation. A method to grow fast is through acquiring other firms. As completing an IPO provides benefits regarding the desire to acquire other firms, it becomes possible that future M&A activity is a modern time-dependent factor that can partially explain underpricing.

Within this paper, the predominant argument for the relation between post-IPO M&A activity and underpricing is that the former causes through ex-ante valuation uncertainty the latter. Ex-ante valuation uncertainty refers to the situation that an investor cannot be certain when placing a purchase order for a stock whether it will increase or decrease in price once the stock starts trading. Beatty and Ritter (1986) explain that investors demand a compensation in offerings with greater uncertainty, which implies that ex-ante valuation uncertainty is positively related to the level of underpricing in a firm.

An important aspect in the relation of interest is that M&A activity occurs after the IPO, while underpricing is observed at the first day of trading publicly. Therefore, the relationship can only exist if during the IPO process there are M&A plans for when the firm is public. I infer that underpricing can then be a result of intentional underpricing, through investors being better able to predict the likelihood of the IPO firm getting involved in M&A activity or through a combination of the two. For the first claim, Brau and Fawcett (2006) show in their survey research that CFOs accept underpricing when conducting an IPO with one of the most opted arguments being a lack of perfect information for the investors. That could imply that firms intentionally set a lower offer price to compensate investors for the information asymmetry between them concerning future M&A plans. For the second assertion, a manner that increases this predictability is by mentioning future acquisitions in the IPO prospectus. In general, this would increase the probability of occurrence, which subsequently makes the impact of future acquisition activity more prevalent in valuation metrices. In such a scenario, information regarding the potential targets allows investors to better incorporate future acquisitions in valuation metrics with as probable result that valuation estimates become more accurate. Hence, information provision is negatively related to the ex-ante valuation uncertainty.

In both mechanisms, the information level of M&A activity plays an essential part in the relationship with underpricing. In the next subsections, I elaborate on how underpricing is affected by the different categories of post-IPO M&A activity, whereas I focus on factors that cause dissimilarities in the information provision.

2.2.1 Post-IPO Acquirer

In the situation of post-IPO acquirers, investors can face more ex-ante valuation uncertainty as firms tend to be cautious in disclosing detailed information regarding future acquisition plans. In the process of an IPO, firms have the opportunity to inform investors about any plan through their prospectus[3]. However, a limitation of sharing information in this manner is that competitors also have access to this source. As a consequence, providing extensive information about a future acquisition could attract other potential buyers, which jeopardises a potential transaction. Beatty and Ritter (1986) partly confirm this argumentation as they find that firms are reluctant to indicate highly specific information about what firms intend to do with the proceeds to avoid disclosure of proprietary information to competitors. Therefore, if a firm has the intention to act upon future acquisition plans after their IPO, it is less likely that information regarding these plans is disclosed with much detail.

Furthermore, acquisitions on itself poses valuation uncertainty for the acquirer. In terms of stock returns at the announcement of a potential acquisition completion, almost half of them show

[3] Ljungqvist (2007) argues that the absence of rules concerning what information to disclose in the prospectus makes it unclear whether differences reflect different applicable factors of underlying uncertainty or that it is a difference in drafting the prospectus. As such, firms do not necessarily include all present plans.

negative returns (Alexandridis, Antypas & Travlos, 2017). The direction of such return is according to Netter, Stegemoller and Wintoki (2011) partially depending on the size and public status of the respective target. More importantly, Brau, Couch and Sutton (2012) describe that specifically acquirers perform poorly after their IPO in the long run. Hence, for prospective investors it is highly uncertain whether an acquisition will be beneficial to the overall performance of a company when they lack information about a target. As such, prospective investors would naturally have more valuation uncertainty when an IPO firm indicates acquisition plans.

In addition, the academic literature on the announcement returns of acquisitions based on the type of payment is not promising as well for prospective investors of an IPO issue. If the IPO firm issues primary shares and it pays for the acquisition in cash, Harford (1999) predicts that such transaction has a high probability to create negative announcement returns. This prediction is supported by the free cash flow theory of Jensen (1986), who argues that in the situation where high free cash flows are available, managers are more likely to complete low-benefit and value-destroying acquisitions. Alternatively, when the IPO firm pays the acquisition with stocks, Travlos (1987) indicate that it is likely to have negative announcement returns as well. The reason for this negative announcement return is that stock payments is for investors a signal that the stocks of the buyer are overvalued. As indicated, Rhodes–Kropf, Robinson and Viswanathan (2005) shows that positive misvaluation indeed drives firms to use their stock as acquisition payment. Although the stocks do not have to be overpriced, the market can still react to it in this manner as most of the time information asymmetry is applicable. Therefore, the announcement of a post-IPO acquisition has a higher likelihood to be valued negatively by the market, irrespective of the type of payment by the IPO firm.

2.2.2 Post-IPO Acquirer Duration

The duration before a company becomes an acquirer could provide additional insight in the degree of predictability of acquisitions at the time of IPO. Therefore, I divide firms that are post-IPO acquirers in groups conditional on the time before they takeover a company, similar as Celikyurt et al. (2010) and Arikan and Stulz (2016). I refer to a short-term acquirer if a firm makes an acquisition within one year after their IPO. For medium-term acquirer is a similar definition applicable with the alteration that the period interval is from one year until a maximum of three years. An additional restriction is that a firm can only be in one of the two groups, whereas the first acquisition is decisive for the acquirer group allocation. This is desirable in the light of comparison intentions.

The level of underpricing for a company can be influenced as of the advancement in the acquisition plans at the first day of being public. I infer that firms can have higher IPO underpricing when it identifies temporary positive NPV acquisition projects that can be established only with a successful IPO. As indicated previously, a successful IPO results in an increased availability of capital

options (e.g. Celikyurt et al., 2010) and could be necessary to finance the acquisition opportunity. Edelen and Kadlec (2005) describe that in similar cash-required investment scenarios, initial owners of an IPO firm are willing to accept a lower offer price if that increases the probability of IPO completion. A lower offer price causes inevitably higher underpricing as the difference with the market valuation becomes larger. Arikan and Stulz (2016) confirm the view that firms are likely to use IPO proceeds for acquisitions shortly after the IPO. In their research, it is observable that the acquisition rate peaks in the first year after the IPO. Other support of the idea that firms identify these projects is also present in previous literature. For instance, Marquardt and Zur (2014) display that the average time to complete a M&A deal process in public US firms is 269 days or approximately 9 months. Given the average time length of the deal process, firms that acquire in their first public year are more likely to have detected this takeover opportunity prior to the IPO date. Therefore, these firms are more likely to be subject to accepting lower offer prices to enhance the probability of IPO completion.

This relation between underpricing and positive NPV acquisition opportunities is also supported by the offer price determination and share allocation theory of Benveniste and Spindt (1989). They argue that IPO firms are more likely to agree upon a firm-commitment contract with the underwriter, if IPO firms need a minimum level of proceeds for future financing requirements. Such contract gives the investment bank the obligation to purchase all shares that are not presold at the offer price. As a result, the investment bank has an incentive to presell the whole issue. Thereby, a part of the shares could be allocated to low-interest regular investors, who would otherwise neglect the opportunity. In order to make these shares still attractive to such investors, shares in these offerings typically experience heavier underpricing. Benveniste and Spindt (1989) mention that this incentive is the strongest for investment banks that presell firms with the greatest ex-ante price uncertainty. As explained above, post-IPO firms that engage in acquisitions tend to have greater ex-ante price uncertainty. Therefore, the level of underpricing for firms with a firm-commitment contract is likely to be higher as well.

2.2.3 Post-IPO Acquirer Frequency

An extra extension to the discussion of underpricing in post-IPO acquirers is whether the frequency of acquisitions matters. This acquirer dimension could provide addition insight into whether investors are able to recognize firms that have a more aggressive external growth strategy and incorporate this in their valuation. To analyse this, I make the distinction between acquirers that either make a single acquisition or multiple acquisitions, similar as Bessler and Zimmermann (2011). I refer to these types of acquirers as single and serial acquires, relatively.

Firms that intend to make multiple post-IPO acquisitions have a greater incentive to hide details regarding their acquisition plans to increase the probability of realizing their growth options.

Gao et al. (2013) argue that an important factor of future profitability of a firm is the ability to grow fast. A crucial aspect in their reasoning is that larger firms have more valuable growth options than smaller firms. In that sense, firms can benefit from a more aggressive external growth strategy. Smit and Moraitis (2010) similarly emphasize the relative importance of such options and introduce an argumentation for the appropriateness of including real option theory in an acquisition setting. They mention multiple growth option opportunities that can typically benefit a serial acquisition strategy and urge that the realisation of them are not only dependent on firm and market related risks, but also on competitor behaviour. Therefore, if an IPO firm recognises valuable growth options, it has a bigger incentive not to disclose valuable information about this to avoid that competitors take away such opportunity. In effect, investors would have less information as well and have a greater probability to face more ex-ante valuation uncertainty.

2.2.4 Post-IPO Target

Apart from the influence of post-IPO acquisitions, the level of underpricing could be influenced by the desire to sell the company post-IPO. If the cash flow rights optimization theory of Zingales (1995) holds, then pre-IPO owners have an incentive to disclose as much information as possible to reduce ex-ante valuation uncertainty. Differently put, underpricing would be minimalized (Beatty & Ritter, 1986). Therefore, the level of underpricing is likely to be lower in the occasion that pre-IPO owners have the intention to sell the controlling block after the IPO.

The eventual selling of a firm and related underpricing can also be viewed through a cost-benefit angle. Whereas a selling shareholder has the financial desire to maximize the total proceeds of the divestment of the company, it does not have to imply that underpricing should be minimalized. Habib and Ljungqvist (2001) argue that the issuer will only reduce the information asymmetry up to the point that the marginal benefits equal the marginal costs. Underpricing is especially costly when a high proportion of the shares are issued during the IPO. However, as Zingales (1995) mentions for the optimization of the controlling rights, the controlling block is optimally sold through direct negotiations after the firm is public. Thereby, if targets issue a relatively small fraction of the shares in an IPO[4], the potential underpricing has a smaller effect on wealth loss. As a consequence, the marginal benefit of a reduction in underpricing may not be substantial enough to outweigh the cost of information asymmetry reduction in each target IPO. In that sense, the expectation of lower underpricing may be limited in terms of percentage difference.

[4] The optimal fraction of the company that is retained after the IPO is according to Zingales (1995) dependent on several parameters. As such, the optimal amount of shares being sold in an IPO is firm dependent.

2.3 Hypotheses

For post-IPO acquires, with the findings concerning announcement return, long-run performance and acquisition payments, I infer that acquisition activity results in more valuation uncertainty among prospective investors. Moreover, IPO firms tend to be more reluctant to provide information when competitors can benefit from it. Thereby, it is more likely that information asymmetry, and hence ex-ante valuation uncertainty, is to greater extent present in post-IPO acquirer firms. Beatty and Ritter (1986) argue that if investors have a higher level of ex-ante valuation uncertainty, they need to be compensated with a higher level of underpricing. For investors to buy shares of post-IPO acquirers, a higher first-day return may therefore be expected to reflect the valuation uncertainty. Thereby, I hypothesize the following:

> *Hypothesis (H1): The level of underpricing for IPO firms that complete subsequent acquisition(s) within three years is higher than for IPO firms that do not takeover firms after their IPO.*

Secondly, prior to the IPO, if firms recognise a positive NPV project for which the required funds to materialize are forthcoming from the IPO proceeds, such firms are more likely to have higher underpricing (Edelen & Kadlec, 2005). In addition, if firms are more dependent on a specific amount of proceeds from the IPO, then they are more likely to arrange a firm-commitment contract with the underwriter. With such contract, an IPO firm experience heavier underpricing (Benveniste & Spindt, 1989). In the case of short-term acquirers, the firm is more likely to have identified the target prior or during the IPO process than ex-post compared to medium-term acquirers. This can be argued as for the short-term acquirer the time between the IPO and the acquisition is limited and the completion of the deal requires time as well. As such, I hypothesize that:

> *Hypothesis (H2): The level of underpricing is higher for post-IPO short-term acquirers in comparison to medium-term acquirers.*

Thirdly, serial acquirers are more likely to pursue valuable growth options as these result in a higher valuation of the company (Gao et al., 2013; Smit & Moraitis, 2010). As a consequence, information regarding acquisitions and growth options are more valuable than in the scenario of single acquirers. By disclosing less detailed information, serial acquirers prevent alerting competitors from seizing their growth options. On the other hand, investors have less information about their strategy and therefore faces more ex-valuation uncertainty. Thereby, I predict that:

> *Hypothesis (H3): The level of underpricing is higher for post-IPO serial acquirers than for single acquirers.*

Lastly, the initial owners of post-IPO targets can optimize the proceeds of selling their firm through maximizing the proceeds of cash flow rights in an IPO and subsequently sell the controlling rights in direct negotiations over the firm (Zingales, 1995). To achieve high cash flows, information asymmetry should be low to minimalize ex-ante valuation uncertainty (Beatty & Ritter, 1986). However, at some point reducing information is not efficient anymore as it becomes too costly compared to the benefits that lower underpricing yields (Habib & Ljungqvist, 2001). In that sense, the effect on underpricing can be less evident. Nevertheless, I hypothesize that:

> *Hypothesis (H4): The level of underpricing for post-IPO firms that complete a company transaction as target is lower in comparison to IPO firms that are not takeover targets.*

3. Data

In this research, I make use of US IPO and M&A market data. An advantage of using US data is that it allows me to use more extensive data sources since famous corporate finance researchers, like Ritter, provide online access to their (manually) collected data. Furthermore, a related paper by Bessler and Zimmermann (2011) examine the EU market and find that issuing firms from common law countries[5] are more often involved in post-IPO M&A activity relative to issuing firms from civil law countries. In that sense, researching the US market offers a unique opportunity as this geographical region falls under the common law system and this topic is to my knowledge not investigated in prior literature. In addition, the observation that more M&A activity occur in common law countries suggests that there is a greater tendency to observe a potential relation in my data.

The data in this research originates from the Center for Research in Security Prices (CRSP), Compustat, Thomson One[6], LexisNexis and websites of academics in the field of IPO research. The time period of interest is for IPOs between January 2003 and December 2016. IPO data after this period is left out on purpose to allow for a subsequent period in which firms could get involved in M&A activity. Restrictions for the IPO dataset are similar to previous topic related research (e.g. Butler, Keefe & Kieschnick, 2014; Celikyurt et al., 2010; Purnanandam & Swaminathan, 2004; Loughran & Ritter, 2004). In subsections 3.1 and 3.2, I elaborate on the restrictions that are applicable in my data and indicate the number of observations that are left out as consequence. Afterwards, I present descriptive data statistics in section 3.3

[5] The EU consists mainly of civil law countries, whereas the UK and Ireland are the only exceptions. Therefore, only 25% of the observations from Bessler and Zimmermann (2011) comes from common law countries.
[6] The data accessible in Thomson One is the same as the SDC Platinum New Issues database referred to in many of the cited empirical papers.

3.1 IPO Database

The initial search in Thomson One concerns US IPOs in the time interval between 2003 and 2016, from which I exclude issues with an offer price below 5 USD. This minimum boundary prevents the possible influences of very high and low underpricing as penny stocks are more volatile than ordinary stocks due to their low offer prizes (Ritter & Welch, 2002; Bradley, Cooney Jr, Dolvin, & Jordan, 2006). This step results in a reduction from 5,388 IPO observations to data about 2,511 IPOs. Next, I omit 43 duplicate observations. Moreover, if in the dataset a sample firm does not report a 9-digit CUSIP code, then I try to discover this code through finding a corresponding matching name in the IPO data of the Field-Ritter dataset[7]. If information concerning the 9-digit CUSIP identifier is missing after merging both datasets, then I remove such firm from the dataset as further application cannot be completed without this information. This step excludes 125 observations, creating a total of 2,343 identical IPOs.

Subsequently, I use the CUSIP code to subtract corresponding firm data from the CRSP database. A total of 536 IPOs is unable to match with the CRSP data through their CUSIP identifier. Therefore, I omit these from the sample. From the existing IPO data, I only include data from ordinary common shares as indicated by the CRSP share codes 10 and 11. The implication of this exclusion is that I omit the data of Real Estate Investment Trusts (REITs), American Depository Receipts (ADRs), Shares of Beneficial Interest (SBIs), Unit offerings, Americus Trust Components, Limited Partnerships and Closed-end funds. I exclude these types of shares as for these shares the value is easily calculated. The price of these shares is primarily based on assets of which much public information is available to accurately calculate their value. As a result, in these types of offerings a lower level of underpricing may be expected as there is substantial less valuation uncertainty in comparison to other share types. Including these offerings in my research could then reduce the accuracy of the results with the possibility to miss a genuine significant effect of underpricing among ordinary common shares. By excluding these types of IPO shares, I remove this potential bias. In total, I omit an additional 581 firms through this exclusion.

Furthermore, I exclude 158 IPO firms because these firms operate in the financial sector. Fama and French (1992) report that the high leverage levels applicable in this sector has a different meaning in terms of risk compared to firms that are active in the nonfinancial sector. Also, the financial sector is highly regulated compared to other sectors. Therefore, the relation towards pricing can deviate, making it better to exclude these observations to capture the effect of risk in the rest of the economy more accurately. A firm operating in this sector is recognised by their SIC code being in the interval 6000-6999. The SIC code for each observation initially originates from CRSP. I use the SIC codes from the year that a company has its IPO. In the scenario that observations either have no available SIC code

[7]As used in Field and Karpoff (2002) and Loughran and Ritter (2004). See: https://site.warrington.ufl.edu/ritter/files/2018/04/FoundingDates.pdf

in CRSP or indicate to be a non-classifiable establishment, I use the SIC code from Thomson One as alternative.

Furthermore, I restrict the type of IPOs by excluding auctions. IPO auctions can influence the level of underpricing in a different manner as regular IPOs. With the auction mechanism, bidders drive up the price to a point that only investors that value the shares the highest are willing to buy these shares and win the auction. Therefore, it is likely that investors in these offerings are more subject to the winner's curse[8] and that subsequent underpricing is less prevailing. The firms that auctioned their IPO are identified through manually matching the company ticker and name with the IPO auction firm data supplied by Ritter (2019). Through this method, 11 firms were removed from the dataset as they were IPO auctions. The total number of firms that satisfy the above-mentioned restrictions for the merged Thomson One/CRSP database equals 1,057.

As an extension to the IPO database, I merge the Thomson One/CRSP database with the Compustat database using the identifiers GVKEY and CUSIP. I apply the Compustat searches with both GVKEY and CUSIP as an attempt to minimize the loss of firms through merging the databases. As a result, only 41 observations were lost in the process, bringing the final IPO database down to 1,016 sample companies.

An additional source of data comes from Ritter (2017) and helps to identify firms that have multiple share classes after the IPO issuance. This data is publicly available. I merge their data with my database on basis of the company's PERMNO. As a result, I can verify the Thomson One data about which firms have multiple share classes after going public. Companies with multiple share classes are necessary to be identified as I use data from CRSP for the calculations of number of shares outstanding. This database has the disadvantage that it only reports shares outstanding which are publicly trading. This implies that shares in companies that are issued but do not trade are neglected. Therefore, when a company has multiple share classes, the data of Thomson One becomes more appropriate to indicate the total number of shares outstanding in these companies (Loughran and Ritter, 2004). In the identification process of multiple share companies, there is a discrepancy between Thomson One and the data of Ritter for 43 firms. To assure the correctness of the database, I manually check information about multiple share classes and use the number of other shares outstanding as reported in the prospectus, rather than the data of Thomson One or CRSP.

The last extension to the IPO database is the inclusion of the publicly available data of Ken French about industry classification and their respective returns[9]. With this data, the firms are

[8] The winner's curse is based on the idea of Thaler (1988) who argues that the bidding process is normally distributed, whereas the highest bid is likely to be more than the true value of the auctioned item.
[9] See: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

classified in the 12-industry groups of Fama and French. Consequently, data about industry returns, standard deviation and peer groups are linked to the IPO firms.

3.2 M&A Database

As an extension to the IPO dataset, I include post-IPO M&A activity data for each observation. I retrieve this data by entering the 6-digit CUSIP code of the IPO firms in the M&A search engine of Thomson One. The search includes both acquirers and targets in the time interval between January 2003 and November 2018. Afterwards, I match and verify the data by company name to assure that the output corresponds to the correct IPO firm. I remove acquisitions and takeovers of a firm that occur before their IPO date. Based on these conditions, the total IPO sample of 1,016 firms completed a combined number of 2,867 (partial) acquisitions and are 1,671 (partially) sold after their IPO.

From the acquisitions, I remove the post-IPO acquisitions that are completed later than three years after the IPO[10]. This is the same post-IPO time frame as Hovakimian and Hutton (2010) uses. I apply this limitation as it enhances the likelihood that the IPO is the predominant factor that makes it possible to engage in M&A activity. In that sense, the two events are related. As a result, investors would be more prone to predict whether firms are involved in subsequent M&A activity or not. A larger time frame on the other hand increases the probability that M&A activity is due to other factors than the IPO. I exclude 1,549 post-IPO acquisitions as a result of this time span restriction. The second restriction is based on the fraction of ownership that is acquired. Some firms acquire less than 100% of the shares of a firm. This could be the case when for instance firms acquire a toehold position before completing a complete takeover or to acquire enough shares to meet the threshold of creating a controlling block. Therefore, I add similar to Hovakimian and Hutton (2010) the condition that acquisitions are only considered when at least 50% of the shares are acquired in the transaction resulting in at least a 90% post-transaction ownership. Consequently, I omit 59 partial acquisitions from the dataset. The final acquisition database consists of 1,259 acquisitions made by the IPO firms within three years after the event.

From the firms that are sold, I remove the transactions that do not have a change in controlling interest after the effective takeover date, similar as Hsieh et al. (2011). This exclusion follows naturally from the theoretical fundament described by Zingales (1995) in which initial owners can maximize their proceeds by selling the controlling interest after the IPO. Thereby, 163 partial transactions are removed from the dataset. In addition, the transactions that contain no information about the percentage of shares acquired and percentage of shares owned after the transaction are deleted as well. Without this information it is impossible to identify whether a change of controlling interest

[10] The M&A database includes data up to November 2018. Thereby, for firms that went public after November 2015, the range is less than three years. See also next footnote for further implications of this data unavailability.

occurred. The exclusion of this condition reduces the number of transactions with 1,133 observations. Moreover, similar as for the acquisitions, the data is restricted to a time frame of three years after the IPO date. I exclude 236 transactions as a result of the time span restriction. Furthermore, if a firm has multiple transfers of controlling interest within the specified timeframe, only the first observation is included. This is the case for 11 firms. After applying all the restrictions, a total of 128 post-IPO targets are identified in the dataset.

3.3 Descriptive Statistics

From the computed dataset, I create multiple variables. This subsection provides an outlook of their respective values. For testing purposes, I adjust the definition of underpricing in an IPO by adding the offer price as a scaling factor. This adjustment avoids biased outputs due to differences in offer price determination. The formula of underpricing that I use in the descriptive statistics and tests is thus:

$$(1) \quad \frac{P_{1st\,day} - P_{Offer}}{P_{Offer}} * 100\%$$

Moreover, I use the data to create dummy variables for M&A activity, which indicate 1 if the IPO firm is involved in M&A activity and a 0 if it is not[11]. The M&A activity variable is divided into several forms that relate to the hypotheses. I make the following distinctions: (1) acquirer, (2) short-term acquirer, (3) medium-term acquirer, (4) single acquirer (5) serial acquirer and (6) target. In addition, I also use the indication of future acquisitions in the IPO prospectus as a dummy variable. This dummy indicates 1 if this motive is mentioned in the IPO prospectus and 0 if it is not indicated. This is similar as how Hovakimian and Hutton (2010) construct their M&A activity proceed dummy. The control variables concern firm, ownership and market characteristics. In appendix A.1, I provide a detailed explanation of the computation and inclusion of each control variable.

In Table 1, I report the summary statistics of the variables that I use in the regressions. Noticeable, the mean level of underpricing is 16.6%, slightly higher than the equal-weighted 14.2% average underpricing observed by Ritter (2019). The difference can be explained by the fact that Ritter has more IPOs in his observation group[12]. In Figure 1, I show the interquartile ranges and the averages of the level of underpricing across the years of interest. Notably, the averages are in most years approximately the same while in the between 2012 and 2015 a slight upward peak is observable.

[11] If the firm went public after November 2015, the data for a three-year period is not complete. Therefore, conditional on the M&A engagement that is available for this period, the observation of variables is omitted. In the scenario that a firm had acquired a company or was taken over within the incomplete time period, the observation remains valid as there is certainty that future data does not alter the value of the dummy variable. I applied similar reasoning of certainty to include or omit medium-term acquirers, single acquirers and serial acquirers, respectively.

[12] The size difference of the observation is 578 firms and is to a great extent caused by the issue of not being able to match all IPO firms with the correct identifier in the different databases. This exclusion resulted in 536 firms being omitted, while Ritter hand-collected all data for the firms.

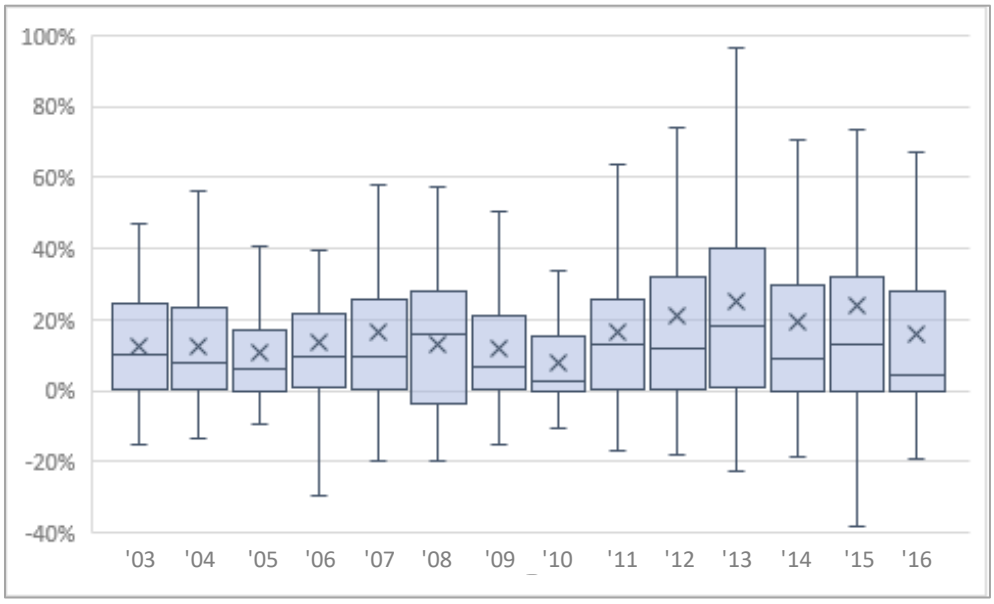
Table 1: Summary Statistics

The summary statistics in the table is a descriptive measure to introduce the data in this research. The table shows the number of observations (n), mean, standard deviation (SD), minimum (Min.), the 10% tails range (10th and 90th percentile) the median (50th percentile) and the maximum (Max.) for the regression variables from 2003 through 2016. Exclusions from the prior subsections are applicable on the data in this table. See appendix A.1 for the computation of these variables.

Variable	*n*	Mean	SD	Min.	10th	50th	90th	Max.
Underpricing (%)	1016	16,631	27,251	-72,157	-5,357	9,487	49,381	217,000
Sales	1016	4,180	2,336	0,000	0,000	4,437	7,123	11,558
Debt	1013	0,930	1,376	0,000	0,221	0,721	1,485	27,607
Price Revision (%)	1016	-3,444	21,647	-70,588	-30,769	0,000	20,000	100,000
Price Revision (-) (%)	1016	-10,044	14,268	-70,588	-30,769	0,000	0,000	0,000
Share Overhang	1016	1,385	0,449	0,000	0,846	1,366	1,956	4,234
P/V multiple	907	1,046	0,961	0,007	0,212	0,816	2,143	7,682
NASDAQ index	1016	0,082	0,168	-0,682	-0,138	0,096	0,264	1,164
Prospectus	1016	0,392	0,488	0,000	0,000	0,000	1,000	1,000
Acquirer	962	0,428	0,495	0,000	0,000	0,000	1,000	1,000
Short	1016	0,218	0,413	0,000	0,000	0,000	1,000	1,000
Medium	957	0,200	0,400	0,000	0,000	0,000	1,000	1,000
Single	958	0,168	0,374	0,000	0,000	0,000	1,000	1,000
Serial	958	0,258	0,438	0,000	0,000	0,000	1,000	1,000
Target	950	0,135	0,342	0,000	0,000	0,000	1,000	1,000

Figure 1: Underpricing deviation

The distribution of the interquartile range for IPO underpricing between 2003 and 2016. The upper and lower boundary of the boxes represent the 75th and 25th percentile of underpricing in a given year. The horizontal line within these boxes is the median level of underpricing. The average level of underpricing is marked with a cross, whereas the whiskers indicate the standard deviation of the interquartile range.



In addition, the median is in most years under the average, implying that the averages tend to be skewed upwards through the top underpricing observations. Also, it is clearly observable that the first quartile value is often close to 0% underpricing. First, this implies that there are generally more firms which have underpricing rather than overpricing. Secondly, given the consistency of the level of

underpricing in the first quartile range, it indicates that every year at least a number of firms is able to offer their shares for a similar price as the market thinks they are worth.

Apart from underpricing, Table 1 indicates some additional insights into the variables. For instance, the minimum and 10th percentile observation of the sales variable indicates that at least a relatively large proportion of the observations did not have any prior fiscal sales before going public. Related to this observation is the statistic that 70% of these firms had their IPO after the signing of the Jumpstart Our Business Startup (JOBS) Act in April 2012 (see in the appendix Figure A4.1). This act enables Emerging Growth Companies (EGC), firms with a revenue below the one billion dollars, to reduce mandatory disclosure which effectively encourages smaller firms to initiate a public offering. Hence, this act can explain the high frequency of firms without any prior sales when going public. An extension to this are the evident high values of the price-value multiple. This multiple uses the sales level to arrive at a value. As a consequence of low prior sales, the value of this variable tilts upwards for such firms. Therefore, the distribution of observations is slightly skewed to the right. Furthermore, the debt ratio shows values that are considerably higher than one at the 90th percentile. In general, healthy firms would not exceed this threshold of one as this implies that there are more liabilities than the combined value of all the assets in the firm. However, these values are taken from their balance sheet prior to the IPO. With an IPO, firms tend to generate additional equity and cash inflows through a primary share offering which would allow them to pay off at least a part of their liabilities. As such, at least a subset of the observations is likely to have as primary motive to reduce indebtedness, rather than acquiring other firms.

Focussing on the M&A activity statistics, Figure 2 and 3 give a conspicuous overview of M&A activity after the IPO of a firm. Figure 2 shows that between 33% and 50% of the annual IPO firms engage in acquisitions afterwards. A smaller fraction, between the 5% and 20%, becomes eventual takeover targets. The total number of firms that have post-IPO M&A involvement is slightly lower than the combined percentages because some firms become both acquire and target within three years after the IPO. See Figure A4.2 in the appendix for more detail concerning this distribution. Furthermore, a decrease in the number of IPOs is observable during the financial crisis. In the aftermath of the crisis, the firms perform less M&A activity after their IPO than prior to the financial crisis.

In Figure 3, I display the distribution of M&A activity in firms within the three years after their respective IPO. Interestingly, the highest peak of acquisitions is after 6 months. Meaning that an IPO has completed the entire M&A deal process within this period. As mentioned earlier, the average time to complete such process is approximately nine months (Marquardt & Zur, 2014). Despite the variation in completion time due to the different complexities in the transactions, this finding in combination with Figure 3 indicate that IPO firms do recognise potential takeover targets before their IPO date. For

Figure 2: IPO and future M&A activity
The amount of US IPOs and the relative number of firms that become an acquirer or target within three years after the IPO.

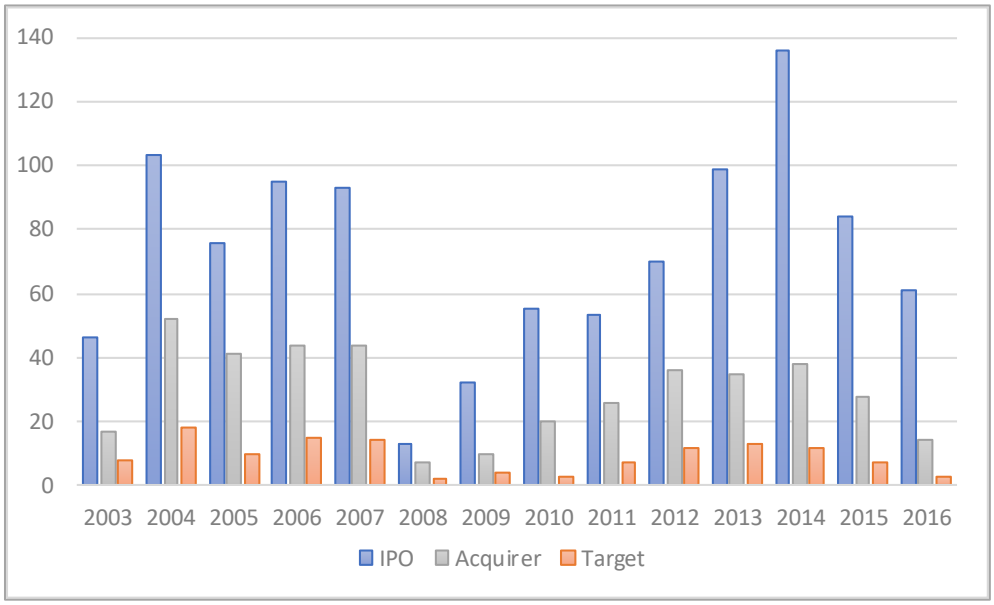
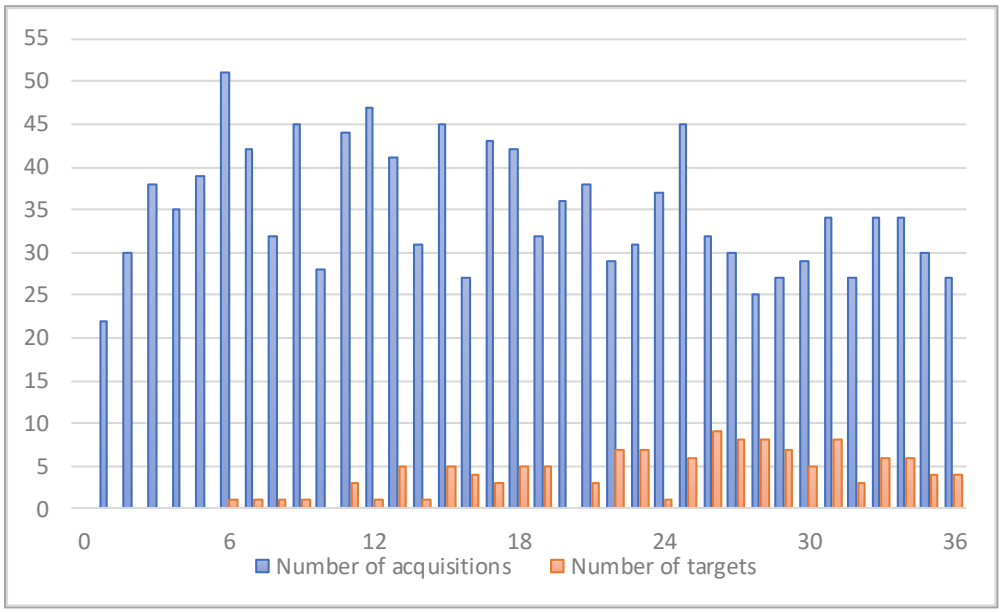


Figure 3: Time between IPO and M&A activity
The total number of acquisitions that the US IPO firms have completed and the number of firms that completed a transaction as targets within three years after their IPO.



the post-IPO targets, Boone and Mulherin (2009) show that the sale process of a US firm takes about 6 to 7 months from deal initiation to public announcement. This means that the due diligence phase excludes in this period and would slightly extend the length of this time frame. An additional factor in the sale process is that insider shareholders must deal with the IPO lock-up period that usually ranges between 90 to 180 days. They are not allowed to sell shares in this period. This clarifies that in Figure 3 no observation of a sale occurs within 6 months. Notably, initial owners of the IPO firms who decide to sell their controlling block do this primarily starting from year one rather than before. This would

Table 2: M&A Activity Distribution in IPO Firms

Descriptive statistic concerning the number and percentage of firms that indicate the future acquisition use of proceeds in the IPO prospectus. *Prospectus* is a dummy variable which indicates 1 if the firm includes future acquisitions in the source of proceed section in the IPO prospectus. *Acquirer* represents the firms that acquire at least one company. *Targets* are those that are taken over by another firm. Firms that acquire a company within one year after their IPO belong to the group *Short. Medium* is the group of firms that make their first post-IPO company acquisition later than one year after their IPO, but within three years. *Single* are firms that make one acquisition. *Serial* are the firms that make multiple acquisitions. A timespan of three year after the IPO is applicable for each variable, if not specified differently. The percentages in parentheses display the relative number of observations that indicate this use of proceed compared to the total number of firms in that M&A group.

Panel A: Future acquisition use of proceeds across firms

	Post-IPO M&A firms			
Prospectus	Acquirer	Target	Non-M&A	All firms
0	205 (49.8%)	64 (50.0%)	329 (69.9%)	618 (60.8%)
1	207 (50.2%)	64 (50.0%)	142 (30.1%)	398 (39.2%)
Total	412	128	471	1016

Panel B: Future acquisition use of proceeds across acquirer firms

	Acquirer duration		Acquirer frequency	
Prospectus	Short	Medium	Single	Serial
0	100 (45.2%)	105 (55.0%)	95 (59.0%)	107 (43.3%)
1	121 (54.8%)	86 (45.0%)	66 (41.0%)	140 (56.7%)
Total	221	191	161	247

imply that the initial owners have either come to the idea to sell their shares post-IPO, rather than ex-ante, or have waited before showing their intention to transfer the ownership. In case of the former scenario, the results of the level of underpricing for post-IPO targets would be trivial.

Furthermore, when concentrating on the statistic of information disclosed in the IPO prospectus concerning potential acquisitions, it becomes visible in panel A of Table 2 that the post-IPO acquisition motive is mentioned in approximately 39% of the use of proceeds sections of all IPO firms. Interestingly, the inclusion of this use of proceed is relatively scattered throughout the different type of M&A firms in panel A. Approximately half of the IPO firms that complete an acquisition mention this use of proceeds appetite in their prospectus. In the case of non-M&A IPO firms, this percentage lays only 20 percentage points lower. An explanation for this high level of future acquisition indication in the use of proceed section is that part of these firms could have had the intention to takeover other firms but were ultimately unable to execute their intentions. Alternatively, firms could have been unsure concerning how to spend the proceeds from the IPO and thereby listed future acquisition as an option to protect themselves from litigation risk once the firm finds attractive acquisition opportunities in the future.

Focussing on the different dimensions of acquirer, Figure 3 suggested that at least a subsample of firms had already identified a takeover target before their IPO date. Short-term and serial acquirers

are expected to be more likely in this group due to their design. Panel B of Table 2 shows that short-term and serial acquires indicate relatively more often future acquisitions in their use of proceeds section than medium-term and single acquirers respectively. However, the difference is relatively small within acquirer duration and frequency with 9.8 and 15.7 percentage points, respectively. The relatively small differences within these groups, but also with respect to targets and non-M&A firms, contribute as a supporting argument to the discussion of Ljungqvist (2007) that it is unsure how meaningful mentioning future acquisitions in the use of proceed section is. As such, drafting differences could be a problem in observing which impact this use of proceed has as it is not certain that all private information is included in every prospectus.

4. Methodology

In this section, I describe first the design of the independent variables and the intuition for testing these variables. After that, I explain the research design of the initial empirical test mechanisms.

4.1 Variable Selection

In order to test the hypotheses, I use multiple independent variables that relate to future M&A activity. One of these variables concerns the effect of the future acquisition indicator in the use of proceeds section of an IPO prospectus. During the book building process, investors could read in the prospectus that future acquisitions is a reason for the firm to go public and are therefore clearly informed about their acquirer intention. As a result, this is a good proxy to capture how the market reacts to the disclosing of this information.

Whereas the prospectus offers information about the intention of future acquisitions, it does not infer information about the realisation of a future acquisition nor about selling a controlling ownership stake. In addition, the inclusion of the intention to use the proceeds for future acquisitions is sensitive to subjectivity; a firm is not obligated to use the proceeds in the manner stated in the prospectus as it in general provides a condition that the firm should identify an attractive opportunity before going into action. Therefore, another proxy will look at post-IPO data in which IPO firms could either be involved in M&A activity or not. This post-IPO data has as advantage over the prospectus data that it provides the opportunity to look at possible influences of the selling side as well.

On the other hand, given that this data is ex-post obtained, it could be that the motive to initiate an IPO is different from the potential post-IPO M&A involvement. Although CFOs state that firms mostly initiate an IPO in order to facilitate future acquisition (Brau & Fawcett, 2006), firms that do acquire other firms do not necessarily have this as their primary reason to go public. As indicated in the descriptive statistics section 3.3, a substantial number of IPO firms that engage in subsequent M&A activity do not report this intention in the use of proceeds section of their prospectus. This observation indicates that the intention to use the proceeds for future acquisitions deviates

considerably with the ex-post activities of the IPO firms. Therefore, I apply an interaction effect between use of proceeds and the post-IPO M&A data to look if also the level of underpricing deviates. The outcome of this interaction effect can help identify the level of underpricing in firms that are more likely to have identified a takeover target prior to the IPO. Contrary, the ex-post acquisition variable can then look at whether underpricing is evident for post-IPO acquirers, despite not having disclosed this information in the future proceeds section of the prospectus.

4.2 Empirical Tests

First, I test for differences of means within the M&A variables through a two-sample t-test. For each comparison of sample testing, I check with the Levene's test whether equal variances can be assumed in the t-test. The variation in underpricing between the categories of post-IPO M&A activity allows me to examine the direction of the relative difference in these groups and hence the correctness of my expectations in the hypotheses. The test looks at the underpricing means in (1) acquirers vs. non-acquirers, (2) short-term acquirers vs. medium-term acquirers, (3) serial acquirers vs. single acquirers, (4) targets vs. non-targets.

Secondly, I perform an Ordinary Least Squares (OLS) regression in which underpricing acts as the dependent variable. M&A activity is the independent variable and I apply multiple control variables to capture the effect of firm, ownership, and market characteristics to IPO underpricing. These control variables originate from prior high-quality IPO underpricing studies. Among these studies, Butler et al. (2014) examine the relative importance of many prior documented factors on underpricing. From their findings and those reported in other IPO papers, I choose the most influential factors to use as controlling variables in the multivariate tests. In section 5.3, a short elaboration follows on the robustness of these findings when including more and other variables documented in Butler et al. (2014). In Table 3, I indicate for the initially selected control variables which prior study uses this controlling variable as well.

The multivariate regressions determines whether potential differences in means are influenced through the presence of M&A activity or due to other factors. The regression satisfies the comments of Petersen (2009) and uses clusters of standard errors per quarter. The reasoning for applying this adjustment to the standard errors is that the data is potentially subject to cross-sectional dependence. That means that the residuals in a specific quarter are likely to be correlated across different firms, which makes the OLS standard errors and White (1980) robust standard errors biased. Below is the regression formulated:

$$(2)\quad Underpricing = \beta_0 + \beta_1 M\&A\ Activity_n + \beta_2 Prospectus + \beta_3 M\&A\ Activity_n * Prospectus + \gamma Controls + \varepsilon_{it}$$

Table 3: Control Variables

The control variables from the OLS regression with a small description and the sources from previous literature. The direction of the effect on underpricing is indicated in parentheses before the names of the authors. (-) represents a negative effect on underpricing, whereas (+) indicates that the variable has a positive effect on the level of underpricing. I explain the computation of the variables in more detail in appendix A.1.

Variable	Variable description	Sign direction and source
Sales	The natural logarithm of one plus the net sales	(-) Purnanandam and Swaminathan (2004), (-) Aruğaslan et al. (2004)
Debt	Total liabilities divided by total assets	(-) Butler, Keefe and Kieschnick (2014)
Price Revision	Percentage difference between offer price and middle of the original file range prices	(+) Edelen and Kadlec (2005), (+) Cliff and Denis (2004), (+) Lowry and Schwert (2004)
Price Revision (-)	Negative values of Price Revesion and otherwise zero	(-) Lowry and Schwert (2004), (-) Edelen and Kadlec (2005)
Share Overhang	Natural logarithm of one plus secondary retained shares over shares offered	(+) Loughran and Ritter (2004)
P/V multiple	Natural logarithm of market price to sale ratio of the IPO firm over that of a peer group	(+) Purnanandam and Swaminathan (2004)
NASDAQ index	Average prior 30-day return of the equal weighted NASDAQ index	(+) Cliff and Denis (2004), (+) Lowry and Schwert (2004)

The $M\&A\ Activity_n$ indicates the different categories of post-IPO activity of a firm with n representing the values for: (1) acquirer, (2) short-term acquirer, (3) medium-term acquirer, (4) serial acquirer, (5) single acquirer and (6) target. The $Prospectus$ variable is the dummy which equals 1 if future acquisitions are mentioned in the use of proceeds section as source of future expenditures. The $Control_j$ variable refers to the seven control variables in Table 3 and ε_{it} indicates the error term of the regression.

Furthermore, I add year fixed effects to the OLS regression as they control for annual differences. Considering that the financial crisis occurred roughly between 2007 and 2009, this may have a substantially influence on the macro-economic factors effecting corporate decision making and thus IPO activity. This can be recognised as well in the lower level of IPOs in 2008 and 2009 (Figure 2). In addition, I add the industry fixed effects in attempt to capture the differences per industry that have an influence on the level of underpricing. For instance, industries differ in complexity, whereas firms in more complex industries are more difficult to value for investors. Hence, a higher ex-ante valuation uncertainty can be expected in these industries. Within the regression, I check for possible multicollinearity with the variance inflation factors (VIF's) described by Mansfield and Helms (1982). In this method, it is estimated how much a regressor is influenced by all other predictors in the model. The advantage of this method is that multicollinearity of a regressor can be observed, whereas standard correlation could have indicated that every variable is only little correlated. The VIF method report a value from 1 upwards. If the VIF value exceeds 10, then Alin (2010) indicates that there is high

correlation and serious concern of multicollinearity. With smaller values the instance of multicollinearity is less likely to be the case.

5. Results

This section presents the outcomes of the tests described in section 4.2. First, I look into the findings of the univariate test and discuss them. Afterwards, I continue with the multivariate analysis and finish this section by controlling the robustness of the findings.

5.1 Univariate Analysis

The results of the differences of means test are displayed in Table 4. The table shows that acquirers faced on average an underpricing level of 19.2%, where non-acquirers had only an underpricing level of 15.4%. With a t-test of equal variance, I show that the mean level of underpricing for acquirers is significantly higher than the mean of non-acquirers at a 5% significance level. This provides support for the expectation in hypothesis 1 that acquirers face more underpricing than non-acquirers.

Moreover, short-term acquirers have slightly higher first-day returns compared to medium-term acquirers, albeit the relative difference compared to the entire acquirer group is minimal. The same holds for single and serial acquirer, whereas in this comparison serial acquirers experience a little lower underpricing than single acquirers. Unsurprisingly due to the small differences, both the duration and frequency characteristic of acquirer does not provide a significant difference. Concerning the target group, these firms have a relatively low level of underpricing averaging 14.6%. Nevertheless, the negative difference of 2.3 percentage points with the non-target group is not significant. Thereby, there is not enough supportive evidence to reject the null hypothesis that the means of these group are the same. Overall, the relative differences in the results are consistent with most of the expectations of the hypotheses, except for H3 which expected higher underpricing for serial acquirers. However, only the difference between acquirer and non-acquirer as stated in H1 is significant. For the other difference, there is no evident indication that the hypothesized relationship as stated in H2, H3 and H4 holds. The findings of Bessler and Zimmermann (2011) for European data show similarity in the significance level of these differences.

To elaborate on the findings of the differences of means test, it is possible that there is a variable or a combination of variables that increases both the probability of higher underpricing as well as the probability of being an acquirer. If this is the case, it could be that the variable *Acquirer* is not on its own responsible for the higher underpricing among post-IPO acquirers. In Table 4, I report the Pearson correlation coefficients to give an overview of how *Acquirer* relates to the other variables that influence underpricing and that are applied in the multivariate analysis. None of the correlation coefficients exceed a 19.0% correlation level. Whereas 19.0% may seem substantial, correlation

Table 4: Differences of Means for Underpricing

The results of the differences of means test for the percentage of underpricing per post-IPO M&A activity group. *Acquirer* represents the firms that acquire at least one company. *Non-acquirer* represents the firms that do not meet the requirement of *Acquirer.* Firms that acquire a company within one year after their IPO belong to the group *Short. Medium* is the group of firms that make their first post-IPO company acquisition later than one year after their IPO, but within three years. *Single* are firms that make one acquisition. *Serial* are the firms that make multiple acquisitions. *Target* are those that are taken over by another firm. *Non-target* are the firms that are not taken over. A timespan of three year after the IPO is applicable for each variable, if it is not specified differently. The differences of means test indicates a *, **, and *** for a significance level of 0.10, 0.05 and 0.01 respectively.

Variable	Observations	Mean
Acquirer		
(1) Acquirer	412	19.168%
(2) Non-acquirer	550	15.402%
Test of means: (1) - (2)		3.766%**
Acquirer duration		
(1) Short	221	19.322%
(2) Medium	191	18.991%
Test of means: (1) - (2)		0.330%
Acquirer frequency		
(1) Serial	247	18.975%
(2) Single	161	19.786%
Test of means: (1) - (2)		-0.811%
Target		
(1)Target	128	14.703%
(2) Non-target	822	16.994%
Test of means: (1) - (2)		-2.292%
Full Sample	1,016	16.631%

Table 5: Acquirer Correlation Analysis

The Pearson correlation between the *Acquirer* variable and the controlling variables in the forthcoming multivariate regressions. In parentheses, I report the p-values of the correlation coefficient.

M&A type	Controlling variables						
	Sales	Debt	Price Revision	Price Revision (-)	Share Overhang	P/V multiple	NASDAQ index
Acquirer	0.187	-0.061	0.169	0.189	0.115	-0.054	-0.008
	(0.0000)	(0.0612)	(0.0000)	(0.0000)	(0.0003)	(0.1158)	(0.8077)

between variables is to a certain extent inevitable as in general at least some of the movement in two variables is associated with each other. For this reason, Taylor (1990) describes that labelling systems for correlation coefficients would describe a value of 19.0% to represent a low correlation. As such, it seems that there is only little concern for a bivariate relationship between *Acquirer* and the controlling variables in further underpricing results of the multivariate analysis.

5.2 Multivariate Analysis

5.2.1 Baseline Analysis

The results of the OLS regression deliver a more distinctive view of the influence of the different firm, ownership and market characteristics, rather than filtering on M&A activity solely. In Table 6, I tabulate the outcomes of the regression coefficients and t-statistics of the OLS regression represented by formula (2). In model 1, I run the regression with solely the control variables to examine whether they show a similar effect as in previous studies. All variables show the expected direction effect, but the *P/V multiple*, *Debt* and the *Sales* variable are insignificant. Consequently, the null hypothesis cannot be rejected and hence the sign direction of these variables should be neglected as there is not enough evidence to assume that they differ from zero.

Considering the variables that are significant in model 1 of Table 6, an economic meaningful asymmetric effect of *Price Revision* on the initial returns of the IPO is visible. A positive price update of one standard deviation for this variable corresponds to 19.3% higher *Underpricing*. For negative price updates, the variable *Price Revision (-)* reduces the absolute effect of *Price Revision*. Since these variables have different standard deviations, I apply the percentage change of the price update from one standard deviation of *Price Revision* to indicate the subsequent impact of *Price Revision (-)* on *Underpricing*. A one standard deviation of *Price Revision* implies an absolute 21.5% price update for the observation in this regression model. As such, a negative price update from 21.5% corresponds to a change in *Underpricing* of -5.2% (-19.3 + 14.1). Thus, the magnitude for a negative price update on *Underpricing* is substantially lower in comparison to positive price updates. The observation that the magnitude of underpricing is different with respect to the direction of this change implicates that information updates are differently incorporated in the price. Information leading to a negative price update is better incorporated into the offer price compared to positive information. This outcome regarding *Price Revision* is also found in the research of Lowry and Schwert (2004).

In the case of the variable *Share Overhang*, an increase of one standard deviation results in 3.5% more *Underpricing*. Hence, the economic significance is lower than observed in *Price Revision*, but the one standard deviation of *Share Overhang* still represents 13.5% of the variation of a standard deviation of *Underpricing.* The positive sign direction of this variable implies that when issuers remain a higher fraction of the shares in possession, a higher level of underpricing is expected. Loughran and Ritter (2004) find a similar result regarding the influence of *Share Overhang*.

The *NASDAQ index* has a similar positive relation with underpricing as the other significant controlling variables. An increase of one standard deviation results in 2.6% higher underpricing. This implicates that either investors view the future market more positively based on historical returns than the issuing firm or that the issuing firm does not entirely update the new market information in the offer price. Lowry and Schwert (2004) and Cliff and Denis (2004) find similar results concerning the

Table 6: Acquirer Underpricing

An OLS regression where the percentage of underpricing is the dependent variable. *Acquirer* is a dummy variable representing 1 if the firm acquires a company within three years after the IPO and 0 otherwise. *Prospectus* is a dummy variable which indicates 1 if the firm includes future acquisitions in the use of proceeds section in the IPO prospectus. *Sales* is the natural logarithm of sales in the year prior to the IPO. *Debt* is the liabilities to assets ratio. *Price Revision* is the offer price minus the middle of the original filing price range divided by the same middle of the original filing range. *Price Revision (-)* is the negative values of the *Price Revision* variable or 0 otherwise. *Share Overhang* is the natural logarithm of one plus the ratio of shares retained over the sum of shares offered in the market. *P/V multiple* is the natural logarithm of the market price to sales ratio of the IPO firm divided by an average of the same ratio from market peers. *NASDAQ index* is the prior 30 trading days return of the equal-weighted NASDAQ firms. Fixed effects include year and industry effects. The standard errors are clustered per quarter. The level of significance presented as *, ** or *** for 0.10, 0.05 or 0.01 respectively. The t-statistic is beneath the regression coefficient in parentheses.

Variable	Model 1	Model 2	Model 3
Acquirer		0.377	2.159
		(0.33)	(1.27)
Prospectus			1.922
			(0.75)
Prospectus x Acquirer			-4.108
			(-1.33)
Sales	-0.908	-1.112	-1.127
	(-1.39)	(-1.62)	(-1.43)
Debt	-4.111	-4.509	-4.461
	(-1.59)	(-1.46)	(-1.47)
Price Revision	0.897***	0.887***	0.890***
	(5.13)	(5.10)	(5.11)
Price Revision (-)	-0.654***	-0.648***	-0.653***
	(-2.96)	(-2.96)	(-3.00)
Share Overhang	7.722***	7.883***	7.774**
	(2.75)	(2.69)	(2.55)
P/V multiple	0.640	0.443	0.458
	(0.48)	(0.32)	(0.34)
NASDAQ index	15.080***	15.927***	15.937***
	(3.24)	(3.30)	(3.30)
Constant	-0.055	0.777	0.219
	(-0.01)	(0.17)	(0.05)
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
Cluster on quarter	Yes	Yes	Yes
Adjusted R^2	0.354	0.358	0.358
Observations	907	866	866

influence of prior market returns.

Apart from the implications of the regression coefficients, I want to highlight the massive impact of *Price Revision* on the adjusted R-squared in the model. Including this variable in the model increases the explanatory variation of this model on *Underpricing* with approximately 50%. In that sense, this variable is an important predictor of the level of underpricing observed in an IPO. On the one hand, the high predictive power can be easily explained by the partial price adjustment theory of Benveniste and Spindt (1989) and Hanley (1993). This theory clarifies that when positive information is gathered by the underwriter in the pre-issue period, then the offer price is only partially adjusted upwards. As a consequence, investors are rewarded for their truth-telling by greater underpricing in

the issue. Hence, a strong relation between these variables can be expected. On the other hand, the relatively high increase in the adjusted R-squared does shed light on the possibility that omitted determinants could correlate with this regressor. Given the nature of the variable, positive or negative price revision values tend to be present as result of new information regarding the pricing of stocks. As such, a variable *X* that represents this new information provision could be neglected in the model and therefore be present in the error term. If this is the case, then this could lead to omitted variable bias which implies that OLS estimators could be inconsistent. In the robustness check, I elaborate briefly on this concern of omitted variable bias.

In model 2 of Table 6, I include *Acquirer* to see how the inclusion of post-IPO data influence the regression on underpricing. Likewise, in model 3 I add the *Prospectus* and the interaction term between *Prospectus* and *Acquirer*. Different than expected, the t-statics imply for all newly added variables that there is not enough evidence to reject the null hypothesis. This means that the post-IPO acquire characteristic nor the inclusion of future acquisitions in the use of proceeds section can be assumed to influence the level of underpricing during the IPO. As such, the results suggest that the higher level of underpricing observed in the differences of means test tends not to be attributable to the post-IPO acquisition activity. In that sense, the reasoning for H1 is not supported by the results in Table 6.

When comparing these results with the European findings by Bessler and Zimmermann (2011), it becomes evident that *Acquirer* is in both studies insignificant while *Prospectus* has a different statistical inference in their paper. They observe that the prospectus dummy is significant at the 0.01 level. This difference in significance implies that disclosing information of potential future acquisitions does not result in a reliable signal of the issuing firm to investors in the US. Relating this to a paper that discusses the effect of information disclosure, Hanley and Hoberg (2012) find in their research that the litigation risk of US IPO firms is mostly hedged strategically through information disclosure, underpricing or a combination of the two. That is, the IPO issuer tends to decide on whether including additional information in the prospectus based on a cost trade-off mechanism between the level of proprietary value of information disclosure and underpricing. This finding emphasizes that drafting difference in IPO prospectuses decrease the degree of information provision as investors are uncertain whether a firm prefers to conceal information regarding future acquisitions. Moderate support of this argumentation is earlier documented in Table 2, which showed that approximately 50% of the acquiring firms did not include future acquisitions in the use of proceed section of their prospectus. Therefore, this is a potential explanation why the *Prospectus* dummy is insignificant in the OLS regression in my dataset.

An explanation for the insignificant results of the *Acquirer* dummy is that the predictability of its future occurrence is not high enough during the IPO to make a significant contribution to the pricing

Table 7: Variable Inflated Factor Analysis

The table shows the Variable Inflated Factor (VIF) values of the independent and control variables in the OLS regression for underpricing of Table 6.

Variable Inflated Factor						
Mean	Acquirer	Prospectus	Prospectus*Acquirer			
2.16	2.04	2.35	3.17			
Sales	Debt	Price Revision	Price Revision (-)	Share Overhang	P/V multiple	NASDAQ index
3.46	1.07	4.45	4.29	1.39	2.37	1.27

mechanism on the first-trading day. That is, investors could find it difficult to assess whether particular IPO firms have a higher likelihood to commit future acquisition activity. The previous described drafting difference in the prospectus is a supporting argument for this idea as this file is an important source of information for many investors. Alternatively, acquisitions intentions in acquiring firms could be unprocessed or not even present yet at the first day of being public. As a consequence, the likelihood of predicting such event becomes automatically low and hence will not impact first-day returns substantially.

Another explanation might be that one or more of the variables that indicate a higher correlation with *Acquirer* can predict both post-IPO acquisitions and underpricing. This problem is also known as multicollinearity. In such occasion, the standard errors of coefficients tend to bias upwards as OLS estimates becomes less precise. As a result, the size of the confidence interval inflates, which in turn deflates the t-statistic. This makes it more likely for variables to be assessed as insignificant. From Table 5, it is evident that *Sales*, *Price Revision* and *Price Revision (-)* indicate a slightly higher correlation with *Acquirer* than the other control variables. Interestingly, Hovakimian and Hutton (2010) show that the *Sales* is a significant predictor for future acquisition probability. In that sense, *Sales* could be such variable that causes multicollinearity as Purnanandam and Swaminathan (2004) and Aruğaslan et al. (2004) show that *Sales* also influences the level of underpricing. In Table 7, I display the variable inflated factors from the regressors to assess to what extent their variance is inflated upwards. Concerning the VIF value of *Sales*, it is slightly high with 3.46, but in general this would not indicate concerns for multicollinearity (Alin, 2010). A drawback of this method is that it does not distinguish which other variable causes the inflation in variance. However, recognizing that the design of the price-value multiple is based on the sales level, I find that a large extent of inflated factor disappears when excluding this variable. Other relatively high values in Table 7 are present for the variables *Price Revision* and *Price Revision (-)* with 4.45 and 4.29 respectively. Yet, through the construction of these variables, a clear suggestion is that these two variables inflate each other. As such, when I exclude one of the two variables from the regression, the other variable shows a substantially lower VIF value. Therefore, it does not seem that either *Sales*, *Price Revision*, *Price Revision (-)* or a combination of these variables inflate the standard errors of *Acquirer* substantially enough to relate this to the insignificant

finding in the OLS regression in Table 6. Nevertheless, these indications do not rule out the existence of any such relationship, making it possible that *Acquirer* is to a certain extent inflated.

5.2.2 Endogeneity Analysis

An explanation which I want to explore in more detail for the insignificant result of *Acquirer* in Table 6 is that the regression could be subject to simultaneous causality. In this subsection, I dive deeper into this potential concern as in previous literature the conclusions of predicting acquisition activity with IPO underpricing as regressor are ambiguous. Celikyurt et al. (2010) does not find that underpricing influences the acquisition likelihood. Similarly, Arikan and Stulz (2016) show that underpricing does not exhibit a significantly different acquisition rate among firms within three years after their IPO. Contrary, Hovakimian and Hutton (2010) find that post-IPO acquisitions are significantly influenced by underpricing, but the effect depends on the acquisition payment. If simultaneous causality is present in the model, then *Acquirer* would be correlated with the error term. As a result, the OLS regression is invalid to use as the regression coefficient is not close to the true approximation of the value in this case.

As a solution for the possible simultaneity concern, I use a Two Stage Least Square (TSLS) regression to isolate the hypothesized effect of *Acquirer* from the correlation with the error term. That is, in the first stage of this method I use an instrumental variable (IV) in combination with the control variables to estimate the effect of *Acquirer*. I refer to this estimation as $\widehat{Acquirer}$. In the second stage, I examine how *Underpricing* reacts to $\widehat{Acquirer}$. This method is formulized in regression (3) and (4):

$$(3)\ \widehat{Acquirer} = \beta_0 + \beta_1 Instrumental\ Variable + \gamma Controls + \varepsilon_{it}$$

$$(4)\ Underpricing = \beta_0 + \beta_1 \widehat{Acquirer} + \gamma Controls + \varepsilon_{it}$$

In order to capture the desired effect of *Acquirer* on *Underpricing*, an IV must satisfy the exclusion and relevance restriction. Without meeting these restrictions, the instrument is invalid and produces meaningless results. The exclusion restriction require that the instrument is exogenous. That is, the instrument affects *Underpricing* only through *Acquirer*, but does not cause *Underpricing* on itself. Unfortunately, there is no test available to confirm that an instrument is exogenous. The relevance restriction specifies that the instrument is sufficiently able to predict the variation in the *Acquirer* variable. If instruments explain only little of the variation, then they provide a weak approximation of the sampling distribution of the TSLS estimator $\widehat{Acquirer}$. Therefore, I test whether the instrument is relevant enough by examining whether the first-stage F-statistic is higher than 10. This test mechanism is described by Stock, Wright and Yogo (2002) to check for weak instruments. Overall, the IV must be good predictor of firms becoming acquirers after their IPO, while it should not influence the level of underpricing during their IPO in any other way.

I introduce the variable *Industry Mergers* to use as an IV to predict post-IPO acquisition activity. The variable consists of the prior acquisition activity among public firms in the same Fama and French industry group. This activity is taken over a period of six months before the IPO date. The time frame is deliberately set on a short interval before the IPO as it enhances the probability that the firm would act as acquirer after the IPO date rather than before. I measure acquisition activity as the number of acquisitions in which at least 50% of the shares are acquired in the transaction, resulting in at least a 90% post-transaction ownership. Subsequently, I scale these acquisitions per industry group by the natural logarithm of the number of firms which are listed on the NYSE, AMEX or NASDAQ and belong to the respective industry group at the time of the IPO date. This avoids issues of industry group size, since larger industry groups would otherwise dominate the top values of prior acquisition activity, while it could only be due to the higher number of firms being active in this industry group.

As required by the exclusion restriction for IVs, *Industry Mergers* should not influence *Underpricing* through another way than the increased probability of *Acquirer*. *Industry Mergers* is relevant as it functions as a good proxy for the likelihood of acquisitions within an industry. Celikyurt et al. (2010) supports this idea with the finding that M&A activity of an IPO firm is strongly linked to the degree of M&A activity within their respective industry. Thereby, *Industry Mergers* can influence *Underpricing* through the increased probability of *Acquirer.* For the consideration to what extent *Industry Mergers* could influence *Underpricing* directly, I discuss which aspects from acquisitions of other public firms can cause investors to attach a higher or lower valuation to the respective shares while the offer price remains the same. In this discussion, I focus on how prior market acquisitions are unlikely to influence popular valuation metrics used by investors. These valuation metrics primarily include a multiple analysis and a discounted cash flow (DCF) model (Ernst & Young, 2011).

In terms of the multiple analysis, acquisitions of other public firms cannot change past or current financial items of the IPO firm. Thereupon, when investors value the company with a multiple analysis, only the multiple that is obtained from a peer group could hypothetically change. However, it questionable whether fundamentals of the firm remain comparable to that of the IPO firm after it has completed an acquisition. If such acquisition brings along a substantial difference, it is likely that such firm is not representative anymore. Consequently, the firm is omitted from the peer sample group. A potential downside in this valuation approach could be when a high number of acquisitions occur prior to the IPO date. If that is the case, then it could be more difficult to find representative firms for the peer group. In addition, a trade-off could arise in which investors have to choose between a small sample of high representative firms and a larger sample containing firms that are only in certain dimensions comparable. In either case it could potentially result in a less accurate valuation estimate. Despite this potential uncertainty, there is no distinction that a higher acquisition intensity in the

industry yields this trade-off problem. Therefore, the multiple analysis does not appear to be influenced by the *Industry Mergers* variable.

Concerning the future financial projections in the DCF model, competitor acquisitions has a minimal probability of influencing the expected growth level of the IPO firm. A way in which this could be the case is if acquisitions could influence competitors' competitive advantage over the IPO firm. With such competitive advantage, a competitor is more likely to capture a greater proportion of the market share and hence shrinks revenue projection of the IPO firm. However, this scenario has numerous limitations regarding its existence. For instance, competitor acquisitions do not per definition contribute to a better or worse competitive advantage over an IPO firm. Furthermore, it is highly uncertain whether a firm in the same industry could be considered as a competitor that can influence future earnings projections. For example, firms in the same industry are not necessarily active in the same geographical locations. Alternatively, the Fame and French 12 industry classification represents a broad range of firms with different SIC codes belonging to the same industry group. As a result, not all firms that belong in a specific Fama and French industry deliver a product or service in the same value chain as the IPO firm. Hence, the influence on earnings projections of industry acquisitions that are not active in the same geography or from businesses that do not sell relatable products should be neglectable if not absent. Moreover, it is likely that investors incorporate competitor movements in their DCF models to predict the expected grow of a company. Completed acquisitions of other companies would then be accounted for during the announcement or even earlier in such models. Therefore, I do not suspect that prior industry acquisitions influence future cash flow projection of an IPO firm.

Apart from a direct link between the IV and *Underpricing*, I recognize that there could be an indirect link as *Industry Mergers* can be a proxy of industry shocks. In that scenario, higher or lower underpricing could be more dependent on exogenous factors influencing financial projections rather than the uncertainty related to acquisitions. I tackle this potential criticism by looking to what extent industry shocks can be predicted from my IV. In the opinion of Harford (2005), merger waves occur primarily through industry shocks. As such, I replicate the *Merger Waves* variable of Harford (2005) to use this as a proxy for industry shocks and look whether this can significantly explain a part of the underpricing. Adding *Merger Waves* to the original OLS regression does not provide any indication that this variable has an impact on *Underpricing*. Consequently, it is irrelevant for the exclusion restriction to determine whether *Industry Mergers* can predict *Merger Waves* as this variable does not influence *Underpricing*.

Overall, the reasoning of both valuation metrics and the weak relation between *Merger Waves* and *Underpricing* suggests that the *Industry Mergers* instrument variable meets the exclusion requirement. However, I acknowledge that the discussion does neither provide certainty that *Industry*

Table 8: Estimate Acquirer Underpricing

A TSLS regression to control for the possibility of simultaneous causality between *Acquirer* and *Underpricing*. Model 1 contains the first-stage regression results with *Acquirer* as dependent variable. Model 2 represents the second stage of the regression with *Underpricing* as dependent variable. *Industry Mergers* is the number of acquisitions in the prior 6-months to the IPO date divided by the natural logarithm of the number of listed firms, respectively for the matching Fama French 12 industry group classification. *Instrumented acquirer* represents the TSLS estimator $\widehat{Acquirer}$, which contains the predicted values for *Acquirer* from model 1. The other variables are specified in the same manner as stated in Table 6. Fixed effects include year effects. The level of significance presented as *, ** or *** for 0.10, 0.05 or 0.01 respectively. The t-statistic is beneath the regression coefficient in parentheses.

Variable	Model 1 Acquirer	Model 2 Underpricing
Industry Mergers	0.009***	
	(6.39)	
Instrumented Acquirer		10.592*
		(1.77)
Sales	0.024*	-0.961**
	(1.76)	(-2.15)
Debt	-0.046**	-3.872
	(-2.22)	(-1.25)
Price Revision	-0.002	0.926***
	(-1.14)	(5.37)
Price Revision (-)	0.008***	-0.750***
	(3.37)	(-3.26)
Share Overhang	0.070*	6.963**
	(1.83)	(2.50)
P/V multiple	0.001	0.838
	(0.04)	(0.66)
NASDAQ index	-0.005	15.128***
	(-0.06)	(3.13)
Constant	0.033	4.553
	(0.24)	(0.57)
Year dummies	Yes	Yes
Industry dummies	No	No
Cluster on quarter	Yes	Yes
Adjusted R^2	0.114	0.307
Observations	866	866

Mergers influences *Underpricing* on itself nor indirectly. In the scenario that *Industry Mergers* is not exogenous, then it is unable to define the exogenous variation in the TSLS estimator $\widehat{Acquirer}$. Hence, the IV fails to provide a consistent estimate of *Acquirer*. In that sense, the TSLS regression provides only an additional insight, but is not able to replace the findings of the OLS entirely.

Table 8 shows the output of the TSLS regression, in which *Acquirer* is instrumented through *Industry Mergers*. Model 1 represents the first-stage regressions where the dependent variable is $\widehat{Acquirer}$. The second stage of the regression is visible in model 2 and has *Underpricing* as dependent variable. I omit industry fixed effects from the regression as *Industry Mergers* has a high correlation to most industry groups and has together with the industry groups a substantial higher VIF value. This observation suggests that the IV captures at least part of the effect which the industry fixed effects

explain in standard OLS regression. The exclusion is therefore necessary as it provides more certainty that the IV is not endogenous by itself.

The results in Table 8 suggest that the IV is a relevant predictor of the TSLS estimator. In model 1, *Industry Mergers* is significant at the 1% level for the estimation of *Acquirer*. In addition, the first-stage F-statistic is larger than 10 (Table A3.2 in the appendix). Nevertheless, the F-statistic as well as the partial R^2 is relatively low, which implies that *Industry Mergers* is not the strongest IV. On the other hand, the scores are high enough to reject the null hypothesis that the instrument is weak. In combination with the argumentation for the exogeneity of *Industry Mergers*, this infers that my IV satisfies both exclusion and relevance restriction.

Nonetheless, the results of the TSLS regression concerning the influence of *Acquirer* indicate a similar conclusion as the OLS regression. The instrumented variable of *Acquirer* is not significant at the 0.05 level in the second stage of the regression in Table 8. Therefore, the simultaneity concern is not a suitable explanation to completely explain the insignificant regression coefficient of *Acquirer* in the earlier observed OLS regression. On the other hand, the best estimate of the regression coefficient for *Acquirer* changes substantially from 0.377 to 10.592 when applying a TSLS regression rather than an OLS regression. In addition, the statistical inference for this variable increases substantial and is in a relatively close approximation of the formalized significance threshold of 0.05. In that perspective, the TSLS regression provides an indication that *Acquirer* could become a significant factor in a larger sample research. While this may be applicable, I have to reject H1 with my results as there is not enough evidence that the acquisition characteristic cause significantly higher underpricing.

A limitation of the TSLS approach is that I treat the estimator of *Acquirer* as a linear regressor in the second stage of the regression, while *Acquirer* is a binary variable. This issue arises as the first stage of the regression is an OLS rather than a probit or logit model. Hence, most estimates are unequal to zero or one. However, this would not be a problem as estimates are only intended to give an approximation of the true probability for an interval of values. As a result, this linear probability model provides marginal effects at the mean and are consistent with TSLS estimates, although it is less efficient than in the scenario that the endogenous variable has a linear nature. In addition, this method is preferable to the output function of a non-linear first stage as in that approach very restrictive assumptions hold for the estimator to be uncorrelated with the error term (Wooldridge, 2002).

Lastly, I apply a postestimation tool to test whether treating *Acquirer* as an endogenous variable is correctly. The regression-based test statistic is insignificant at the 0.05 level (Table A3.3 in the appendix). Therefore, I fail to reject the null hypothesis that this variable is exogenous, although the close proximity towards this threshold implicates that the endogeneity concerns are legitimate. A consequence of interpreting the variable as exogenous is that there is no necessity for using a TSLS

approach as the coefficients in an OLS regression generally suits better the genuine effect of exogenous variables.

5.2.3 Acquirer Dimensions Analysis

In this part of the result section, I replace the M&A activity variable with the acquirer categories of duration and frequency separately. This allows me to look closer at whether a more specific definition of acquirer involvement results into different observations. Starting with the duration of acquirers, Table 9 shows the regression output for the short-term acquirers and medium-term acquirers. The results in model 1 and 3 show that *Short* and the corresponding interaction term with *Prospectus* are significant determinants of *Underpricing*. However, the *Prospectus* on itself does not have enough evidence to assume that it is different from zero. In model 1, the positive coefficient for the *Short* variable indicates that firms observe on average 5.0% higher underpricing if they acquire a company within a year after their IPO. However, when such firm had indicated in their prospectus that it had the intention to acquire another business, the combined *Short* and interaction effect becomes -2.9%. Thus, the regression indicates that short-term acquirers who mention acquisition plans in the use of proceeds section of the prospectus observe on average a lower level of underpricing, controlling for other influential factors. The insignificant t-statistic of *Medium* suggests that acquisitions later than one year after the IPO does not influence the level of underpricing. Similarly, the *Prospectus* variable and interaction term with *Medium* are insignificant. This implies that these coefficients cannot be interpreted to have any effect on underpricing.

Since the medium-term acquisition characteristic cannot be assumed to be different from zero, the output suggests that short-term acquirers experience more underpricing than medium-term acquirers if the firm does not disclose information about a potential future acquisition in the prospectus. This conclusion provides inadequate evidence to accept the argumentation for my second hypothesis as the characteristic of short-term acquisitions do not systematically lead to higher underpricing. Also, the prior differences of means test did not find a significant difference. As such, H2 is rejected.

The asymmetric effect of *Short* can be clarified by the possibility that short-term acquirers that do mention acquisition plans in their prospectus provide more specific information. Given the time to process an acquisition deal, short-term acquirers tend to possess a more defined acquisition plan in comparison to firms belonging to other acquirer dimensions during the IPO process. As such, investors would be better able to the predict acquisitions in firms that are short-term acquirers because there is potentially more information to gain through the prospectus or other sources. Hence, this can translate in lower ex-ante valuation uncertainty when these firms disclose valuable information considering acquisition activity in their prospectus. Contrary, not disclosing this information in the prospectus leads to higher ex-ante valuation uncertainty as is suggested by the observations in Table 9.

Table 9: Acquirer Duration Underpricing

An OLS regression where the percentage of underpricing is the dependent variable. *Short* is a dummy variable representing 1 if the firm acquires a company within one year after the IPO and 0 otherwise. *Medium* is a dummy variable representing 1 if the firm makes their first post-IPO company acquisition later than one year after their IPO, but within three years and 0 otherwise. The other variables are specified in the same manner as stated in Table 6. Fixed effects include year and industry effects. The standard errors are clustered per quarter. The level of significance presented as *, ** or *** for 0.10, 0.05 or 0.01 respectively. The t-statistic is beneath the regression coefficient in parentheses.

Variable	Model 1	Model 2	Model 3
Short	5.042**		4.462**
	(2.47)		(2.26)
Medium		-1.226	-0.126
		(-0.53)	(-0.05)
Prospectus	2.178	-0.152	2.075
	(1.05)	(-0.07)	(0.81)
Prospectus x Short	-7.894**		-7.198**
	(-2.48)		(-2.02)
Prospectus x Medium		1.653	-0.603
		(0.49)	(-0.17)
Sales	-0.895	-1.064	-1.089
	(-1.21)	(-1.37)	(-1.38)
Debt	-4.081	-4.513	-4.480
	(-1.61)	(-1.49)	(-1.46)
Price Revision	0.903***	0.881***	0.887***
	(5.18)	(5.03)	(5.11)
Price Revision (-)	-0.666***	-0.638***	-0.651***
	(-3.06)	(-2.89)	(-3.00)
Share Overhang	7.605**	7.747**	7.632**
	(2.60)	(2.54)	(2.52)
P/V multiple	0.722	0.475	0.504
	(0.55)	(0.35)	(0.37)
NASDAQ index	14.975***	16.502***	16.451***
	(3.25)	(3.32)	(3.38)
Constant	-1.225	1.013	0.002
	(-0.30)	(0.23)	(0.00)
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
Cluster on quarter	Yes	Yes	Yes
Adjusted R^2	0.356	0.361	0.362
Observations	907	861	861

An alternative explanation for the higher level of underpricing for short-term acquirers is that these firms had a higher incentive to establish a successful IPO and thereby being able to make a positive NPV acquisition. However, if this would be the case, then one might expect that the higher level of underpricing is independent of disclosing this information in the prospectus as it does not alter the incentive of the firm for a successful completion of the IPO. Since disclosing this information has a higher absolute effect on the level of underpricing than the post-IPO acquisition, it is less likely that this reasoning holds to explain the observable effect.

Apart from duration, the acquisition frequency could give another insight into characteristics of post-IPO acquirers. Table 10 displays the regression output in which the M&A variables are single

Table 10: Acquirer Frequency Underpricing

An OLS regression where the percentage of underpricing is the dependent variable. *Serial* is a dummy variable representing 1 if the firm acquires two or more companies within three year after the IPO and 0 otherwise. *Single* is a dummy variable representing 1 if the firm acquires one company within three year after the IPO and 0 otherwise. The other variables are specified in the same manner as stated in Table 6. Fixed effects include year and industry effects. The standard errors are clustered per quarter. The level of significance presented as *, ** or *** for 0.10, 0.05 or 0.01 respectively. The t-statistic is beneath the regression coefficient in parentheses.

Variable	Model 1	Model 2	Model 3
Serial	-1.236		-0.092
	(-0.55)		(-0.04)
Single		4.686*	4.600*
		(1.79)	(1.80)
Prospectus	1.001	0.882	2.103
	(0.44)	(0.45)	(0.82)
Prospectus x Serial	-1.544		-2.659
	(-0.47)		(-0.76)
Prospectus x Single		-3.688	-4.864
		(-1.09)	(-1.32)
Sales	-0.987	-1.082	-1.030
	(-1.28)	(-1.39)	(-1.32)
Debt	-4.529	-4.458	-4.468
	(-1.50)	(-1.47)	(-1.47)
Price Revision	0.884***	0.888***	0.890***
	(5.05)	(5.10)	(5.11)
Price Revision (-)	7.740**	7.659**	7.631**
	(2.51)	(2.52)	(2.51)
Share Overhang	-0.640***	-0.658***	-0.656***
	(-2.88)	(-3.00)	(-3.00)
P/V multiple	0.519	0.470	0.507
	(0.38)	(0.35)	(0.37)
NASDAQ index	16.368***	16.711***	16.578***
	(3.39)	(3.42)	(3.43)
Constant	0.923	0.354	0.267
	(0.22)	(0.08)	(0.06)
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
Cluster on quarter	Yes	Yes	Yes
Adjusted R^2	0.362	0.363	0.362
Observations	862	862	862

and serial acquirers. The t-statistic for the *Serial, Prospectus* and interaction term between the two indicates that there is not enough evidence to assume that these factors have an influence on the level of underpricing. For the *Single* variable there is some evidence of higher underpricing. Yet, this is not enough to reject the null hypothesis at a confidence level of 0.05. Also, the *Prospectus* and interaction term for *Single* are both insignificant. This means that all independent variables of M&A activity for acquirer frequency are not significant, which is the same outcome as Bessler and Zimmermann (2011) find. The implication of these findings, in combination with the outcome of the differences of means test for acquirer frequency, is that I reject H3.

A possible explanation for the insignificant results for the M&A activity variables is that the acquisition frequency is related to the time period and industry. For instance, Maksimovic et al. (2013) indicate that M&A activity tends to be influenced by financial factors in time. Thereby, the probability that a firm becomes a serial acquirer instead of a single acquirer could be more influenced due to the favourable market conditions in a specific time period, rather than the prior-IPO recognition of valuable growth options through acquisitions. Similarly, Harford (2005) indicates that merger waves can occur as a result of industry shocks. This increases the probability of a specific industry to engage in more acquisitions, which could be different than initially intended prior to the IPO. If such positive market condition and industry shock occur after the IPO without prior predictability of it, then this cannot be incorporated in the predictability of acquisition frequency and possibly the level of underpricing.

Another explanation for the insignificant results is that ignoring the transaction value in the acquisitions has an impact on the underlying uncertainty from the acquisitions. That is, the number of acquisitions defines to which group of acquirers a firm belongs in this research. Nevertheless, if a firm spends a relatively small amount of the IPO proceeds on two acquisitions, then this would present less valuation uncertainty than in the scenario where a firm utilizes a majority of the IPO proceeds to make one acquisition. Hence, the unevenness in the ratio of use of proceeds on future acquisitions can affect the extent to which acquisition frequency can influence underpricing as underlying ex-ante valuation uncertainty could be less accurately defined per acquirer category.

5.2.4 Target Analysis

Next, I switch the focus from the acquirer side of the M&A spectrum to firms that are sold after their IPO. In Table 11, the regression output is visible in which I use target as M&A activity category. The OLS results for the *Target*, *Prospectus* and the interaction term are insignificant, meaning that selling the firm after the IPO does not seem to influence underpricing during the IPO. Thereupon, H4 is similarly to the other hypotheses rejected as there is not enough evidence for lower underpricing among targets.

This finding is contradicting to what Zingales (1995) predicts as cash flow rights do not appear to be maximized if underpricing is not significantly lower compared to other IPOs. Nevertheless, the *Share Overhang* variable emphasizes that initial shareholders who sell a greater proportion of their company during the IPO tend to have more underpricing than issuers that retain a greater percentage of the shares. If initial investors want to exit the firm through an IPO, this observation shows that there is an opportunity to potentially maximize profits if not all shares are sold immediately, but rather through a two-staged sale.

Table 11: Target Underpricing

An OLS regression where the percentage of underpricing is the dependent variable. *Target* is a dummy variable representing 1 if the firm is taken over by another company within three years after the IPO and 0 otherwise. The other variables are specified in the same manner as stated in Table 6. Fixed effects include year and industry effects. The standard errors are clustered per quarter. The level of significance presented as *, ** or *** for 0.10, 0.05 or 0.01 respectively. The t-statistic is beneath the regression coefficient in parentheses.

Variable	Model 1	Model 2
Target	-0.699	1.155
	(-0.42)	(0.46)
Prospectus		1.074
		(0.51)
Prospectus x Target		-3.793
		(-0.96)
Sales	-1.126	-1.060
	(-1.64)	(-1.36)
Debt	-4.557	-4.497
	(-1.48)	(-1.49)
Price Revision	0.857***	0.855***
	(4.94)	(4.92)
Price Revision (-)	-0.613***	-0.612***
	(-2.78)	(-2.78)
Share Overhang	7.724**	7.640**
	(2.64)	(2.49)
P/V multiple	0.496	0.577
	(0.36)	(0.42)
NASDAQ index	16.572***	16.886***
	(3.44)	(3.44)
Constant	1.468	0.476
	(0.31)	(0.11)
Year dummies	Yes	Yes
Industry dummies	Yes	Yes
Cluster on quarter	Yes	Yes
Adjusted R^2	0.347	0.346
Observations	853	853

As the M&A variable is not significant, it remains interesting why in Table 2 it is visible that 12.6% of the IPO firms are sold within three years after their IPO. Gao et al. (2013) observe a similar percentage and Maksimovic et al. (2013) indicate that this is substantially higher than the takeover rate for private and other public firms. An explanation for the insignificant effect of post-IPO target data on underpricing is that the decision to sell-off the entire company is more often made after the IPO rather than before. Previous literature provides arguments why post-IPO companies are more often acquired than private and more mature public firms. For instance, an IPO generates analyst coverage and a lot of new publicity through media attention, regardless of substantial underpricing. The publicity and the publicly available information of these firms result in lower search costs for interested companies that are looking for acquisition opportunities (Capron & Shen, 2007). Another clarification for a post-IPO selling decision is that the IPO firm was unable to grow fast enough to establish a profitable market position. Thereupon, if it is not able to acquire another firm to establish such position, it could become more rewarding to get acquired by another firm rather than relentlessly

waiting for such opportunity to occur (Gao et al., 2013). This would also explain why 50% of the *Target* firms indicate future acquisitions as a source of use of proceeds in their prospectus (see Table 2) as well as the observation that 48 out of the 128 firms acquire a firm before they are acquired themselves.

5.3 Robustness Check

Regarding the robustness of the regression results, I examine whether the results remain the same when including or moderating several steps in the testing process. In some test phases, contradicting assumptions exist concerning which method is more suitable to use. In this section, I inspect whether different choices regarding the construction of the M&A variables, the usage of control variables and the dealing with standard errors influences the findings of this paper.

First, I check the M&A activity variable. One adjustment is to enhance the time span after the IPO from three to five years. This allows me to evaluate the M&A activity effects in an equally large time span as Celikyurt et al. (2010) uses to test the relation between IPOs and takeovers. The disadvantage is that an IPO and subsequent acquisition become more unassociated. In addition, I also check whether formulating a continuous string variable, that considers the days between the IPO and the M&A activity, has the same impact on the level of underpricing. Hovakimian and Hutton (2010) construct similarly a time variable. The downside of this variable is that it considers only the first time a firm acquires another company. Thereby, it is not applicable to test this alteration for the frequency of acquisitions.

Furthermore, Butler et al. (2014) give as explanation for contradicting results in previous IPO underpricing literature that researches barely uses the same control variables as determinants of first-day IPO returns. If inappropriate or too few control variables are used, the independent variable becomes sensitive to omitted variable bias. As a result, the effect of the independent variable could be incorrectly interpreted. Therefore, I examine whether including additional control variables from this benchmark alters the results of M&A activity in the OLS regressions of the prior section. It concerns the following variables: (1) news stories, (2) investment bank, (3) prior 30-day average underpricing, (4) prior 30-day average offer price revision, (5) prior 30-day industry return[13], and (6) prior 30-day standard deviation of industry return. See in the appendix section A2 and Table A3.6 for additional information concerning these variables. The inclusion of these variables does not have a distinctive impact on the level of underpricing and are all insignificant. This is different than Butler et al. (2014), who observes that these variables are robust throughout time. An explanation for this difference is that their research uses a substantial higher volume of observations. Thereby, the distribution is more

[13] Although Butler et al. (2014) uses the 49-industry classification described by Fama and French (1997), I maintain the 12-industry classification as more specific industry groups result in a low number of firms in the uncommon industry groups. Therefore, this more explicit industry classification captures too much the individual firm effect, rather than that of the industry.

likely to be normally distributed and hence the effects are better captured. In addition, the decreasing number of IPOs in the beginning of the 21st century (Gao et al., 2013) has a negative effect on the predictability of the information spill-over variables. That is, if a lower number of IPOs are initiated, then the value of the average prior day is more dependent on an individual occasion causing the impact on next IPOs to shrink (Benveniste, Ljungqvist, Wilhelm Jr, & Yu, 2003). Therefore, it can be due to the different time-setting that these variables miss explanatory power.

In addition, I apply several alterations to some of the control variables as this could be more applicable in my research. One of these alterations is to control for the high number of firms that have non-positive sales. As seen in the descriptive statistic section, a disproportional fraction of the observations is in the bottom tail of the sample. Within this subsample, a much higher standard deviation and a substantial lower mean of underpricing is observable. This observation is similar to what Signori (2018) detects in European data with firms that have low sales values. Therefore, I check whether excluding these observations or adding a dummy for the low values and interaction term changes the effect of sales on underpricing. Moreover, I include a dummy for the firms that are compliant as EGC companies for the time period after the JOBS act. Barth, Landsman and Taylor (2017) shows that EGC firms have higher information uncertainty resulting in higher underpricing compared to similar firms before the JOBS act. Given the high sales threshold, a very large fraction of the firms is recognised as an EGC. As a result, the effect is presumably already captured by the year fixed effects, which indicate in the years after 2011 strongly significant higher underpricing. Including a dummy for the EGC firms violates the multicollinearity threshold, which is an indication that the year fixed effects indeed capture this effect. For the variables investment bank reputation, prior underpricing and prior price revision from Butler et al. (2014), I extend the time frame of calculations to reduce high volatility and dependence on single observations in these variables. Intuitively, the downside is that the extension of the time periods assumes equal importance of observations across time, whereas this is less likely to be the case than in the standard situation.

Moreover, the distribution of the observations could contain outliers if the data from the sources was incorrectly stated in their databases. I look at the distribution of the observations in histograms to detect potential outliers. If observations have extreme values compared to the median, then these values could be potentially outliers. In that scenario, I winsorize the variable data to examine the impact on the regression results without these extreme value observations. Notably, this method does not yield enough information to mark values as outliers, since there is no proof that these values are not genuine. Therefore, this specific robustness check is mainly for controlling purpose in the case that the sample does suffer from outliers.

Lastly, I control for different assumptions concerning standard errors. For instance, standard errors can be differently clustered than through time. Harford (2005) suggests that IPOs cluster per industry. Therefore, I examine the influence of clustering the standard errors by industry.

Introducing all the above alterations separately to the sample or the setup of the regression does not yield substantial changes to the conclusions in this paper. The only alteration is that when including all controlling variables of Butler et al. (2014) the interaction term between *Prospectus* and *Short* falls just below the 0.05 significance threshold. The other t-statistics of independent and control variables remain significant, whereas the coefficients of all variables remain in the same the direction. Therefore, apart from the possible deviation in significance of the interaction term between *Prospectus* and *Short*, all other results are robust.

6. Concluding Remarks

In this paper, I research the relation between post-IPO M&A activity and the level of underpricing. This area in the IPO underpricing literature is relatively unexplored, despite previous research indicating that newly public firms are to greater extent involved in company transaction at both buying and selling side. I reflect on this possible relationship by arguing that either intentional low offer price setting or that if investors are able to predict M&A activity plans in IPO firms, then post-IPO M&A activity can contribute to ex-ante valuation uncertainty among investors and underpricing. I evaluate within M&A activity four categories, in which I have different predictions regarding its influence on underpricing.

My findings indicate that there is little evidence to suggest that post-IPO acquisition activity has an impact on first-day returns of the firms. For the group of acquirers, I observe significant higher underpricing than in firms that do not acquire other firms after their IPO. However, this difference in acquisition activity tends not to explain the higher underpricing when controlling for other firm, ownership and market characteristics. Regarding the duration category of acquisitions, I find that the short-term acquirer characteristic explains part of the deviation in the level of underpricing. The direction of this variation is dependent on whether such firm had indicated future acquisition plans in their prospectus, which makes the difference with medium-term acquirers asymmetric. This finding supports the hypothesized effect of ex-ante valuation uncertainty on underpricing in some aspects. In addition, my findings for both acquisition frequency and target do not display any form of evidence to indicate that these factors have an impact on first-day returns. The conclusion from all the findings implicate that post-IPO M&A activity is barely incorporated in the first-day returns in the IPO market.

The findings in this paper enlarge the understanding of the effect of future M&A activity on IPO underpricing. Despite the majority of insignificant test results, I provide a fundament that the level of underpricing is at least to some extent influenced by acquisitions that occur shortly after an IPO. Where researchers such as Hsieh et al. (2011), Hovakimian and Hutton (2010) and Arikan and Stulz

(2016) interpret underpricing to be a potential explanatory factor of M&A activity, I find suggestive evidence that a reversed relationship exists. My analysis shows that further research may be desired to safeguard correct interpretations of regression estimates in researches that examine a relationship between these factors.

I recognize several areas for further research to extend the scope of this research. First, academics can examine announcement returns when post-IPO acquirers announce an acquisition. This paper looks at whether information about the predictability of M&A activity is priced into the shares at the first day of trading. If that is the case, then lower absolute price adjustment should be recorded after the announcement of any M&A event as less new information is released into the market. Further research could investigate whether this effect is observable. Secondly, further research can examine to what extent the inclusion of transaction value data on post-IPO acquisitions has an impact on the level of underpricing. With this data, additional insight in the degree of influence from M&A activity on future cash flow projections can be obtained. That is, when firms spend a higher percentage of the proceeds on acquisition activity, it is more likely that a greater extent of the financial projections is dependable on the profitability of such acquisitions. Thirdly, researchers can look at how the comprehensiveness of the use of proceeds section can influence the ex-ante valuation uncertainty among investors. The degree of details that this section discloses is likely to be different in each offering. Prospectuses with more detailed information about future acquisitions have more informative power on the predictability of future acquisitions. Further research could examine with content analysis whether including a higher degree of information disclosure in the use of proceeds section contributes to the level of underpricing.

Appendix

A.1 Control Variables

In this section of the appendix, I elaborate on the construction of the control variables that I use in my empirical tests. Behind every computation of the variable that uses firm, ownership or market data, I indicate in parentheses the database from which this data stems and the corresponding abbreviation that links to that data source. After the construction, I discuss how these variables influence underpricing according to previous papers.

- ***Sales*** – concerns the natural logarithm of one plus the net sales (Compustat, REVT) of a firm within one year prior to the IPO. This is a proxy to indicate the size of a firm (Aruğaslan et al., 2004). Ritter (1984) indicate that the size of a firm influences the ex-ante valuation uncertainty as the difficulty of valuing a firm is negatively related to their size. Butler et al. (2014), Aruğaslan et al. (2004) and Purnanandam and Swaminathan (2004) find that this variable has a (weakly) significant negative effect on the level of underpricing.

- ***Debt*** – concern the total liabilities (Compustat, LT) divided by the total assets (Compustat, AT) of a firm. These data items look at the reported values within one year before the IPO offer date. Butler et al. (2014) find a negative significant relation between this firm characteristic and the level of underpricing.
- ***Price revision*** – considers the difference between offer price and the middle of the original file price range, divided by the middle of the original filing price range. The offer price (USPR) and the file range prices (AH_HFILE and AH_LFILE) stems from Thomson One. Hanley (1993) argue that underwriters only partially adjust the pricing range to reward prospective investors for truthfully revealing pricing information of stocks. Consequently, a positive price revision would yield in more underpricing in such an offering. Cliff and Denis (2004) confirm that underpricing in IPOs is positively related to the offer price revision from the preliminary prospectus towards the final offer date.
- ***Price revision (-)*** – considers the negative values of the *Price revision* variable. Lowry and Schwert (2004) find that the absolute percentage value from midpoint filing range to offer price of a negative price revision is significantly different from a positive price revision. Thereby, this variable allows to capture the effect of price revisions more accurately.
- ***Share overhang*** – considers the natural logarithm of one plus the secondary shares retained divided by the shares offered (Thomson One, TOT). I calculate the secondary shares retained by subtracting the total shares sold, including allotment option (Thomson One, TOTSHOVSLD), from the total number of outstanding shares (CRSP, SHROUT). Note that some firms have multiple share classes. If this is the case, the number of shares outstanding represents the number of all share classes. I use Ritter (2019) and the Thomson One database to determine which firms have multiple share classes on the time of issue, as discussed in section 3.
- ***P/V multiple*** – considers the natural logarithm of the ratio of market price to sales of an IPO firm, divided by the same ratio from a market peer sample of firms that are in the same Fama and French industry group. The market price for IPO firms is the offer price (Thomson One, USPR) multiplied by the total shares outstanding after the IPO. For the peer sample, the market price is the fiscal closing price (Compustat, PRCC_F) multiplied by the common shares outstanding (Compustat, CSHO). This is subsequently divided by the annual firm sales (Compustat, REVT) to get the ratio for an IPO firm and for the Fame and French industry peer sample group. The peer sample group consists of the entire database in Compustat, from which I subtract firms that do not meet the minimum dollar and non-ordinary common share restrictions that I also apply to the main dataset. Subsequently, I apply the GVKEY as identifier to obtain the correct SIC codes (SICCD) and common shares outstanding from CRSP. Through matching the CRSP SIC code I allocate the firms in the corresponding Fama and French industry

groups. Also, to assure that these firms have not been influenced by an IPO, I omit firms from the peer group that have initiated an IPO three years prior to a matching IPO firm in my dataset. From these firms, I construct a 12-month rolling average of the market value to sales ratio and link that to the Fama and French industry group. Finally, I link firms in my dataset to the one-month lagged ratio of their respective Fama and French industry group. This matching approach is the same as described by Purnanandam and Swaminathan (2004). They find that the *P/V multiple* of sales, EBITDA and earnings have a significant positive effect on the first-day returns of an IPO.

- ***NASDAQ index*** – considers the average return of the equal-weighted NASDAQ index in the previous 30 trading days. The data stems from CRSP (EWRETD). Information about the market that indicates a downward sloping trend before the IPO offer date leads to a negative revision of the value expectation of a firm. This expectation reflects both the lower firm value through worse future market conditions and the increasing demand in a falling market according to Hanley (1993). He, Lowry and Schwert (2004) and Bradley and Jordan (2002) find that there is a positive and significant effect of prior *NASDAQ index* on the level of underpricing. Lowry and Schwert (2002) observe the coefficient for the *NASDAQ index* to be insignificant in their OLS regression for the previous 15 trading days, which may implicate that the effect is not always observable.

A.2 Other Variables

- ***News stories*** – considers the natural logarithm of one plus the number of full text hits in the LexisNexis News and Wire database for US data in the six months prior to the IPO. The search string in the database consists of the company name with possible alterations for the observations that include "Corporation", "Incorporated" and "Technology" in their name. These alterations are necessary as some media refer to the abbreviations. Therefore, I end the search strings with "Corp!", "Inc!" and "Tech!" to replace these terms, respectively. Part of the news stories data originates from the dataset of Butler et al. (2014), which is publicly available[14]. Through the PERMNO identifier, I can match the number of news stories of a company to the corresponding firm in my database. I deal with missing data for firms in this period in the same way as for the other firms in the sample outside this period. The *News Stories* variable is proxy for the pre-issue publicity of an IPO firm. Cook, Kieschnick and Van Ness (2006) find that prior IPO publicity is positively related to underpricing.
- ***Investment bank*** – considers the total offer value of IPOs in which investment bank *x* acts as leading underwriter in year *n* and is divided by the total offer value of all US IPOs in year *n*. The

[14] To find their data, search the following website: https://sites.google.com/site/mockeefe/Data

offer value of a single IPO firm in this context is the shares offered (Thomson One, TOT) multiplied with the offer price (USPR). I assign full credit of the offer value to the leading underwriter of the IPO. I use data from Thomson One (BOOK) to identify the leading underwriter. Alternatively, if this data is not available, I use the prospectus. This variable is a proxy for underwriter reputation, where Carter (1998) finds that underwriters with a higher reputation have lower first-day underpricing. Also, Bradley and Jordan (2002) find that the market share of the underwriting investment bank is significantly positively related to initial returns in an IPO.

- ***Prior underpricing*** – considers the average first-day returns from other companies in previous completed IPOs that occurred in the past 30 calendar days before the IPO offer date of the firm of interest. Edelen and Kadlec (2005) argues that the issuing party should adjust their offer price to information of how economic shocks influence prior underpricing. Bradley and Jordan (2002), Lowry and Schwert (2002) and Loughran and Ritter (2002) observe a significant positive autocorrelation in first-day IPO returns.
- ***Prior price revision*** – considers the average price revision in previous completed IPOs that occurred in the past 30 calendar days before the IPO offer date of the firm of interest. Edelen and Kadlec (2005) argue that prior price revision can reveal private spill-over information from other IPOs. For instance, the demand of shares in prior IPOs are likely to reflect investor sentiment which is applicable for other IPOs as well. Edelen and Kadlec (2005) show that the price revision of the previous completed IPOs has a significant positive effect on the first-day returns of an IPO.
- ***Prior industry return*** – considers the average prior 30 day return for the industry group based on the Fama and French 12 industry classification. Data for the industry returns originate from the Ken French website. Edelen and Kadlec (2005) argues that the offer price is partially adjusted to this public information as it reveals how economic forces are priced in public firms. They and Butler et al. (2014) indicate that this industry return variable has a significant positive effect on the level of underpricing.
- ***Prior SD*** – considers the standard deviation (SD) in the prior 30 days return per industry group. I calculate this through subtracting the return on day *i* from the average 30-day return and take the square of this value. Next, I sum this for every observation of *i* and take the square root of this summed number to get the SD. Ljungqvist and Wilhelm Jr (2002) argue that bigger deviations result in higher ex-ante valuation uncertainty as investors are less able to predict how macroeconomic factors will influence the performance of a company. As mentioned by Beatty and Ritter (1986), higher ex-ante valuation uncertainty is related to higher levels of underpricing. Butler et al. (2014) provides empirical support that this factor influences

underpricing; he finds that a higher standard deviation of industry returns is significantly and positively related to the level of underpricing.

A.3 Tables

Table A3.1: Test of Equal Variances

The table reports the p-values of the Levene (1960) and Brown and Forsythe (1974) robustness test for equality of variances between groups. The differences of means test numbers refer to (1) *Acquirer* vs. *non-acquirers*, (2) *Short* vs. *Medium* (3) *Serial* vs. *Single* (4) *Targets* vs. *non-targets* as presented in Table 4. The level of significance is presented as *, ** or *** for 0.10, 0.05 or 0.01 respectively.

Test statistic	**Differences of means test**			
	(1)	(2)	(3)	(4)
Mean	0.255	0.167	0.095*	0.200
Median	0.759	0.258	0.329	0.289
10% trimmed	0.614	0.208	0.227	0.284

Table A3.2: IV Wald Relevance Test

The table shows the first-stage regression summary statistics for judging the explanatory power of the instruments. The F-statistic should be higher than 10 (Stock, Wright & Yogo, 2002) in order to reject the weak instrument test.

First-stage regression summary statistic				
Variable	Adjusted R^2	Partial R^2	F-statistic	Probability
Acquirer	0.114	0.041	40.854	0.000

Table A3.3: Exogenous Test Acquirer

The table shows the Durbin (1954), Wu-Hausman (Wu, 1974; Hausman, 1978) and robust (Wooldridge, 1995) test for endogeneity concerning the variable *Acquirer*. The null hypothesis in each test is that *Acquirer* can be treated as exogenous.

Test	Test-statistic	Probability
Durbin Chi2-statistic	2.10	0.147
Wu-Hausman F-statisitic	2.05	0.153
Robust F-statistic	3.58	0.064

Table A3.4: M&A Activity Correlation Analysis

The table shows the Pearson correlation between the post-IPO M&A activity variables *Short*, *Medium*, *Serial*, *Single* and *Target* and the regressors which I use in the OLS regressions. These OLS regressions are presented in Table 9, 10 and 11. In parentheses, I report the p-values of the correlation coefficient.

M&A type	Sales	Debt	Price Revision	Price Revision (-)	Share Overhang	P/V multiple	NASDAQ index
Short	0,123	-0,054	0,116	0,140	0,060	-0,030	0,028
	(0.0001)	(0.0888)	(0.0002)	(0.0000)	(0.0547)	(0.3655)	(0.3763)
Medium	0,111	-0,019	0,096	0,091	0,069	-0,036	-0,038
	(0.0006)	(0.5655)	(0.0030)	(0.0047)	(0.0340)	(0.2900)	(0.2398)
Serial	0,188	-0,080	0,155	0,155	0,116	-0,054	0,002
	(0.0000)	(0.0131)	(0.0000)	(0.0000)	(0.0003)	(0.1144)	(0.9552)
Single	0,024	0,014	0,043	0,069	0,016	-0,005	-0,015
	(0.4534)	(0.6654)	(0.1885)	(0.0331)	(0.6168)	(0.8883)	(0.6337)
Target	-0,023	-0,026	-0,039	-0,025	0,005	-0,018	0,028
	(0.4756)	(0.4168)	(0.2282)	(0.4450)	(0.8768)	(0.5979)	(0.3956)

Table A3.5: Variable Inflated Factor Multivariate Regressions

The table shows the Variable Inflated Factor (VIF) values of the independent and control variables in the OLS regression for underpricing of Table 9, 10 and 11, respectively in panel A, B and C.

Panel A: Acquirer duration						
Mean	Short	Prospectus	Prospectus*Short			
2.16	2.20	1.68	2.64			
Sales	Debt	Price Revision	Price Revision (-)	Share Overhang	P/V multiple	NASDAQ index
3.51	1.06	4.51	4.36	1.40	2.41	1.26
Mean	Medium	Prospectus	Prospectus*Medium			
2.10	1.96	1.60	2.20			
Sales	Debt	Price Revision	Price Revision (-)	Share Overhang	P/V multiple	NASDAQ index
3.47	1.07	4.45	4.24	1.40	2.38	1.28
Mean	Short	Medium	Prospectus	Prospectus*Short	Prospectus*Medium	
2.17	2.42	2.11	2.35	3.03	2.48	
Sales	Debt	Price Revision	Price Revision (-)	Share Overhang	P/V multiple	NASDAQ index
3.49	1.07	4.48	4.31	1.40	2.38	1.28

Panel B: Acquirer frequency						
Mean	Serial	Prospectus	Prospectus*Serial			
2.14	2.31	1.83	2.91			
Sales	Debt	Price Revision	Price Revision (-)	Share Overhang	P/V multiple	NASDAQ index
3.50	1.07	4.45	4.24	1.39	2.38	1.28
Mean	Single	Prospectus	Prospectus*Single	Single		
2.09	1.82	1.53	2.02	1.82		
Sales	Debt	Price Revision	Price Revision (-)	Share Overhang	P/V multiple	NASDAQ index
3.46	1.07	4.46	4.27	1.39	2.38	1.28
Mean	Serial	Single	Prospectus	Prospectus*Serial	Prospectus*Single	
2.18	2.49	1.96	2.35	3.2	2.24	
Sales	Debt	Price Revision	Price Revision (-)	Share Overhang	P/V multiple	NASDAQ index
3.50	1.07	4.47	4.30	1.40	2.38	1.28

Panel C: Target						
Mean	Target	Prospectus	Prospectus*Target			
2.10	2.11	1.50	2.28			
Sales	Debt	Price Revision	Price Revision (-)	Share Overhang	P/V multiple	NASDAQ index
3.45	1.07	4.46	4.26	1.38	2.37	1.29

Table A3.6: Summary Statistics Robustness Check Variables

The table is a basic summary statistic, which reports the number of observations (n), mean, standard deviation (SD), minimum (Min.), the 10% tails range (10^{th} and 90^{th} percentile) the median (50^{th} percentile) and the maximum (Max.) for the regression variables in the US IPO/M&A dataset from 2003 through 2016. The exclusions indicated in section 2 are applicable on the data in this table.

Variable	*n*	Mean	SD	Min.	10th	50th	90th	Max.
Target 3-5	729	0.130	0.337	0.000	0.000	0.000	1.000	1.000
Acquirer 3-5	746	0.332	0.471	0.000	0.000	0.000	1.000	1.000
Single 0-5	777	0.162	0.369	0.000	0.000	0.000	1.000	1.000
Serial 0-5	786	0.460	0.493	0.000	0.000	0.000	1.000	1.000
Ln (Days Target)	1016	0.823	2.174	0.000	0.000	0.000	6.260	6.999
Ln (Days Acquirer)	1016	2.262	2.823	0.000	0.000	0.000	6.392	6.990
Ln (Number Acq)	1016	0.483	0.688	0.000	0.000	0.000	1.386	3.497
Ln (News Stories)	1016	3.108	1.143	0.000	1.792	3.045	4.477	8.007
Investment Bank (%)	1016	8.352	9.393	0.013	0.276	6.421	17.253	65.528
MA Investment Bank (%)	1016	8.061	8.253	0.003	0.188	5.801	17.958	42.585
30-day Underpricing	977	19.048	14.297	-18.333	3.781	16.133	39.760	97.222
90-day Underpricing	1014	17.520	9.087	-1.368	7.528	15.300	32.250	46.954
30-day Price Revision	977	-1.779	11.764	-46.667	-17.508	-1.233	12.585	70.000
90-day Price Revision	1014	-2.870	7.678	-36.842	-13.098	-2.076	6.586	23.333
30-day Ind. Return	1016	7.137	15.096	-84.233	-10.700	8.467	24.400	86.400
30-day SD of Ind. Ret.	1016	0.911	0.354	0.362	0.577	0.827	1.345	4.289
Ln (Sales) minimum	870	4.866	1.757	0.740	2.643	4.740	7.262	11.558
EGC	1016	0.360	0.480	0.000	0.000	0.000	1.000	1.000

A.4 Figures

Figure A4.1: IPO Firms without prior sales

The figure shows a distribution of IPO firms that did not have any prior sales before going public. Over the time period in this research, the figure indicates a peak of such firms going public after the signing of the JOBS Act in April 2012.

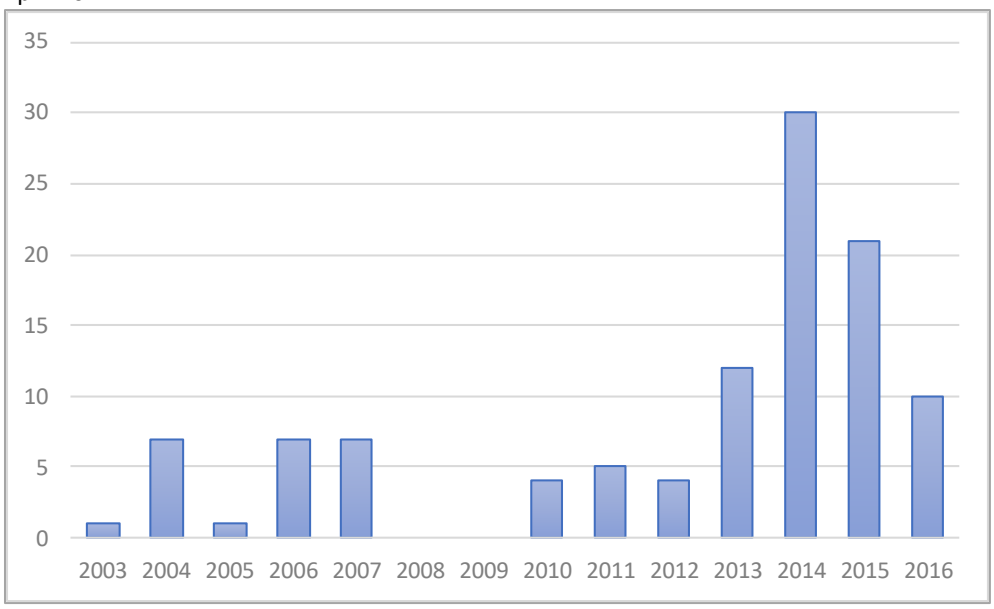


Figure A4.2: Distribution acquisition activity targets

The figure shows the distribution of other acquisition activity in the *Target* group. A firm is considered as *Target* when it is taken-over by another firm. *Acquirer* represents the firms that acquire at least one company. *Non-Acquirer* represents the firms that do not meet the requirement of *Acquirer.* Firms that acquire a company within one year after their IPO belong to the group *Short. Medium* is the group of firms that make their first post-IPO company acquisition later than one year after their IPO, but within three years. *Single* are firms that make one acquisition. *Serial* are the firms that make multiple acquisitions.

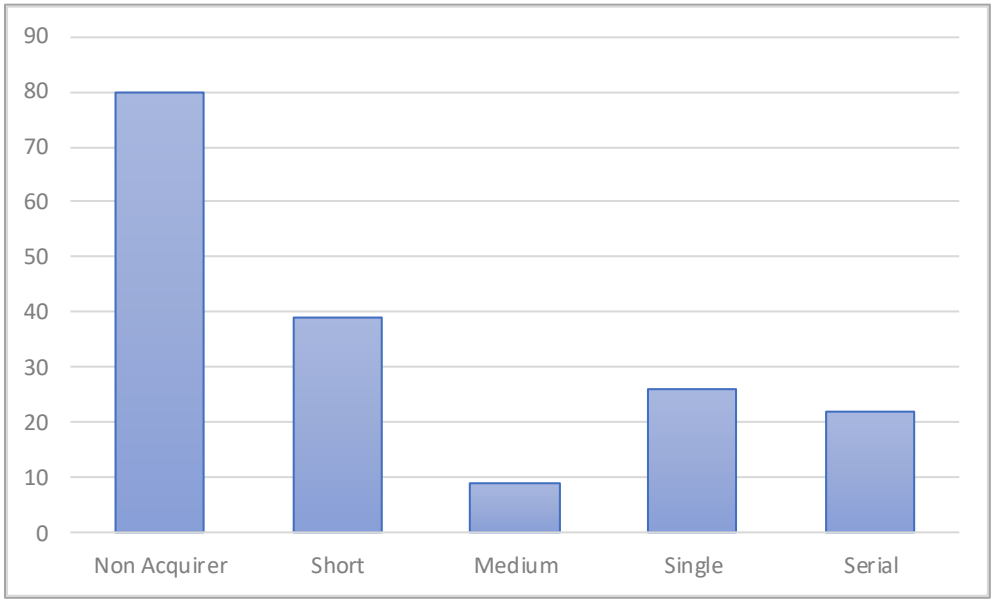
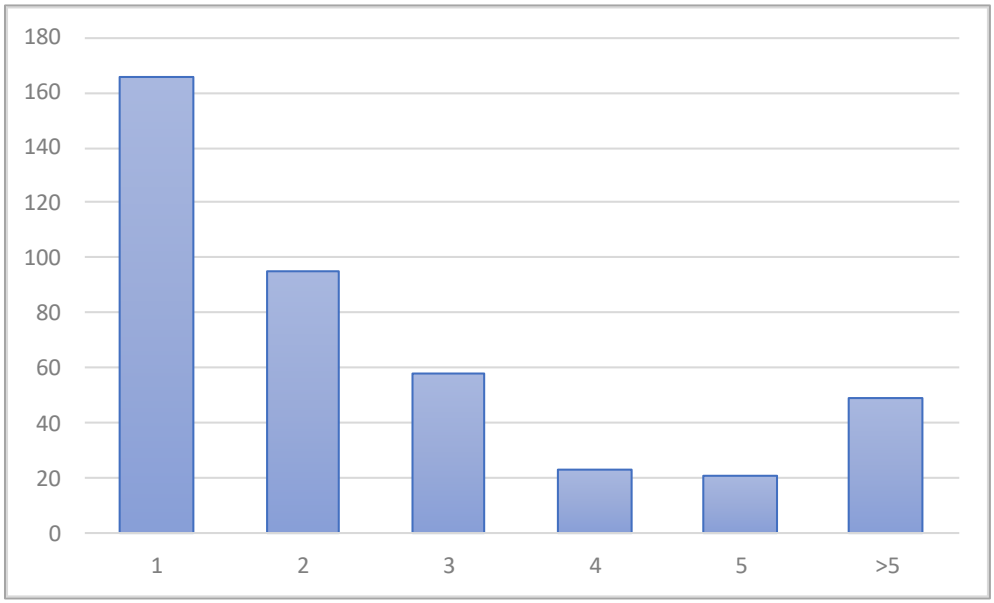


Figure A4.3: Number of acquisitions

The figure shows the distribution of the acquisition count for the group of *Acquirer*. All the acquirers that have one acquisition are defined as single acquirers (*Single*), whereas firms with more than one acquisition are referred to as serial acquirers (*Serial).*



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