Stockholm School of Economics

Master Thesis

Accounting & Financial Management

Spring 2017

# Target's Accounting Quality and Acquirer's Acquisition Performance

## Does acquirer gain higher return with higher target's accounting quality?

This study aims to investigate whether higher accounting quality (AQ) of a target firm could lead to higher acquirer's acquisition return and increase the likelihood of the deal being settled in cash. The study is conducted with Swedish acquisition data between 2002 and 2015. The results show a significant positive relation between the target's AQ and the acquirer's cumulative abnormal return (CAR) around the announcement, implying that higher quality accounting information can facilitate a more accurate target valuation and increase the acquirer's acquisition return. Nevertheless, no significant positive relation is found between target's AQ and the change in return on assets (ROA) in the combined entity. Furthermore, the results also show a significant positive relation between target's AQ and the likelihood of the deal being settled in cash. It implies that higher target's AQ reduces target value uncertainty and hence acquirer will be more willing to make cash offer in which the target will not share the consequence of value uncertainty as compared to share offer. The practical implication of these results is that target's AQ is an important attribute of accounting information and should be considered when assessing an acquisition.

---

**Authors:** Josefin Halvarsson (22508) and Tsz Ling Lau (40856)
**Tutor:** Håkan Thorsell

**Keywords:** Accounting Quality, Acquisition Performance, Cumulative Abnormal Return, M&A

## Acknowledgements

We would like to start by thanking all our friends and family for their continuous and warm support during this spring semester. We would also like to express our warmest gratitude to Kenth Skogsvik, Professor at the Department of Accounting at Stockholm School of Economics, for invaluable guidance and insights. Another person we would like to thank for inspiration and useful advice is Florian Eugster, Assistant Professor at the Department of Accounting at Stockholm School of Economics. Furthermore, we would like to thank Per-Olov Edlund, Associate Professor at the Centre for Economic Statistics at Stockholm School of Economics for enthusiasm along with valuable inputs in statistical issues. We would like to give a special thanks to our tutor, Håkan Thorsell, Visiting Teacher at the Department of Accounting at the Stockholm School of Economics, for invaluable help and guidance.

Finally, we would like to take this opportunity to express our warmest gratitude to all people we have met during our time at SSE, specifically those at the Department of Accounting. Thank you for all the knowledge and inspiration.

Stockholm, May 2017

Josefin Halvarsson Tsz Ling Lau

# Table of Contents

1. Introduction ..... 4
1.1 Purpose of study ..... 6
1.2 Research boundaries ..... 6
1.3 Outline ..... 6
2. Theoretical framework and previous empirical research ..... 7
2.1 The acquisition setting ..... 7
2.1.1 Agency theory ..... 8
2.1.2 Winner's curse ..... 9
2.2 Information asymmetry and valuation uncertainty ..... 10
2.3 Accounting information and accounting quality ..... 11
2.3.1 Relationship between accruals and accounting quality ..... 12
2.3.2 Swedish accounting standards ..... 13
2.3.3 Existing models for calculating accounting quality ..... 14
2.4 Assessment of acquirer's acquisition performance ..... 18
2.5 Accounting quality and acquisition ..... 20
3. Test logic and hypothesis development ..... 22
4. Research method ..... 24
4.1 Methods for estimating accounting quality ..... 24
4.1.1 Overview of the steps in estimating accounting quality in different models ..... 25
4.1.2 Operationalisation of the Kothari et al. (2005) model ..... 26
4.1.3 Operationalisation of the Jones (1991) model ..... 29
4.1.4 Operationalisation of the modified Dechow and Dichev (2002) model ..... 31
4.2 Methods for estimating the acquirer's acquisition return ..... 33
4.2.1 Cumulative abnormal return ..... 33
4.2.2 Return on assets ..... 38
4.3 Statistical models ..... 39
4.3.1 Hypothesis 1 ..... 39
4.3.2 Hypothesis 2 ..... 39
4.3.3 Hypothesis 3 ..... 40
4.3.4 Control variables ..... 41
5. Data collection and sampling criteria ..... 43

6. Results and analysis ..... 45
6.1 Descriptive statistics ..... 45
6.2 Hypothesis 1 ..... 49
6.3 Hypothesis 2 ..... 53
6.4 Hypothesis 3 ..... 55
7. Discussion ..... 58
7.1 Sensitivity analysis ..... 58
7.1.1 Excluding finance industry and pharmaceutical industry ..... 58
7.1.2 Choice of cumulative abnormal return measurement period ..... 59
7.1.3 Choice of accounting quality model ..... 59
7.2 Robustness test ..... 60
7.2.1 Heteroskedasticity ..... 60
7.2.2 Multicollinearity ..... 61
8. Conclusion ..... 62
8.1 Limitations ..... 63
8.2. Suggestion for further research ..... 63
References ..... 65
Appendix ..... 71

# 1. Introduction

Merger and acquisition (M&A) is an important corporate event that firms pursue in the hope of creating value, but at the same time it has been widely proved that in general M&A deals are value-destroying for acquirers (e.g. Loughran and Vijh, 1997; Moeller, Schlingemann, and Stulz, 2005). This paradox raises the interest among academics and business regarding how acquirer can price target more accurately and increase their return from acquisition.

Accounting information has been proved to be value relevant in different investment decisions, and it is also perceived as the most important source of financial information for fundamental valuation. Surprisingly, the difference in the quality of accounting information among targets as well as the effect on valuation uncertainty and acquisition return has been widely disregarded and it therefore brings up an interesting question:

*Does higher target's accounting quality increase acquirer's acquisition return?*

In order to answer the above question, the relationship between target's accounting quality (AQ) and acquisition pricing needs to be established. In McNichols and Stubben (2015), they find that higher target AQ can alleviate the information asymmetry between target and acquirer. As a result, higher AQ enables the acquirer to price the target more accurately and hence enjoy a higher acquisition return in their US sample. Nevertheless, the above research only assesses the relationship between public target's AQ and its effect on acquirer's acquisition performance.[1] In Sweden, majority of the acquisition activities are between private targets and public acquirers, it is therefore of interest to examine if the findings from previous research hold in a mixed sample of public and private targets in Sweden.[2]

In addition to acquisition return, another dimension to examine the relationship between target AQ and acquisition return is whether the acquirers adjust their choice of payment method in response to different target AQ in order to mitigate the risk of uncertainty and maximise the return from the acquisition. In Hansen (1987) and Fishman (1989), they document that if there is high target value uncertainty, the acquirer will prefer to offer equity instead of cash. The reasoning is

[1] Throughout this study, public target is defined as a target that is quoted on a stock exchange in Sweden and private target is defined as a target that is not quoted on a stock exchange in Sweden.
[2] According to SDC Platinum database, there are only 15% of the total 710 acquisition deals in Sweden that are between public targets and public acquirers between 2002 and 2015.

that share value is contingent on acquisition profitability whereas cash value is unaffected by acquisition profitability and does not carry this contingent pricing feature. In the above mentioned research, transaction costs is used as a proxy to target value uncertainty. Therefore, they do not bridge a direct linkage between target AQ and choice of payment method. We believe that by examining the direct linkage between target AQ and the choice of payment method can provide a better understanding on whether target AQ is one of the drivers of target value uncertainty and influence the acquirer's choice of payment method.

This study contributes to the growing body of research on the relation between accounting quality and acquisition decisions in two aspects. First of all, this study investigates the effect of both private and public target AQ on public acquirer's acquisition return. Since there is limited access to private firms accounting data, most previous research in this area only consider public targets in their studies. Therefore, there is a need to investigate if the inclusion of private targets in the sample will cause any difference in the effect of target's AQ on acquisition return. Secondly, this study also looks into both return and non-return aspects of acquisition in order to better understand the effect of target's AQ in acquisition setting. Acquisition return reflects the overall performance, however it does not reflect how acquirers react to different AQ by adjusting their decision during the acquisition. By looking into the non-return aspect of acquisition, it enables us to understand the interaction between target's AQ and different elements in an acquisition, such as choice of payment method.

## 1.1 Purpose of study

The purpose of the study is to investigate whether target's accounting quality (AQ) is value relevant to the acquirer. In this study, the value relevance of target's AQ is measured in two ways: (1) acquirer's acquisition return and (2) acquirer's choice of payment method. If target's AQ can influence the accuracy of acquirer's valuation on the target and allow them to price the deal more accurately, the effect should be reflected on the acquisition return as well as in their choice of payment method. Therefore, this study aims to answer the following research question:

*"Does acquirer make better acquisition with higher target's accounting quality?"*

## 1.2 Research boundaries

The scope of the study is to investigate Swedish completed acquisition deals of both public and private targets conducted by public acquirers. Due to the restriction on data availability on targets accounting information, the sample period has been limited to the years between 2002 and 2015. In this study, we will build the linkage between the research areas of properties of earning and investor responsiveness to earnings by examining how acquirers are affected by different level of target's accounting quality. Specifically, we do not investigate whether target pursues earnings management before acquisition, but instead we investigate how it will affect the acquirer's acquisition decisions and performance that given the existing target accounting quality.

## 1.3 Outline

The study is outlined as follows. Chapter 2 presents the theoretical framework and previous research in acquisition, target's accounting quality and acquirer's return. Chapter 3 presents the test logic and hypothesis development. In Chapter 4 and 5, the research method and data sample are described and motivated respectively. Thereafter, it follows by Chapter 6 which consists of the results and analysis from our statistical models. A discussion of the results can be found in Chapter 7. Finally, in Chapter 8 a conclusion of the study as well as suggestion for further research on accounting quality and its effect on acquisition are presented. In Chapter 8 and 9, references used in the study and appendix are presented respectively.

# 2. Theoretical framework and previous empirical research

In this chapter we put forward the theoretical framework and previous empirical research on acquisition settings, accounting quality and acquisition performance. In section 2.1 and 2.2, the theories about the acquisition settings and valuation uncertainty are introduced to set the foundation for our study. It follows by a discussion on the relationship between accounting information and accounting quality in section 2.3. Thereafter, in section 2.4 previous research on the assessment of acquirer's acquisition return are presented. This chapter will end with a discussion on the linkage between target's accounting quality and acquirer's acquisition performance in section 2.5.

## 2.1 The acquisition setting

Acquisition is an important corporate event which has been commonly used as a way for value creation. Nevertheless, whether acquisition can truly create value for the acquirer depends on the combined effect of different decisions made during the acquisition process. Apart from the consideration of strategic fit, one of the most important decisions in the acquisition is to determine an appropriate bid price.[3] Specifically, when an acquirer decides on the offer price (P), it needs to estimate the sum of target's fundamental value (V) plus any expected synergies (S).

$$P=V+S$$

In an acquisition with perfect information, the range of offer price is determined by looking into both fundamental value of target (V) and expected synergies (S). V is a benchmark for the acquirer to determine the minimum offer price that target would accept, whereas S is the maximum premium that acquirers are willing to offer on top of the fundamental value. As mentioned by Hansen (1987), acquisition can be perceived as a bargaining under asymmetric information in which the target has more information about its own intrinsic value than the acquirer. Specifically, with higher level of information asymmetry, it is more difficult for acquirers to accurately assess the target's fundamental value and expected synergies (McNichols and Stubben, 2015). Among different theories that explain overpayment in acquisition, agency theory and the winner's curse are perceived as the two most important theories in this area (Morck, Shleifer and Vishny, 1990).

[3]Following McNichols and Stubben (2015), we assume that acquirers choose target firms for strategic business reasons. The main role of target's accounting information and its quality is to assist acquirers to determine the bid price, which is an acquisition decision after choosing the appropriate target to acquire.

Both theories predict that the higher the target value uncertainty, the more likely the acquirer will overpay (McNichols and Stubben, 2015).

### 2.1.1 Agency theory

Agency relationship is a contractual arrangement under which the principal(s) delegate the decision making authority to another person (the agent) to perform services on their behalf (Jensen and Meckling, 1976). Based on the economic hypothesis which assumes all individuals are utility maximisers, one can infer that the agent will not always act at the best interest of the principal, especially when the benefit of pursuing their self-interest is higher than the cost of not acting in the best interest of the principals.

In order to ensure that the agent will make optimal decisions from the principal's point of view, agency relationship always comes at a cost of monitoring (Jensen and Meckling, 1976; Black, 1989). The cost of monitoring is usually in form of different compensation structures which aim at better aligning the agent's self-interest with the principal's interest. For example, in a corporate setting, the compensation system is usually based on the growth in sales or profits (Black, 1989; Jensen and Murphy, 1990). As noted by Murphy (1985) and Jensen (1986), these kind of performance-based compensation provide incentives for managers to grow the firm beyond optimal size. Therefore, although managers are paid to act at the best interest of the shareholders, divergence of interest is still inevitable due to the structure of the compensation (Black, 1989).

Extending the general agency problem to acquisition context, Morck et al. (1990) notes that if the managers in acquiring firms pursue personal benefit other than shareholders value maximisation, it is more likely that the acquisitions are characterised by overpayment. This is described by Halpern (1983) as non-value maximising behaviour by the management of acquiring firms. Furthermore, Black (1989) also documents that if managers place personal prestige and interest prior to the interest of the shareholders, they will be more willing to overpay in acquisitions by exaggerating the benefits of the acquisition and discount the risks incurred. Moeller, Schlingemann and Stulz (2004) argue that acquisitions made by large firms show more managerial hubris in forms of offering higher premium than those made by small firms. Although the effect of agency conflicts are well-documented by previous research, one should not assert that managers can completely disregard the market value consequences and principals' opinions when they make the investment decisions. As mentioned by both Jensen and Meckling (1976) and McNichols and

Stubben (2015), one of the primary monitoring mechanism employed by shareholders is the board of directors. Nevertheless, whether the board of directors can effectively monitor the investment proposed by the managers depends on the information availability as well as the information quality (Bushman and Smith, 2001). Specifically, in an acquisition context, if accounting information help to reduce uncertainty in the value of target and allow the board of directors to clearly identify the potential synergies in the acquisition, it will be more difficult for managers to justify a high bid to the board (McNichols and Stubben, 2015).

### 2.1.2 Winner's curse

Winner's curse is an empirical possibility that occurs in competitive situations when the winning bidder overpays for a commodity with uncertain value (Bazerman and Samuelson, 1983). This concept is first discussed by Capen, Clapp and Campbell (1971) to explain the low returns on investment for oil companies engaged in bidding for oil and gas drilling leases. They empirically show that the lease winner tends to be the bidder who overestimates the potential value of the drilling sites the most. After Capen et al. (1971), this concept has been widely applied to explain winners' overpayment in other competitive bidding contexts. The successful bidder is said to be "cursed" either when the bid price exceeds the value of the commodity or when the value of the commodity is less than expected (Thaler, 1988). According to Bazerman and Samuelson (1983), the underlying rationale of winner's curse is that (1) even though the average bidders may accurately predict the value of the commodity, some of the bidders will overestimate or underestimate this value, and (2) the bidder who highly overestimates the value of the commodity will most likely win the bid.

Cox and Isaac (1984) note that winner's curse will not occur if all bidders act rationally. Thaler (1988) further elaborates on this concept and suggests that the prerequisite for a rational bid is bidder's ability to distinguish the expected value of the commodity for sale and the expected value of winning the bid. Ideally, bidder should discount the bid price when the degree of uncertainty and competition increase (Bazerman and Samue1son, 1983; Varaiya and Ferris, 1987). Nevertheless, in the absence of perfect information over the value of the commodity as well as the estimated value of the commodity placed by different bidders, it is practically difficult for bidders to act rationally in a competing bid. As mentioned by Black (1989), avoiding winner's curse is not

easy. Given that the uncertainty incurred in a bid is high, average bidders, who are risk-averse and take a conservative approach of offering less than its best estimate of value, will still overpay.

All of the above suggest that information asymmetry and the subsequent value uncertainty incurred in competing bids are the key drivers that affect the magnitude of winner's curse. In fact, both information asymmetry and value uncertainty are also highly relevant in the context of acquisitions. Previous research empirically show that winner's curse holds in the corporate acquisition settings (Varaiya and Ferris, 1987; Thaler, 1988; Baker, Ruback and Wurgler, 2007).[4] In Varaiya and Ferris (1987), they empirically link winner's curse with the phenomenon of acquirer overpayment and negative average return for successful acquirers. Bazerman and Samuelson (1983) discuss two factors that can increase the likelihood and magnitude of winner's curse: (1) the degree of uncertainty of the commodity for sale and (2) the number of competing bidders. Consequently, the winner's curse occurs when acquirers fail to discount bids in response to greater uncertainty in a competitive bid and instead they choose to offer a higher bid price in order to win the acquisition (Andrade, Mitchell and Stafford, 2001; Moeller et al., 2005).

## 2.2 Information asymmetry and valuation uncertainty

Following the definition from Zhang (2006), information asymmetry is defined as investor's perceived uncertainty about a firm's fundamentals (i.e. earnings and cash flow). It means that with higher information asymmetry between target and acquirer, there are more uncertainty regarding the target's fundamental value. As mentioned in the winner's curse hypothesis, such valuation uncertainty caused by information asymmetry will increase the probability of acquirer overpayment and hence reduce the acquisition return.

In addition to acquisition pricing, there are other stream of research explore the linkage between information asymmetry and acquirer's choice of payment method. For example, Officer, Poulsen and Stegemoller (2009) find that acquirer's return is higher if the acquirer makes equity offer in acquisition of target with greater value uncertainty. Their findings are consistent with that from Hansen (1987) and Eckbo and Thorburn (2000) which suggest that share offer is used to

[4] Some research fail to find evidence of the existence of winner's curse. For example, in Boone and Mulherin (2008), they were unable to find evidence for the existence of winner's curse in their sample. As noted by Dyer and Kagel (1996), the experiments often do not capture the richness of industry-specific features that arise to mitigate the winner's curse. Differences in measure of target firm uncertainty and other industry features can be the reasons to explain the differences in research results.

mitigate the risk of information uncertainty incurred in target valuation. On the contrary, Moeller Schlingemann and Stulz (2007) suggest that acquirer abnormal returns are only negatively related to information uncertainty for equity offer but not for cash offers. Overall, albeit the differences in the research focus and findings, previous research in general show that the existence of information asymmetry plays an important role in the acquisition decision making process and indirectly affect the acquirer's return from the acquisition.

## 2.3 Accounting information and accounting quality

The discussion in section 2.1 and 2.2 show the importance of information availability in acquisition decision-making and on acquisition return. Among all information that acquirers use to assess the targets, accounting information, especially the financial statements, has been considered as the most important source of firm-specific financial information. The importance of such information lies on the fact that they provide a foundation for the acquirers to evaluate the past performance of a firm and make prediction about future business development. Given that accounting information is widely used in acquisition decision-making, accounting quality (hereafter AQ) appears to be an important attribute of accounting information (Imhoff Jr., 1992). As mentioned by Raman, Shivakumar and Tamayo (2013), the quality of target accounting information plays an important role in the acquisition process as choices made are likely to depend upon the quality of information available to the acquirer.

Reliability and comparability are the key qualitative characteristics of accounting information and they are said to be undermined if a firm acts opportunistically by enhancing their reported earnings. In addition to intentional manipulation, the existence of some firm- and industry-specific characteristics can also restrict the comparability of financial performance across firms and industries. Since the quality of accounting information is determined by the usefulness of the information for the accounting information users to base their decisions upon. Therefore, understanding and assessing the information quality is essential for these users which in this study are the acquirers. Biddle, Hilary and Verdi (2009) find that investors can mitigate information asymmetry and enhance investment efficiency by using financial reports of higher quality. Nevertheless, given the variety of attributes of accounting information, there is no universally applicable measure to quantify the level of AQ. In addition, AQ is a broad concept which has been

defined differently in previous research as each of them look into various attributes of accounting information (Kothari, Leone and Wasley, 2005). Some of these definitions are listed below:

"[…] *accounting quality is the extent to which a firm's accounting information reduces inherent uncertainty about future cash flow."*

(McNichols and Stubben, 2015)

*"Higher quality earnings provide more information about the features of a firm's financial performance that are relevant to a specific decision made by a specific decision-maker."*

(Dechow, Ge and Schrand, 2010)

*"[the] precision with which financial reporting conveys information about the firm's operations, in particular its expected cash flows that informs equity investors."*

(Biddle et al., 2009)

To better align the definition of accounting quality in an acquisition context where acquirer uses accounting information in fundamental valuation of target, the definition from McNichols and Stubben (2015) is adopted in our study.

### 2.3.1 Relationship between accruals and accounting quality

In Dechow et al. (2010), they classify the existing research on accounting quality (AQ) proxies into three categories, (1) properties of earnings, (2) investor responsiveness to earnings and (3) external indicators of earnings misstatements. The research area of interest in our study is the linkage between properties of earning and investor responsiveness. Specifically, we utilise the AQ estimation models from the research area of properties of earnings to examine acquirers (investors) responsiveness to earnings.

As summarised by Dechow et al. (2010), different models were developed in the research area of properties of earnings to try to directly capture and detect the AQ problem derived from the accrual basis accounting method. Comparing to cash basis accounting method, accrual basis accounting is more commonly used in the preparation of financial statements. As mentioned by Dechow and Dichev (2002), one role of accruals is to shift or adjust the recognition of cash flows over time so that the adjusted earnings can better measure firm's financial performance. Therefore, the accrual basis accounting, which addresses both current year cash flow and current year total accruals are supposed to give a better picture regarding a firm's performance during a particular

period. Nevertheless, the above posit is built on the assumption that accruals are entirely business-relevant and free from any intentional manipulation. In reality, the total accruals can be partitioned into discretionary and non-discretionary accruals. Non-discretionary (normal) accruals refer to the part of accruals that naturally occur in business operations and the reporting of them is clearly mandated by different reporting standards, such as IFRS. Discretionary (abnormal) accruals refer to the accruals that are made out of estimation and at the discretion of management (Healy, 1985). Among two types of accruals, the discretionary part has been described by many researchers as "noise" that reduces the beneficial role of accruals as they can easily be manipulated by management to achieve certain earnings' goals and mislead financial users, so called earnings management (Dechow and Dichev, 2002; Dechow et al., 2010; McNichols and Stubben, 2015). As aforementioned, the original purpose of accrual basis accounting is to complement cash flows and make the reported earnings a better figure for users to assess a firm's financial performance. Therefore, if management use discretionary accrual opportunistically, it can reduce the overall usefulness of financial statements and ultimately undermine the AQ.

### 2.3.2 Swedish accounting standards

In Sweden, limited companies (aktiebolag) must prepare their annual reports according to the "K-regulations" (K-regelverk) issued by the Swedish Accounting Standards Board (Bokföringsnämnden). There are four categories of regulation under the K-regulations. Each of the category set criteria on financial characteristics as threshold that a firm must fulfil in order to prepare their financials under that particular regulation (Bokföringsnämnden, 2016). The categories that are relevant to our study are K2, K3 and K4 which are applicable in limited companiess. K2 and K3 are applicable for private firms. The main difference between these two are the amount of information that a firm needs to disclose in the annual reports, in which K2 requires less amount of financial information disclosure than K3. K4 is applicable for all public firms. Unlike K2 and K3 where Swedish GAAP is applied, IFRS is used as the accounting standard for firms who prepare their annual reports under K4. The main difference between IFRS and Swedish GAAP is that under IFRS, firms are prohibited from allocating part of their earnings to balance sheet as untaxed reserves.

In the computation of accounting quality (AQ), the issue in concern is the availability of accounting information for the estimation of AQ by particular models. Therefore, as long as the

definition of the accounting items used in the model is consistent with the corresponding reporting categories, different disclosure requirements will not cause substantial influence to the computation of AQ.

### 2.3.3 Existing models for calculating accounting quality

Although total accruals are observable in the financial statements, it is difficult to decompose the figure into non-discretionary and discretionary parts as management intention is unobservable and the effect of intentional manipulation is inherent in the total accruals which cannot be easily distinguished from normal accruals (Dechow and Dichev, 2002). Therefore, most of the existing AQ measures are regression models which map the current period accruals into specific economic drivers that drive the change in current period accruals, such as sales and cash flow from operations. The residual derived from the regression models, which is the part of accruals that cannot be mapped into the predetermined economic drivers, is perceived as a proxy to AQ. The differences between AQ models depend on what the researchers perceive as the most important drivers to accruals that are unique to the research question being addressed (Kothari et al., 2005).

Exhibit 1 summarizes the AQ models that are used in our study.

**Exhibit 1:** *Summary of accounting quality models*

| *Accounting quality model* | *Theory* |
|---|---|
| **(1) Jones (1991) model**<br>$ACC_{f,t-1} = \hat{B}_0 + \hat{B}_1\left(\frac{1}{Total\ assets_{f,t-2}}\right) + \hat{B}_2\Delta REV_{f,t-1} + \hat{B}_3 PPE_{f,t-1} + \varepsilon_{f,t-1}$ | Accruals are a function of revenue growth and PPE. All variables within the model are scaled by total assets. The absolute value of the residuals in the model is treated as an indicator of discretionary accruals such that the larger the residual, the lower the accounting quality. |
| **(2) Kothari et al. (2005) model**<br>$TA_{f,t-1} = \hat{B}_0 + \hat{B}_1\left(\frac{1}{Total\ assets_{f,t-2}}\right) + \hat{B}_2\Delta REV_{f,t-1} + \hat{B}_3 PPE_{f,t-1} + \hat{B}_4 ROA_{f,t-1} + \varepsilon_{f,t-1}$ | An extension of the Jones (1991) model by including ROA as a performance-matched predictor variables of accruals. The absolute value of the residuals in the model is treated as an indicator of discretionary accruals. |
| **(3) Modified Dechow and Dichev (2002) model**<br>$WCA_{f,t-1} = \hat{B}_0 + \hat{B}_1 CFO_{f,t-2} + \hat{B}_2 CFO_{f,t-1} + \hat{B}_3 CFO_{f,t} + \hat{B}_4\Delta REV_{f,t-1} + \hat{B}_5 PPE_{f,t-1} + \varepsilon_{f,t-1}$ | An extension of the Dechow and Dichev (2002) model, accruals are modelled as a function of cash flow from operations at immediate adjacent periods, sales growth as well as PPE. Same as the Dechow and Dichev (2002) model, this model does not disentangle the difference between discretionary and nondiscretionary accruals. Hence, the residuals in this model is an indicator of general accounting quality. |

*2.3.2.1 Jones (1991) model*

The Jones (1991) model (hereafter Jones model) was initially developed to investigate if managers intentionally made income-decreasing accruals during import relief investigations from the US International Trade Commission (ITC). Since the lower the earnings before interest and taxes (EBIT) a firm made, the higher the import relief the firm can enjoy. This provides incentive for management to undergo discretionary manipulation by imposing income-decreasing accruals during the import relief investigation (Jones, 1991).

In this model, accrual process is defined as a function of sales growth and property, plant and equipment (PPE) (Dechow et al., 2010). Specifically, the part of total accrual that is not mapped into the current period sales growth and PPE are perceived as an estimate of management manipulation of accruals (discretionary accruals) and hence the larger the residual is an indicator of lower AQ. Given that the model includes sales growth as matching variable, it inherently

assumes that revenues are non-discretionary (Dechow, Sloan and Sweeney, 1995). As a result, earning management exercises through revenue manipulation will not be captured by the Jones model. Moreover, the findings in McNichols (2002) further shows that estimating discretionary accruals based on the Jones model is likely to include a substantial non-discretionary component and argue that the model is vulnerable to misspecification in particular research settings.

*2.3.2.2 Kothari et al. (2005) model*

In response to the concern and criticism about the correlation between performance and the residuals from the Jones model, Kothari et al. (2005) develop a performance-matched AQ model which controls for the normal level of accruals conditional on return on assets (ROA) (Dechow et al., 2010). The underlying assumption in the Kothari et al. (2005) model (hereafter Kothari model) is that extreme growth gives rise to accruals and firms with extreme performance are more likely to engage in earnings management. This assumption is, however, not specified in the Jones model when measuring the discretionary accruals. According to Kothari et al. (2005), the motivations to use ROA as a matching variable are two-folded. First of all, ROA, as a measure of earnings deflated by average total assets, helps to control for the effect of performance when measuring discretionary accruals. The use of ROA as a matching variable in AQ model can directly address the disadvantage of the Jones model in which the earnings management performed through revenue manipulation is not captured. Secondly, other research suggest that, unless discretionary accruals models can adequately exclude the performance-related components of accruals, the likelihood of spurious indication of discretionary accruals can be very high in sample experiencing unusual past performance (Dechow et al., 1995; Guay, Kothari and Watts, 1996; Kothari et al., 2005), this provides further support to introduce ROA as a matching variable in the Kothari model.

The findings from the simulation analysis performed by Kothari et al. (2005) support that discretionary accruals estimated using the Jones model adjusted for performance-matched firm's discretionary accrual tends to be the best specified measure of discretionary accruals. Since the Kothari model is, to a large extent, an extension of the Jones model which also specifies the residuals as an estimate of discretionary accruals, the Kothari model has also been criticised that the matching process within the model is likely to add noise to the measure of discretionary accruals. Therefore, it is only best applied when performance is of key concern in the research settings (Dechow et al., 2010).

*2.3.2.3 Modified Dechow and Dichev (2002) model*

The modified Dechow and Dichev model (hereafter MDD model) was developed by McNichols (2002) to estimate the general AQ of a firm. The MDD model is an improved version of the AQ model developed by Dechow and Dichev (2002). Dechow and Dichev (2002) model accruals as a function of past, present and future cash flow to address the cash flow-matched aspect of accruals. Unlike other models, such as the Jones model and the Kothari model, Dechow and Dichev (2002) does not disentangle the discretionary accruals from non-discretionary accruals. Therefore, the residuals in their AQ model is a measure of a firm's general AQ rather than the poor AQ specifically caused by discretionary accruals. McNichols (2002) further develop the Dechow and Dichev (2002) model by including the changes in sales growth and current year PPE into the MDD model. The underlying motivation for including sales growth is to address the effect of performance change on current accruals, whereas the inclusion of PPE is to serve the purpose of expanding the model to a broader measure of accruals that includes depreciation (Dechow et al., 2010). According to the findings in McNichols (2002), the inclusion of changes in sales growth and PPE can significantly improve the explanatory power of the Dechow and Dichev (2002) model.

The explanation power of Dechow and Dichev (2002) model as well as the MDD model are proved to be stronger than the Jones model (Dechow et al., 2010). Specifically, the MDD model is proved to be able to provide a significantly larger coefficient of determinants than the original Dechow and Dichev (2002) model (Kent, Routledge and Stewart, 2010). The MDD model is, however, criticised for the practical applicability outside time-series analysis. Particularly in acquisition settings, the application of the MDD model at firm-level requires at least four years of accounting data.[5] As a result, it may lead to a potential selection bias by systematically excluding firms that lack a long history of financial statements (McNichols and Stubben, 2015).

[5] Specifically, when cash flow from operations (CFO) figure is not available, manual computation of past, present and future CFO will require three years earnings and depreciation data as well as four years accounting data on working capital in order to calculate the changes in working capital.

*2.3.2.4 Choice of accounting quality model*

As AQ is defined differently under particular research settings, there is no universally accepted AQ model as each of them was developed to solve a specific research question which has its own economic drivers on accruals. For example, in McNichols and Stubben (2015), they apply the MDD model as a measure of target AQ and find that target AQ is positively related to acquirer acquisition return. Nevertheless, they did not verify the robustness of such relationship by applying other AQ models. Given the advantages and disadvantages of different AQ models, this motivates the use of several AQ models in research to enhance the reliability of the results. As suggested by Hope, Thomas and Vyas (2013), using several AQ models in accounting quality study help mitigate the problem of one particular approach may capture factors that are not related to the specific accounting quality issue in that particular research settings.

## 2.4 Assessment of acquirer's acquisition performance

Previous research on acquisition performance measurement can be classified into two main research streams. The first one relies on market-based measurement, such as cumulative abnormal return (CAR), to evaluate acquisition performance. The second stream of research employs accounting-based measurement to assess the acquisition return, such as the change in return on assets (ROA). The underlying assumption of using market-based measurement is that maximising shareholders' value is the ultimate goal of a firm, and market-based measure is the only direct way to assess the change in shareholders' value caused by certain event (Campa and Hernando, 2004; Lubatkin and Shrieves, 1986). Among different market-based measurement, CAR is the most commonly used in acquisition research. The CAR measurement was initiated by Ball and Brown (1968) and Fama et al. (1969) which introduce today’s event study methodology to measure abnormal share returns. The former shows evidence on the relationship between firm value and accounting information by examining the share price reaction, whereas the latter shows that share prices do react and adjust to new information in a timely manner. The CAR measure shows the extent to which firm’s share price movements deviated from that of the market within a particular period (Martin and Shalev, 2017). Therefore, the purpose of the CAR measure is to capture the reaction of the stock market towards new information. Even though short-window event study is the most commonly used method when it comes to the measurement of CAR in acquisition, there is no common agreement in previous research regarding the length of the event study. According to Fama (1998), share prices do not always adjust accurately even when the market is efficient. In

other words, even though the event window should capture the share price reaction to new information, share price movements outside the event window can also show evidence of irrational pricing in form of a drift in the share price. Share price drift occurs when the equity market delays the price reaction to an event because it either takes time for the market to understand the impact of an event or the market cannot fully understand the effect of an event (Bernard and Thomas, 1989). An alternative market-based measure to assess the long term value creation for acquirers is to use the buy and hold abnormal return (BHAR) which has been used by Bernard and Thomas (1989). The main difference between CAR and BHAR is that CAR uses arithmetic returns when computing the overall return for the event, whereas BHAR uses geometric return. In other words, BHAR can be compounded while CAR cannot. Some argue that BHAR is a better measure of investors' experience in comparison to CAR (Barber and Lyon, 1997; Lyon, Barber and Tsai, 1999) since CAR have biased estimates of the actual returns. However, others argue that CAR is a better measure than BHAR, since the latter is adversely affected by skewness in the sample of abnormal returns due to the compounding of BHAR. In other words, errors made in specifying the expected return will also be compounded and can lead to over-rejection of null hypothesis if the errors are significant (Fama, 1998).

The second stream of acquisition performance research use accounting-based measures to evaluate acquisition performance. Contrary to market-based performance measures, the use of accounting-based measures is based on the underlying assumption that synergies obtained from acquisition are best reflected in accounting measures (Hitt et al, 1998; Papadakis and Thanos, 2010). Comparing with market-based acquisition performance measures which capture the investor's expectation for the future, accounting-based measures are able to capture the direct effects of acquisition on acquirer's financial performance. (Grant, Jammine and Thomas, 1988). In the spirit of previous research, Martin and Shalev (2017) suggest the use of change in return on assets (ROA) as an alternative accounting-based measure to the announcement of firm-specific information. Their explanation is that this accounting-based performance measure is able to address the problems raised by many research regarding whether stock return non-synchronicity capture firm-specific information. Furthermore, according to Wang and Xie (2009), change in ROA is a natural alternative to measure acquisition performance because expected acquisition surplus, on average, is equal to realized surplus whereas a change in ROA can capture the realized surplus in acquisition. An additional motivation to use the change in ROA is that an acquisition is

said to be profitable when the expected synergies are realized and reflected as an improvement in the financial performance of the combined entity, it is expected that in addition to share price reaction, acquisition performance can also be reflected on the change in operating return after acquisition

## 2.5 Accounting quality and acquisition

There are numerous research on either accounting quality (AQ) or acquisition separately. However, relatively little research specifically explore the direct linkage between target AQ and its impact on acquisition decisions and return, and most of them take the underlying quality of target's accounting information as given. Existing research in this area support that target AQ is an important attribute of accounting information to reduce information asymmetry and mitigate the magnitude of overpayment caused by winner's curse. Below we identify two main streams of previous research in this area: (1) target AQ effect on different acquisition decisions and (2) target AQ effect on acquisition performance.

Regarding the effect of target AQ on acquisition decisions, many research find that acquirers prefer negotiated deal if target AQ is poor (Marquardt and Zur, 2014; Raman et al., 2013). One explanation is that acquirers want to get more information about the target and reduce information asymmetry through the negotiation process. Furthermore, another aspect to examine how AQ affects acquirer's acquisition decision is in the choice of payment method. Raman et al. (2013) specify how acquirers use target accounting information to adapt their acquisition strategies. Their findings suggest that acquirers can mitigate some of the target value uncertainty by providing share offer rather than cash. As mentioned in Hansen (1987), share has contingent-pricing effect as the value of share offer is affected by the acquisition profitability. By accepting the share offer, target inherently accepts to bear the consequence of acquirer overpayment caused by poor AQ.

Another stream of research focus on examining the effect of target AQ on acquisition performance. Martin and Shalev (2009) find that expected synergies increase with higher pre-acquisition quality of target information. Moreover, McNichols and Stubben (2015) and Lim, Lee and Chang. (2015) suggest that the higher the target AQ the higher the acquirer's stock return during the announcement window. The explanation is that higher target AQ help to reduce value

uncertainty and allow acquirer to price the target more accurately which ultimately increase its return from the acquisition. Although short-term stock return is prevalent as a measure to indicate the effect of target AQ on acquisition performance, some research choose to use the acquisition premium instead to stress the influence of target AQ on the value discounting in acquisition.[6] For example, Raman et al. (2013) show that target AQ and acquisition premium is negatively related in negotiated (friendly) deals as acquirer can obtain more private information through negotiation which help them to mitigate the information uncertainty and increase their valuation accuracy.

Overall, following the two streams of research described above, our study will also look into the value relevance of accounting information in acquisition settings by examining how target AQ can affect the degree of target value uncertainty as well as acquisition decision and returns.

[6]As suggested by McNichols and Stubben (2015), acquirer's return should reflect the net value of the acquisition to the acquirer. However, using acquisition premium as a measure of acquisition profitability directly reflects any valuation discount due to poor accounting quality, which confounds the acquisition premium measure in our study setting.

# 3. Test logic and hypothesis development

The theoretical framework and previous empirical research presented above is used as a guide for the study. As mentioned in section 2.1.2, although winner's curse is a common phenomenon in acquisition, the likelihood and magnitude of it is affected by the degree of target value uncertainty. That is the higher the target value uncertainty, the higher the probability that the completed deal will be characterized by higher payments and lower return to the acquirer. Since target accounting information is an important source of information for acquirers to estimate the value of targets, it is expected that the availability of higher quality target accounting information can reduce the value uncertainty and ultimately lead to a more profitable acquisition for the acquirer. Following McNichols and Stubben (2015), we examine the incremental effect of targets' accounting quality on acquirers' short-term stock return. This leads to the formulation of the first hypothesis:

Hypothesis 1: *Target's accounting quality has positive effect on the acquirer's short-term stock return.*

Cumulative abnormal stock return has been commonly used as a measure of the acquirer's acquisition performance in previous research. However, there are some disagreement among academics with respect of whether stock-return non-synchronicity captures firm-specific information (Wang and Xie, 2009; Martin and Shalev, 2017). Moreover, since an acquisition is said to be profitable when the expected synergies are realized and reflected as an improvement in the financial performance of the combined entity, it is expected that in addition to share price reaction, acquisition performance can also be reflected on the change in operating return after acquisition. In line with the logical reasoning in the formulation of *Hypothesis 1*, it is expected that higher target accounting quality follows by more accurate target valuation can bring positive effect to the post-acquisition operating return of the combined entity. This leads to the formulation of the second hypothesis:

Hypothesis 2: *Target's accounting quality has positive effect on the change in acquirer's operating return*

Last but not least, this study also examines the effect of target accounting quality on acquirer choice of payment. Comparing with share offer, the value of cash offer is fixed and is therefore not contingent on the acquisition profitability, hence acquirer will need to bear the full

risk of target value uncertainty under cash offer. Since higher target accounting quality can reduce the value uncertainty, we expect that with higher target accounting quality, it is more likely that the acquirers will settle the deal with cash instead of equity. This leads to the formulation of the third hypothesis:

Hypothesis 3: *Higher target's accounting quality increases the probability of cash offer in acquisition*

# 4. Research method

## 4.1 Methods for estimating accounting quality

As mentioned in section 2.3, there is no universally accepted measure of accounting quality (AQ). Therefore, in order to select a suitable measure of AQ, it is important to consider the role it plays in the specific research settings (Marquardt and Zur, 2014). In our sample, there are many young targets without long history of financial statements. Therefore, the application of the MDD model is less preferable as the model systematically excludes younger targets due to insufficient accounting information to estimate the model and results in a substantial decrease in our sample size (McNichols and Stubben, 2015). Furthermore, it is expected that young companies with abnormal growth pattern compared to the industry average are easier to attract potential acquirers in acquisition. Based on the above discussion, the ideal AQ models used in acquisition research should be able to capture the effect of extreme performance on accruals and at the same time minimize the impact of selection bias caused by systematic exclusion of young targets.

Considering the above mentioned criteria, we select the AQ model developed by Kothari et al. (2005) as our primary AQ estimation model. The motivations are two-folded. First of all, we expected that the development in target financial performance and the subsequent effect on total accruals are highly relevant in an acquisition setting. According to Dechow et al. (2010), the Kothari model is preferable in earnings management study when performance is an important consideration. Secondly, from a practical perspective, the MDD model requires at least four years financial information to compute the AQ measure, whereas the estimation of AQ from the Kothari model requires only two years of accounting data. The application of the Kothari model can therefore significantly alleviate the problem of selection bias.

In the testing of *Hypothesis 2*, we adopt the Jones model as a substitute to the Kothari model. This is motivated by the fact that in the Kothari model, ROA is one of the independent variables, but in the model for testing *Hypothesis 2* (see section 4.3.2), change in ROA is used as the dependent variable. Therefore, applying the AQ measure computed by the Kothari model in the model we used to test *Hypothesis 2* will cause endogeneity problem. Considering the fact that the Kothari model is developed by adding ROA in the Jones model as a performance-matched variable, the Jones model is therefore considered to be a good substitute for the Kothari model in the testing of *Hypothesis 2*.

As mentioned in section 2.3.2.4, Hope et al. (2013) suggest that several AQ measurement approaches should be used in AQ research to mitigate the potential problem of model misspecification. Specifically, using single AQ model may capture factors that are irrelevant in the particular AQ research settings. Therefore, we will also present the results by applying the MDD model in the sensitivity tests presented in section 7.1.

### 4.1.1 Overview of the steps in estimating accounting quality in different models

The three AQ models discussed in section 2.3.3 are estimated in the three steps described in Figure 1. Firstly, we estimate the model per industry and per year in order to get the industry-level coefficients in particular models. Secondly, we use the actual firm-level accounting data together with the industry-level coefficients computed from the first step to calculate a normal firm-level accruals for each target. Finally, we calculate the difference between the actual firm-level accruals and the estimated firm-level accruals computed in the second step. The absolute value of the difference times -1 is then interpreted as the total accruals that cannot be explained by the estimated normal accruals, and hence is used a proxy for AQ, such that the closer the value to 0, the higher the AQ it represents.

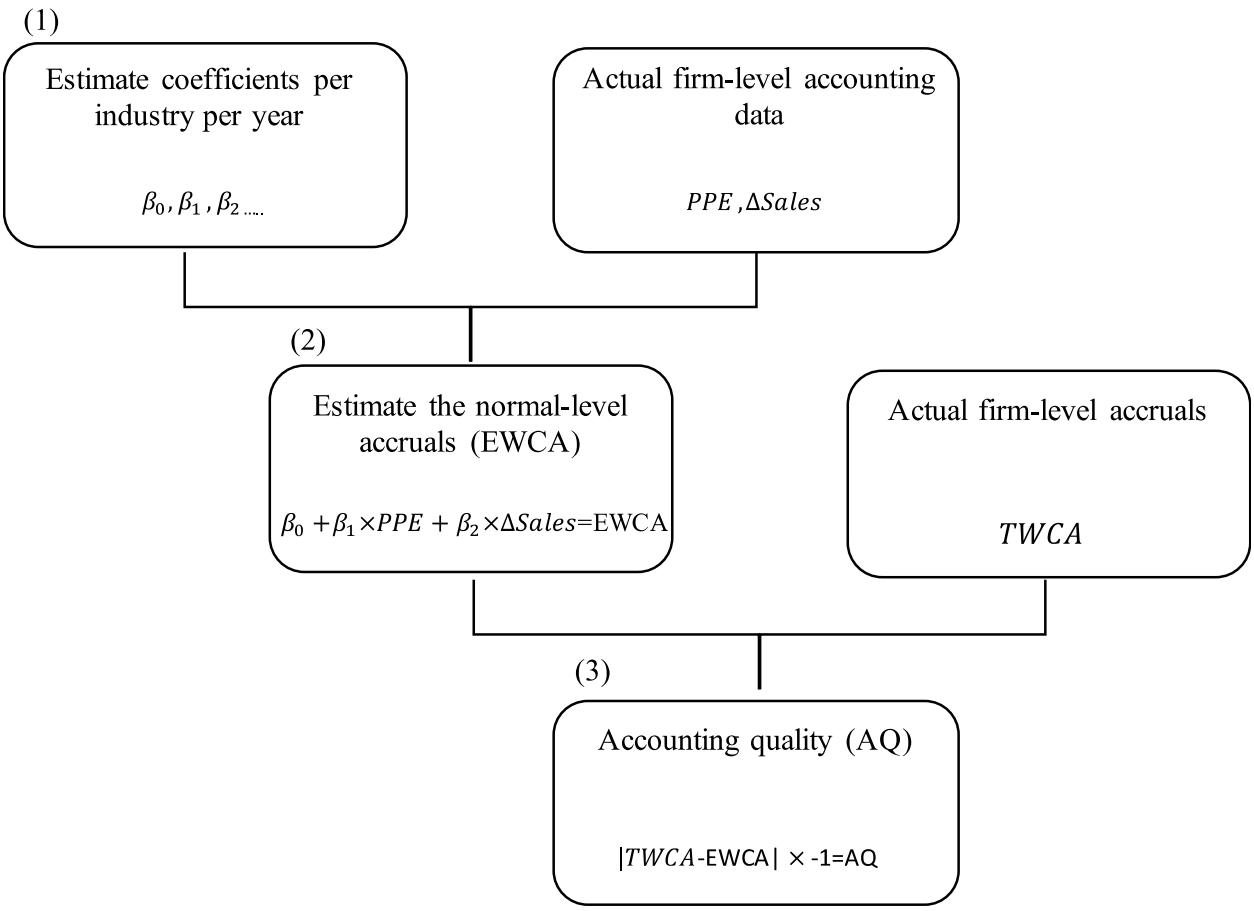



**Figure 1:** *Firm-level accounting quality estimation process*

### 4.1.2 Operationalisation of the Kothari et al. (2005) model

In earnings management research, total accruals are either computed from the balance sheet or directly extracted from the statement of cash flows. As mentioned by Hribar and Collins (2002), it is more preferable to take the accruals directly from the statement of cash flow than computing it through the balance sheet approach. It is owning to the fact that the use of the balance sheet approach inherently presumes that there is articulation between changes in working capital on the balance sheet and accrued revenue and expenses on the income statement. This presumption will result in biased estimates of accruals if the income statement contains a lot of non-operating items such as reclassification and foreign currency translation (Hribar and Collins, 2002). However, since the statement of cash flow is not available in our sample, we compute the total accruals through the balance sheet approach following the methodology suggested by Francis et al. (2005).

In our study, we will estimate the target AQ from the Kothari model at both firm-level and industry-level. The detailed computation process is described below.

First of all, regarding the computation of firm-level AQ, we follow the steps described in Figure 1. Specifically, we classify all valid firm observations that are registered in the Swedish Company Registration Office (Bolagsverket), which is approximately 2.4 million firm-years observations (see Table 2 for detail sample selection process), into each of Fama and French (1997) 48 industry groups. This is done in order to estimate the industry coefficients from equation (1) and use them to compute the normal firm-level accruals in equation (2). Estimation of coefficients are performed only in industry groups with at least 20 observations per year between 2002 to 2015. All variables used in equation (1) are scaled by lagged total assets in order to control for heteroskedasticity. White (1980) claims that heteroskedasticity can be reduced but not eliminated by deflating the variables. Furthermore, in order to protect against the influence of outliers, all variables are winsorized at the extreme one percentiles.

$$TA_{i,t-1} = \hat{\beta}_0 + \hat{\beta}_1 \left( \frac{1}{Total\ assets_{i,t-2}} \right) + \hat{\beta}_2 \Delta REV_{i,t-1} + \hat{\beta}_3 PPE_{i,t-1} + \hat{\beta}_4 ROA_{i,t-1} + \varepsilon_{i,t-1} \quad (1)$$

*Where:*

*TA= Total accruals measured as change in non-cash current assets minus the change in non-interest-bearing current liabilities, minus depreciation and amortisation expenses, scaled by lagged total assets*

*$\Delta REV$= Annual change in revenues, scaled by lagged total assets*

*PPE= Property, plant and equipment, scaled by lagged total assets*

*ROA= Net income divided by average total assets*

*i= Industry*

*t= Fiscal year of the announcement*

The industry-level coefficient together with the actual firm-level accounting data is used to estimate a normal firm-level accruals for each target in equation (2).

$$ETA_{f,t-1} = \hat{\beta}_0 + \hat{\beta}_1 \left(\frac{1}{Total\ assets_{f,t-2}}\right) + \hat{\beta}_2 \Delta REV_{f,t-1} + \hat{\beta}_3 PPE_{f,t-1} + \hat{\beta}_4 ROA_{f,t-1}$$

(2)

*Where:*

*ETA= Estimated normal firm-level total accruals based on the estimated industry-year coefficients*

*ΔREV= Annual change in revenues, scaled by lagged total assets*

*PPE= Property, plant and equipment, scaled by lagged total assets*

*ROA= Net income divided by average total assets*

*f= Target firm*

Finally, in equation (3) we compare the actual firm-level accruals with the normal firm-level accruals computed in equation (2). Accounting quality is calculated as the absolute value of the difference between the actual total accruals and the estimated normal total accruals. The value is then multiplied by -1 so that the higher the value, the higher the AQ of the specific target.

$$AQ_Kothari_{f,t-1} = -1 * |(TA_{f,t-1} - ETA_{f,t.1)}|$$

(3)

*Where:*

*TA= Actual total accruals, measured as change in non-cash current assets minus the change in non-interest-bearing current liabilities, minus depreciation and amortisation expense, scaled by lagged total assets*

*AQ_Kothari= Accounting quality estimated by Kothari et al. (2005) model*

Furthermore, in line with McNichols and Stubben (2015), we also estimate the industry-level average residuals ($\varepsilon_{i,t-1}$ ) one year prior to the acquisition from equation (1) as an alternative measure of target AQ. The absolute value of the residual is multiplied by -1 so that higher value represents higher AQ. According to McNichols and Stubben (2015), the use of industry AQ can overcome the selection bias. However, the disadvantage is that it does not capture the differences in AQ of firms within the same industry. Specifically, the correlation between firm-specific AQ

and industry-specific AQ is questionable especially if the target is a young firm with significantly different firm-characteristics and AQ than the industry average. Given the advantages and disadvantages, we still present the results of using both of the approaches when testing *Hypothesis 1*.

### 4.1.3 Operationalisation of the Jones (1991) model

The operation of the Jones model resembles that of the Kothari model. First of all, regarding the computation of firm-level AQ, we follow the steps mentioned in section 4.1.1. Specifically, we classify all valid firms observations that are registered in the Swedish Company Registration Office (Bolagsverket), which is approximately 2.4 million firm-years observations (see Table 2 for detail sample selection process), into each of Fama and French (1997) 48 industry groups. This is done in order to get the industry coefficients from equation (4) and use them to compute the normal firm-level accruals from equation (5). Estimation of coefficients are performed only in industry groups with at least 20 observations per year between 2002 to 2015. Similar to the estimation of AQ from Kothari model, all variables used in equation (4) are scaled by lagged total assets in order to control for heteroscedasticity and also winsorized at the extreme one percentiles to protest against the influence of outliers.

$$ACC_{i,t-1} = \hat{\beta}_0 + \hat{\beta}_1 \left(\frac{1}{Total\ assets_{i,t-2}}\right) + \hat{\beta}_2 \Delta REV_{i,t-1} + \hat{\beta}_3 PPE_{i,t-1} + \varepsilon_{i,t-1} \quad (4)$$

*Where:*

*ACC= Total accruals, measured as change in non-cash current assets minus the change in non-interest-bearing current liabilities, minus depreciation and amortisation expense, scaled by lagged total assets*

*$\Delta REV$= Annual change in revenues, scaled by lagged total assets*

*PPE= Property, plant and equipment, scaled by lagged total assets*

*i= Industry*

*t= Fiscal year of the announcement*

The industry-level coefficient together with the actual firm-level accounting data is used to estimate a normal firm-level accruals for each target in equation (5).

$$EACC_{f,t-1} = \hat{\beta}_0 + \hat{\beta}_1 \left( \frac{1}{Total\ assets_{f,t-2}} \right) + \hat{\beta}_2 \Delta REV_{f,t-1} + \hat{\beta}_3 PPE_{f,t-1}$$

(5)

*Where:*

*EACC= Estimated normal firm-level total accruals based on the estimated industry-year coefficients*

*$\Delta REV$= Annual change in revenues, scaled by lagged total assets*

*PPE= Property, plant and equipment, scaled by lagged total assets*

*f= Target firm*

Finally, in equation (6) we compare the actual firm-level accruals with the normal firm-level accruals computed in equation (5). Accounting quality are calculated as the absolute value of the difference between actual total accruals and estimated normal total accruals. The figure is then multiplied by -1 so that the higher the value, the higher the AQ of the specific target.

$$AQ_Jones_{f,t-1} = -1 * |(ACC_{f,t-1} - EACC_{f,t.1)}|$$

(6)

*Where:*

*ACC= Actual accounting accruals, measured as change in non-cash current assets minus the change in non-interest-bearing current liabilities, minus depreciation and amortisation expense, scaled by lagged total assets*

*AQ_Jones= Accounting quality estimated by Jones (1991) model*

In the same manner as the Kothari model, we also estimate the industry-level average residuals ($\varepsilon_{i,t-1}$ ) one year prior to the acquisition from equation (4) as an alternative measure of target AQ. The residuals figure is multiplied by -1 such that higher value represents higher AQ. Given the advantages and disadvantages of using both firm-specific AQ and industry-specific AQ mentioned in section 4.1.2, we still present the results of using both of the approaches when testing *Hypothesis 2.*

### 4.1.4 Operationalisation of the modified Dechow and Dichev (2002) model

In the MDD model, cash flow from operations (CFO) of immediate adjacent periods are the matching variables to compute AQ. Ideally, the cash flow from operation figures should be extracted directly from the statement of cash flow (Hribar and Collins, 2002). However, accounting information in the statement of cash flows are not available in our sample, so we follow the indirect approach suggested by Francis et al. (2005) for the computation of CFO that are used in equation (7) and (8).

$$TA_{f,t-1} = \Delta CA_{f,t-1} - \Delta CL_{f,t-1} - \Delta CASH_{f,t-1} + \Delta STDEBT_{f,t-1} - DEPR_{f,t-1} \quad (7)$$

$$CFO_{f,t-1} = NIBE_{f,t-1} - TA_{f,t-1} \quad (8)$$

*Where:*

*TA= Total accruals*

$\Delta$*CA= Change in current assets*

$\Delta$*CL= Change in current liabilities*

$\Delta$*CASH= Change in cash balance*

$\Delta$*STDEBT= Change in debt in current liabilities*

*DEPR= Depreciation and amortization expense*

*CFO= Cash flow from operations*

*NIBE= Net income before extraordinary items*

*f= Target firm*

*t= Fiscal year of the announcement*

First of all, based on equation (7) and (8) we compute the CFO for each firm. Afterwards, the same operation as the Kothari model and the Jones model is used (see Figure 1 for details). Specifically, we classify all valid firm observations that are registered in the Swedish Company

Registration Office (Bolagsverket), which is approximately 2.3 million firm-years observations (see Table 3 for detailed sample selection process), into each of Fama and French (1997) 48 industry groups. This is done in order to get the industry coefficients from equation (9) and use them to compute the normal firm-level accruals in equation (10). Estimation of coefficients are performed only in industry groups with at least 20 observations per year between 2002 to 2015. All variables in equation (9) are scaled with lagged total assets to control for heteroskedasticity and also winsorized at the extreme one percentiles to protect against the impact of outliers.

$$WCA_{i,t-1} = \hat{\beta}_0 + \hat{\beta}_1 CFO_{i,t-2} + \hat{\beta}_2 CFO_{i,t-1} + \hat{\beta}_3 CFO_{i,t} + \hat{\beta}_4 \Delta REV_{i,t-1} + \hat{\beta}_5 PPE_{i,t-1} + \varepsilon_{i,t-1} \quad (9)$$

*Where:*

*WCA= Total working capital accruals measured as change in non-cash current assets minus the change in non-interest-bearing current liabilities, scaled by lagged total assets*

*CFO= Cash flow from operation, scaled by lagged total assets*

*$\Delta REV$= Annual change in revenues, scaled by lagged total assets*

*PPE= Property, plant and equipment, scaled by lagged total assets*

*i= Industry*

The industry-level coefficient together with the actual firm-level accounting data is used to estimate a normal firm-level accruals for each target in equation (10).

$$EWCA_{f,t-1} = \hat{\beta}_0 + \hat{\beta}_1 CFO_{f,t-2} + \hat{\beta}_2 CFO_{f,t-1} + \hat{\beta}_3 CFO_{f,t} + \hat{\beta}_4 \Delta REV_{f,t-1} + \hat{\beta}_5 PPE_{f,t-1} \quad (10)$$

*Where:*

*EWCA= Estimated normal firm-level total accruals based on the estimated industry-year coefficients*

*$\Delta REV$= Annual change in revenues, scaled by lagged total assets*

*PPE= Property, plant and equipment, scaled by lagged total assets*

Accounting quality are calculated as the absolute value of the difference between actual total accruals and estimated total accruals. The figure is then multiplied by -1 so that the higher the value, the higher the accounting quality of the specific target.

$$AQ_MDD_{f,t-1} = -1 * |(WCA_{f,t-1} - EWCA_{f,t.1)}| \quad (11)$$

*Where:*

*WCA= Actual working capital accruals, measured as the change in non-cash current assets minus the change in non-interest bearing current liabilities, scaled by lagged total assets*

*AQ_MDD= Accounting quality estimated by modified Dechow and Dichev (2002) model*

## 4.2 Methods for estimating the acquirer's acquisition return

We are looking at the information content from an acquisition announcement, specifically the economic effect of acquisitions to the acquirers. In our study, we measure such effect by using the acquirer short-term cumulative abnormal returns (CAR) and the change in ROA before and after acquisition.

### 4.2.1 Cumulative abnormal return

A common way to estimate the economic effect from an announcement is to estimate the abnormal return with event study methodology (Brown and Warner, 1985). The abnormal return is the actual ex-post return for the firm over the event window minus the normal return of the firm over the event window, where the normal return is the expected return conditioned on the event not taking place.

$$AR_{ft} = R_{ft} - E(R_{ft}|X_t)$$

*Where:*

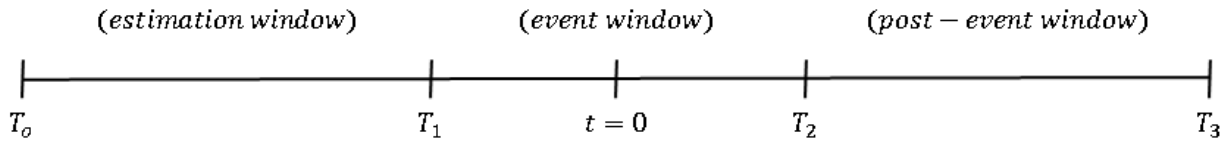
$AR_{ft}$: $Abnormal\ return\ for\ firm\ f\ in\ period\ t$

$R_{ft}$: $Actual\ return\ for\ firm\ f\ in\ period\ t$

$E(R_{ft}|X_t)$: $Normal\ return\ for\ firm\ f\ in\ period\ t$

$X_t$: *The conditioning information for the normal return model*

Measurement of abnormal returns are done by deciding the time of the event. In our case the time of the acquisition announcement is defined as the event day, specified as:




*Where:*

Time $t$ flows between the events such that $T_0 \leq T_1 \leq T_2 \leq T_3$

$t = 0$ is the event date

These point in time described above define the separators between the three event windows:

***The estimation window***: $Between\ T_0\ and\ T_1\ with\ the\ lenght\ L_{Estimation} = T_1 - T_0$

***The event window***: $Between\ T_1\ and\ T_2\ with\ the\ lenght\ L_{Event} = T_2 - T_1$

***The post − event window***: $Between\ T_1\ and\ T_2\ with\ the\ lenght\ L_{Post-event} = T_3 - T_2$

There are many methods to estimate the normal return for a firm and they can be categorised into statistical models and economic models. For statistical models, there are three most commonly used models, namely the market model, the constant mean return model and the factor model. Since they follow statistical assumptions regarding asset returns, they are not restricted by economic arguments. In contrast, economic models such as the capital asset pricing model (CAPM) and the arbitrage pricing theory (APT) follow assumptions regarding investor behaviour.[7]

[7]CAPM is used to price securities and was developed by Sharpe (1964) and Lintner (1965). The model describes the relationship between systematic risk and expected return for assets to be able to estimate the required rate of return of an asset. CAPM is estimated as:
$E(R_i) = R_f + \beta_i(E(R_m) - R_f)$. APT is an asset pricing model and was developed by Ross (1976). The model describe the relationship between many common risk factors and an asset's return. APT is estimated as:
$E(R_i) = R_f + \beta_1 RP_1 + \beta_2 RP_2 + \beta_n RP_n$

First of all, regarding the statistical models, the constant mean model is the most parsimonious model, however it can still yield results in line with more sophisticated models such as the market model. The market model is perceived as an improvement from the constant mean model since it increases the possibility to discover the economic effect from an event by taking away the effect from the variance in the market return and hence reduce the variance in the abnormal return (MacKinlay, 1997).[8] Furthermore, the market model was developed as a one factor model although there are many event studies that use multifactor models. Nevertheless, prior research argue that there are limited gains from using these multifactor models when the reduced variance in abnormal return is small (MacKinlay, 1997).

Secondly, regarding the economic models, a common method used in event studies is the CAPM. However, discrepancy in the results from CAPM have been discovered in previous research, implying that the restrictions set in the CAPM on the market model might not be valid. Therefore, the use of the CAPM has decreased drastically and many have continued to use the market model instead since it is not restricted by any economic assumptions. Finally, MacKinlay (1997) argues that the gain from using the APT is small since it does not add that much extra explanatory power compared to the market model. Given the advantages of statistical models than economic models, the statistical models are preferable in event studies.

Previous research such as MacKinlay (1997) and Moeller et al. (2004) use the market model to estimate the cumulative abnormal return (CAR). The market model is a statistical model and therefore needs to follow the statistical assumptions regarding asset return that says asset returns need to be jointly multivariate normal, independent and identically distributed through time. Given the assumption, the ordinary least square (OLS) is used for the market model.

For any firm $f$ the market model is:

$$R_{ft} = \alpha_f + \beta_f R_{mt} + \varepsilon_{ft} \tag{12}$$

[8] The constant mean model is estimated as: $R_{it} = \mu_i + \vartheta_{it}$ , $E(\vartheta_{it}) = 0$ , $var(\vartheta_{it}) = \sigma^2_{\vartheta_i}$

Further, for firm $f$, the OLS estimates of the market model parameters are:

$$\hat{\beta}_f = \frac{\sum_{t=T_0+1}^{T_1}(R_{ft} - \hat{\mu}_f)(R_{mt} - \hat{\mu}_{m)}}{\sum_{t=T_0+1}^{T_1}(R_{mt} - \hat{\mu}_m)^2}$$

$$\hat{\alpha}_f = \hat{\mu}_f - \hat{\beta}_f \hat{\mu}_m$$

$$\hat{\sigma}_{\varepsilon_f}^2 = \frac{1}{L_1} \sum_{t=T_0+1}^{T_1} (R_{ft} - \hat{\alpha}_f - \hat{\beta}_f R_{mt})^2$$

*Where:*

$$\hat{\mu}_f = \frac{1}{L_1} \sum_{t=T_0+1}^{T_1} R_{ft}$$

*And:*

$$\hat{\mu}_m = \frac{1}{L_1} \sum_{t=T_0+1}^{T_1} R_{mt}$$

The abnormal returns in our sample is estimated by using the below model:

$$\widehat{AR}_{ft} = R_{ft} - \hat{\alpha}_f - \hat{\beta}_f R_{mt}$$

However, the abnormal returns need to be aggregated before we can draw conclusions on the effect of acquisition announcement. Therefore, we aggregate the abnormal return of each firm over the period between $T_1$ *and* $T_2$ to get $CAR_f$.

$$\widehat{CAR}_f(T_1, T_2) = \sum_{t=T_1}^{T_2} \widehat{AR}_{f,t}$$

*Where:*

$\widehat{CAR}_f(T_1, T_2)$: *The sample cumaltive abnormal return from* $T_1$ *to* $T_2$

*Common variables and assumptions:*

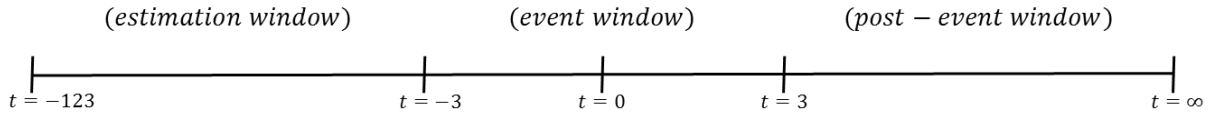
$R_{ft}$: $Return\ for\ firm\ f\ in\ period\ t$

$\alpha_f$: $Alpha\ for\ firm\ f\ in\ the\ market\ model$

$\beta_f$: $Beta\ for\ firm\ f\ in\ the\ market\ model$

$R_{mt}$: $Return\ for\ the\ market\ portfolio\ in\ period\ t$

According to Andrade et al. (2001), a short event windows study is the most statistically reliable method when determining the value relevance of an acquisition. Furthermore, Fama (1970) argues that in an efficient market, prices will adjust quickly after the new information has become available. Therefore, we choose a (-3, +3) days market-adjusted stock return centred around the acquisition announcement (CAR -3, +3) when we test *Hypothesis 1*. A longer event-window is not adopted in our study as it may capture other events than the acquisition that create noise to the measurement. Moreover, since the market model builds on the assumption that the normal returns are free from the effect of the event, we exclude the acquisition announcement (event window) from the estimation period for the calculation of normal returns to prevent the announcement from influencing the estimation of the parameters in the normal performance model. The acquisition announcement date is defined as day $t = 0$ for each acquirer $f$ a total of 127 trading days, starting at -123 days and ending +3 days, are used to calculate the normal returns. The first 120 days leading up to the event window are designated as the estimation period, whereas the following 7 days are the event window and after that it is the post-event window. OMX Stockholm 30 is used to calculate the market returns in our study.



### 4.2.2 Return on assets

Return on assets (ROA) is used as an alternative measure to assess the acquisition profitability for acquirers in terms of operating return. Following Martin and Shalev (2017), we measure the change in ROA (equation 15) as the difference between the ROA in the year after the acquisition announcement ($ROA_{ft+1}$) minus the ROA in the year prior to the acquisition announcement ($ROA_{ft-1}$). $ROA_{ft-1}$ is calculated as the value-weighted ROA for both target and acquirer with the total assets as the weight (equation 13), whereas $ROA_{ft+1}$ is computed for the new combined entity (equation 14). To be precise, $ROA_{ft-1}$ of both acquirers and targets are computed as the operating income before interest, taxes and depreciation in year $t-1$ and divided by the average total assets in year $t-1$ and $t-2$. In the same manner, $ROA_{ft+1}$ is calculated as operating income before depreciation in year $t+1$ divided by the average total assets in year $t$ and $t+1$.

$$
\begin{aligned}
&ROA_{ft-1} \\
&= \frac{EBITDA_{Target,t-1}}{((Total\ assets_{Target,t-1} + Total\ assets_{Target,t-2})/2)} \\
&* \frac{Total\ assets_{Target,average\ t-1 and\ t-2}}{(Total\ assets_{Target,average\ t-1\ and\ t-2} + Total\ assets_{Acquirer,average\ t-1\ and\ t-2})} \\
&\quad + \frac{EBITDA_{Acquirer,t-1}}{((Total\ assets_{Acquirer,t-1} + Total\ assets_{Acquirer,t-2})/2)} \\
&* \frac{Total\ assets_{Acquirer,average\ t-1and\ t-2}}{(Total\ assets_{Target,average\ t-1and\ t-2} + Total\ assets_{Acquirer,average\ t-1and\ t-2}\ )}
\end{aligned}
\tag{13}
$$

$$
\left(ROA_{ft+1}\right) = \frac{EBITDA_{t+1}}{((Total\ assets_t + Total\ assets_{t+1})/2)} \tag{14}
$$

$$
\Delta ROA = ROA_{ft+1} - ROA_{ft-1} \tag{15}
$$

## 4.3 Statistical models

### 4.3.1 Hypothesis 1

Equation (16) is developed for the purpose to test *Hypothesis 1* of whether target AQ has positive effect on acquirer short-term stock return. Acquirer short term stock return is measured by 7-days cumulative abnormal return (CAR) and denoted as ACQ_CAR in the model. Target AQ is either measured as industry-specific AQ (IAQ_Kothari) using the full sample or measured as firm-specific AQ (FAQ_Kothari) using the subsample of targets with enough data to estimate the firm-level AQ by the Kothari model. Other control variables are explained in detail in section 4.3.4. Moreover, year fixed-effect is included by adding a year dummy in the model in order to eliminate the impact of any year-specific factors. The following model is estimated using OLS regression:

$$\begin{aligned} ACQ_CAR = {} & \beta_0 + \beta_1 AQ + \beta_2 UNC + \beta_3 REL_SIZE + \beta_4 ACQ_SIZE + \beta_5 TARG_GROWTH \\ & + \beta_6 IND_LIQUID + \beta_7 CASH + \beta_8 SAME_IND + \beta_9 PRIV_TARG \\ & + \gamma_n Year\ dummies + \varepsilon \end{aligned} \tag{16}$$

The prediction of *Hypothesis 1* is that higher target AQ will have positive effect on ACQ_CAR. Therefore, the coefficient of interests is $\beta_1$. Based on the above model, if the estimated coefficient is statistically different from zero at 10% significant level, we can reject the null-hypothesis.

$$H_0: \beta_1 \leq 0, \quad H_1: \beta_1 > 0$$

### 4.3.2 Hypothesis 2

*Hypothesis 2* is tested by equation (17) where change in operating return after acquisition is measured by the change in ROA (ACQ_ROA). As mentioned in section 4.1, using the Kothari model to estimate the target AQ will create endogeneity problem due to the loop of causality between independent and dependent variables. Alternatively, target AQ in equation (17) is estimated from the Jones model in order to avoid the possible endogeneity within the regression model. Similar to equation (16), AQ in equation (17) is either measured as industry-specific AQ (IAQ_Jones) using the full sample or measured as firm-specific AQ (FAQ_Jones) using the subsample of targets with enough data to estimate firm-level AQ by the Jones model.

$$ACQ_ROA = \beta_0 + \beta_1 AQ + \beta_2 UNC + \beta_3 REL_SIZE + \beta_4 ACQ_SIZE + \beta_5 TARG_GROWTH + \beta_6 IND_LIQUID + \beta_7 CASH + \beta_8 SAME_IND + \beta_9 PRIV_TARG + \gamma_n Year\ dummies + \varepsilon \quad (17)$$

The prediction of *Hypothesis 2* is that higher target AQ will have positive effect on ACQ_ROA. Therefore, the coefficient of interests is $\beta_1$. If the estimated coefficient is statistically different from zero at 10% significant level, we reject the null hypothesis.

$$H_0: \beta_1 \leq 0, \quad H_1: \beta_1 > 0$$

### 4.3.3 Hypothesis 3

In order to test *Hypothesis 3* of whether higher target AQ will increase the likelihood of the deal to be settled in cash, the following two logistic regression models are used:

$$Prob\ (CASH) = f(AQ, ACQ_CAR, UNC, REL_SIZE, ACQ_SIZE, TARG_GROWTH, IND_LIQUID, SAME_IND, PRIV_TARG, \gamma_n Year\ dummies) \quad (18)$$

$$Prob\ (EQUITY) = f(AQ, ACQ_CAR, UNC, REL_SIZE, ACQ_SIZE, TARG_GROWTH, IND_LIQUID, SAME_IND, PRIVTARG, \gamma_n Year\ dummies) \quad (19)$$

In equation (18) CASH is an indicator variable equals one if the acquisition is completely settled in cash and equal zero otherwise. In equation (19) EQUITY is an indicator variable equals one if the acquisition is completely settled in equity and equal zero otherwise. All other variables are the same as those we use to test *Hypothesis 1* and *Hypothesis 2* and they are explained in detail in section 4.3.4.

The motivation to use logistic regression rather than OLS regression in testing *Hypothesis 3* is that the use of linear regression in a model with binary dependent variable is shown to cause heteroskedasticity problem and violate the meaningful zero-one interpretation boundaries

(Walkling, 1985). As a result, it is more preferable to use logistic regression in the testing of *Hypothesis 3* to avoid the above mentioned problems.

The prediction of *Hypothesis 3* is that higher target AQ will increase the likelihood of cash offer. Therefore, the coefficient of interests is the one on AQ, such that coefficient of AQ equals $\beta_1$. If the estimated coefficient is statistically different from zero at 10% significant level, we reject the null hypothesis.

$$H_0: \beta_1 \leq 0, \quad H_1: \beta_1 > 0$$

### 4.3.4 Control variables

Control variables are used in the acquisition return model to determine the value relevance of accounting quality (AQ) by controlling the effect of different internal and external factors. Following the modelling in previous research which include different firm-specific and deal-specific characteristics, we also include these two elements in the selection of control variables in our study (e.g. McNichols and Stubben, 2015; Lim et al., 2015; Moeller et al., 2004; Wang and Xie, 2009).

To begin with, we introduce one minus the ratio of the target firm's tangible assets to total assets as a proxy for target uncertainty (UNC).[9] According to McNichols and Stubben (2015), the purpose of introducing an uncertainty variable into the model is to distinguish the difference between general uncertainty of the environment in which the target operates and the value uncertainty caused by AQ. Specifically, among targets with a particular level of uncertainty within the operational environment whether acquirers get a higher return in acquisition of targets with higher AQ.

Among other firm- and industry- characteristics, acquirer size (ACQ_SIZE) is included as a control variable. It is supported by Fama and French (1993) which find that size tend to affect a firm's stock returns. This is further supported by the finding in Moeller et al. (2004) in acquisition setting. They suggest that acquirer size is expected to have negative relationship with acquirer return such that large firms make acquisitions that result in large losses for shareholders in the

[9] UNC represents the inherent overall uncertainty of the target that arises from the operation, whereas the value uncertainty caused by accounting quality is the uncertainty regarding the quality of the accounting information (i.e. reliability and comparability) that investors rely on to determine the target's fundamental value.

acquiring firms. In addition to acquirer's size, Asquith, Bruner and Mullins (1983) find that acquirer return increases as the ratio between targets market capitalization to the acquirer market capitalisation become larger[10], thus we have included REL_SIZE as a control variable. Furthermore, as our sample has both private and public targets, a control variable of PRIV_TARG is included. It is supported by prior research which have found that acquirers of private targets have higher abnormal stock return than those who acquired public targets (Fuller, Netter and Stegemoller, 2002; Chang, 1998; Hansen and Lott, 1996). Based on the winner's curse hypothesis highlighted in section 2.1.2, competition can increase the likelihood of acquirer overpayment and result in lower return from an acquisition. Therefore, following Moeller et al. (2004), we include industry liquidity (IND_LIQ) as our control variable to assess the intensity of acquisition competition within a specific industry. Finally, prior research find that targets' pre-acquisition performance (TARG_GROWTH) can affect the acquisition performance (Dionne, La Haye and Bergeres, 2015; McNichols and Stubben, 2015), hence TARG_GROWTH is included as one of the control variables.

An indicator variable is included to represent cash (CASH) offer in acquisition. Previous research find that method of payment can affect acquirer return (Officer et al., 2009; Moeller et al., 2004) even though the results are inconclusive regarding the relationship between method of payment and acquisition return. Last but not least, Morck et al. (1990) claim that acquiring a target in another industry results in lower acquirer return, therefore we add a control variable SAME_IND in our model. For more detail definition of the control variables used in our study, please refer to Appendix 1.

[10] Some previous research find a negative relationship between relative size and acquirer's return, such as Travlos (1987).

# 5. Data collection and sampling criteria

The acquisition information is collected from Thomson Reuters SDC Platinum (SDC). There are 710 acquisition announcements with public acquirers between 2002 and 2015 in Sweden. The research period is set between 2002 and 2015 because SDC only contains acquisition information of European countries starting from 2000 and the calculation of targets' accounting quality using the Kothari model requires at least two years of financial information prior the acquisition announcement.

Our data collection and sampling criteria mainly follow Moeller et al. (2004) in which they set requirements for both the deal characteristics and the firm-level financial data. For deal characteristics, the deal must be completed and made by an acquirer quoted in Sweden on either OMX Nordic, First North or Aktietorget. Acquirer daily stock return information is collected from Thomson Reuters Datastream (Datastream). In the final sample, only acquirers with share price information for at least 124 days prior and 3 days after the announcement are included. In order to ensure the acquisition is economically significant, the deal price must be over SEK 1 million and it must be an acquisition of an entity rather than acquisition of investment portfolio, property or a division within an organisation. Moreover, the acquirer must own less than 20% of the shares in the target before the acquisition and end up with 100% of the shares after in order to be included in the sample.

For firm-level financial data, we only consider targets with sufficient data to compute the measure of accounting quality (described in section 4.1). The financial data is retrieved from Serrano which is a database that contains financial history of all Swedish companies. In order to extract firm-level data from Serrano, both acquirers' and targets' latest registered name and organisation number are necessary. The names and organisation numbers are retrieved from the Swedish Tax Agency (Skatteverket) and the Swedish Companies Registration Office (Bolagsverket).

From an initial list of 710 acquisition transactions completed by listed Swedish acquirers between 2002 and 2015, we have arrived at a final sample of 319 acquisitions that fulfils the above sampling criteria, however, the actual sample used in different empirical models may vary depending on the data availability of the remaining control variables in the models. The detail sample construction is shown in Table 1.

**Table 1.** *Sample selection process*
This table illustrates the sample selection process. The number of sample used in different empirical models will vary depending on the data availability for the computation of other control variables in the models.

| Sample selection process | Number of observations |
|---|---|
| Announced M&A deals with public acquirers for years 2002-2015 | 710 |
| *Less:* | |
| Deals with missing information on percentage of shares acquired | -46 |
| Deals with missing information on acquirer share price | -72 |
| *Less:* | |
| Deals related to acquisition of divisions, portfolios, properties and projects | -132 |
| Deals with deal price below SEK 1 million | -13 |
| Deals in which acquirers owned more than 50% of shares before acquisition | -46 |
| Deals in which acquirers owned less than 100% of shares after acquisition | -82 |
| Final sample | **319** |
| - Sample with sufficient data to calculate firm-level accounting quality | 183 |
| - Sample with sufficient data to calculate both the change in ROA and firm-level accounting quality model | 158 |

# 6. Results and analysis

The following chapter starts by presenting the descriptive statistics of the variables in section 6.1. Thereafter, in section 6.2, 6.3 and 6.4 the result from *Hypothesis 1, Hypothesis 2* and *Hypothesis 3* will be presented and analysed respectively.

## 6.1 Descriptive statistics

Table 5 presents the summary statistics of both independent and dependent variables used in the study. Acquirer cumulative abnormal stock return (ACQ_CAR) has a positive mean value of 0.04. This is contrary to previous research which find a negative mean acquirer stock return around acquisition announcement (e.g. Dodd, 1980; Andrade et al., 2001; Moeller et al., 2005; McNichols and Stubben, 2015). Possible explanation for the deviation from previous research can be explained by the fact that 93% of the targets in our sample are private targets. Other research have shown that acquirer of private targets receive a higher return than those of public targets (Fuller et al, 2002; Chang, 1998). Acquirer average change in return on assets (ACQ_ROA) is positive with a mean of 0.03. This is similar to the results from Martin and Shalev (2017) as well as Wang and Xie (2009) which both show a positive average change in ACQ_ROA in their sample, nevertheless the standard deviation in our sample is larger than the above mentioned research (sd=0.35). Regarding the target AQ, the industry accounting quality (IAQ) in both the Kothari model and the Jones model are higher than that of firm-specific accounting quality (FAQ). The FAQ estimated from the Kothari model, the Jones model as well as the MDD model produce similar mean values of –0.20, -0.26 and -0.17 respectively.

**Table 5:** *Summary statistics*

| Variable | N | Mean | Std. Dev. | Q1 | Median | Q3 |
|---|---|---|---|---|---|---|
| ACQ_CAR | 319 | 0.043 | 0.182 | -0.021 | 0.013 | 0.079 |
| ACQ_ROA | 281 | 0.030 | 0.350 | -0.062 | 0.002 | 0.073 |
| IAQ_Kothari | 319 | -0.010 | 0.007 | -0.012 | -0.009 | -0.006 |
| FAQ_Kothari | 189 | -0.200 | 0.444 | -0.208 | -0.078 | -0.027 |
| IAQ_Jones | 319 | -0.007 | 0.009 | -0.009 | -0.004 | -0.002 |
| FAQ_Jones | 189 | -0.264 | 0.689 | -0.230 | -0.102 | -0.046 |
| FAQ_MDD | 168 | -0.176 | 1.099 | -0.105 | -0.059 | -0.028 |
| UNC | 215 | 0.847 | 0.236 | 0.845 | 0.947 | 0.989 |
| IND_LIQ | 319 | 0.009 | 0.035 | 0.000 | 0.001 | 0.003 |
| TARGET_GROWTH | 198 | 3.314 | 12.685 | 0.988 | 1.084 | 1.367 |
| ACQ_SIZE | 319 | 5.885 | 1.064 | 5.180 | 5.796 | 6.629 |
| REL_SIZE | 209 | 0.624 | 1.576 | 0.039 | 0.140 | 0.528 |
| CASH | 319 | 0.511 | 0.500 | 0.000 | 1.000 | 1.000 |
| EQUITY | 319 | 0.279 | 0.449 | 0.000 | 0.000 | 1.000 |
| SAME_IND | 319 | 0.596 | 0.492 | 0.000 | 1.000 | 1.000 |
| PRIV_TARG | 319 | 0.931 | 0.254 | 1.000 | 1.000 | 1.000 |

Exhibit 2 shows the sample distribution by announcement year. The number of acquisition deals reached its peak in 2007, following by a decline between 2008 and 2009 due to the impact of the financial crisis which indicates an increased systematic risk in the market, hence a less liquid market, resulting in a decrease in M&A activities. The number of acquisitions had another peak in 2010, but followed by a downward trend until 2014. From Exhibit 3, average ACQ_CAR were mostly positive within the sample period with a peak in 2003. Similarly, ACQ_ROA were mostly positive within the sample period, however the peak occurred in 2004 instead. It is consistent with the fact that ACQ_ROA is a lagged acquisition performance measure as it is calculated as the change in ROA in acquiring firm one year prior and one year after the acquisition. The development trend of target AQ estimated by the Kothari model (FAQ_Kothari) is closely related to that estimated by the Jones model (FAQ_Jones) with the lowest average FAQ in 2002 and the highest in 2004. More detail sample distribution information is presented in Appendix 3.

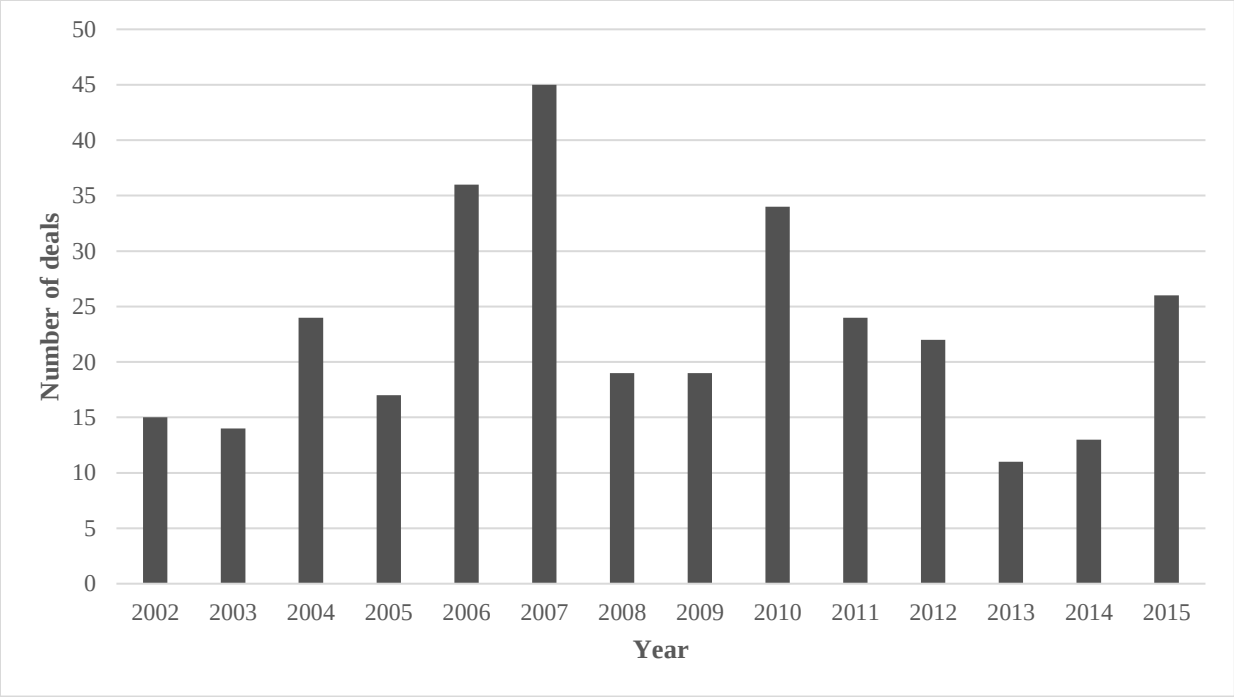



***Exhibit 2:*** *Distribution of acquisitions between 2002 and 2015*

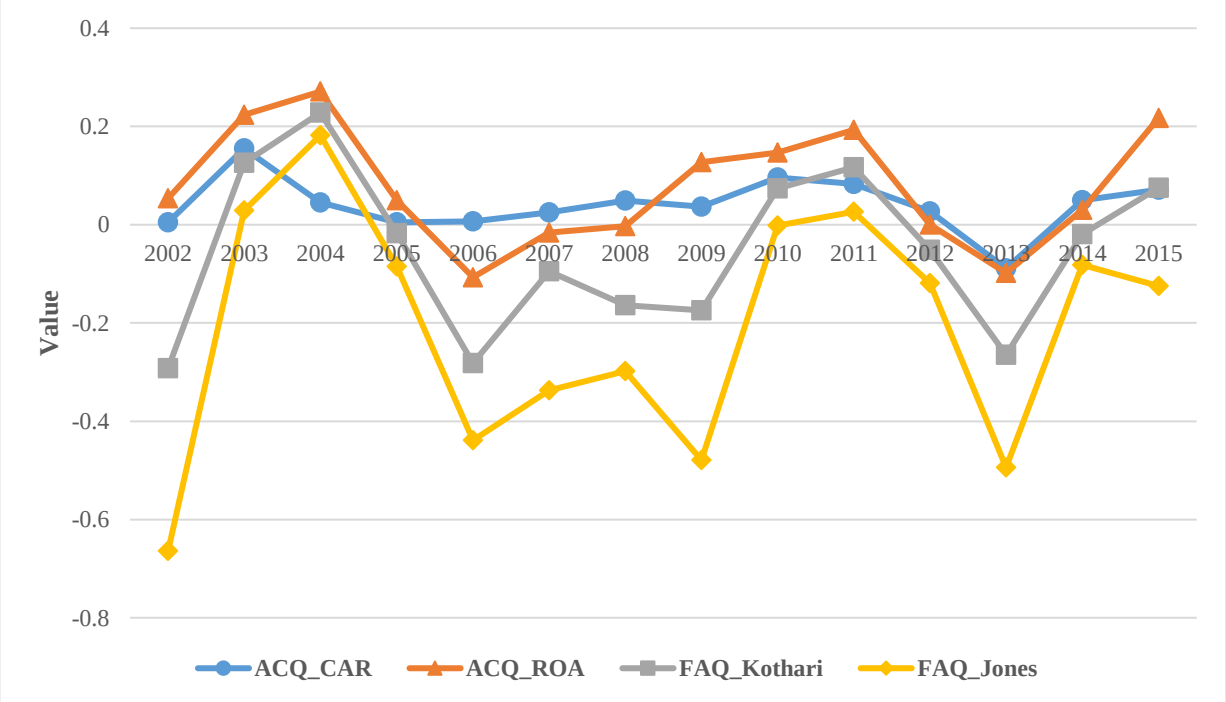



**Exhibit 3:** *Average acquirer acquisition performance and target accounting quality by year*

Table 7 presents the Pearson correlation coefficients between all variables. It shows that FAQ_Kothari is positively correlated with ACQ_CAR (0.12*) and ACQ_ROA (0.15**). Moreover, both firm-specific AQ calculated by the Jones model and the MDD model show a positive but statistically insignificant correlation with ACQ_CAR and ACQ_ROA. There are other control variables that show significant correlation with ACQ_CAR. First of all, target growth (TARG_GROWTH) has significant positive effect on ACQ_CAR (0.21***). Acquirer size (ACQ_SIZE) is negatively correlated with ACQ_CAR (-0.23***), this is consistent with the correlation found in Moeller et al. (2004) where they find that acquirers' size is negatively correlated with acquirers abnormal return. Furthermore, the relative size of target over acquirer (REL_SIZE) shows a significant positive correlation with ACQ_CAR (0.14**).

Table 7 also indicates a significant positive correlation between FAQ_Kothari and FAQ_Jones (0.63***). It is consistent with the fact that the Kothari model is developed as an extended version of the Jones model by including ROA as a performance-matched control variable (Kothari et al., 2005). On the contrary, a negative but statistically insignificant correlation is observed between firm-specific AQ calculated by the MDD model (FAQ_DD) and both FAQ_Kothari (-0.00) and FAQ_Jones (-0.04). IAQ_Jones is positively correlated with FAQ_Jones (0.23***). There are positive correlation between IAQ_Kothari and FAQ_Kothari, however the correlation is not statistically significant (0.10).

Last but not least, Table 7 shows that cash offer (CASH) is positively correlated to FAQ_Kothari (0.13*). Conversely, share offer (EQUITY) is negatively correlated with FAQ_Kothari (-0.22***). Overall, the correlations between variables only provide a general idea of the relationship between variables, all statistical inference in our study will be based on the following multivariate analysis.

## 6.2 Hypothesis 1

Table 8 presents the OLS regression result in which we test *Hypothesis 1* of whether target AQ has positive effect on acquirer short-term stock return. As suggested by McNichols and Stubben (2015), in this study, the testing of firm-level target AQ on acquirer short-term stock return is done in a three-step approach (see model 1 to model 3). The purpose of including and excluding the target's uncertainty (UNC) from the models is to examine if the omission of control variable on the general uncertainty of the environment where target operates will bias the results and affect our inference on AQ.

Based on equation (16), model (1) includes the measure of target uncertainty (UNC) but excludes the measure of target AQ (FAQ_Kothari). Comparing to McNichols and Stubben (2012) in which they find that acquirer short-term stock return is significantly lower when target uncertainty is high, the coefficient on uncertainty in our model is also negative, however, it is not statistically significant (t=-0.37). As a result, the relation between target uncertainty and acquirer short-term stock returns in our sample is inconclusive. In fact, there are different kinds of general uncertainty incurred in a target's operation, the inconclusive result in our sample indicates that there are other uncertainty variables, which are better to explain the relation between the general uncertainty of targets and acquirer acquisition return, are not captured in our model.

Turning to model (2), we exclude the control variable UNC to examine the effect of FAQ_Kothari on acquirer short-term stock return (ACQ_CAR). Consistent with *Hypothesis 1*, acquirer short-term stock return is significantly higher when the target AQ is higher (coef.=0.07; t=2.94). Specifically, the result implies that, holding other control variables constant, one percentage point increases in FAQ_Kothari will lead to 7 percentage point higher ACQ_CAR. As a result, we regard the magnitude of the coefficient on target AQ as both statistically and economically significant. In model (3), which is our baseline model to test *Hypothesis 1*, we include again the control variables UNC together with the target AQ measure (FAQ_Kothari) to examine the incremental effect of target AQ on acquirer short-term stock return (ACQ_CAR) after controlling for UNC. It shows that the inclusion of UNC in the model will slightly weaken the effect of FAQ_Kothari on ACQ_CAR. Nevertheless, the effect of FAQ_Kothari is still significantly positive (coef.=0.07; t=3.02).

**Table 8:** *Acquirer's short-term stock return and target's accounting quality*

Table 8 presents the coefficients and t-statistics of the determinants of acquirer's seven-day market-adjusted abnormal return (ACQ_CAR). Model (1) reports the result from regression by including the target's uncertainty factor (UNC) and excluding the firm-specific AQ estimated from the Kothari model (FAQ_Kothari). Model (2) reports the result from regression by including FAQ_Kothari and excluding UNC. Model (3) reports the result from regression by including both UNC and FAQ_Kothari. Model (4) and (5) replace the FAQ_Kothari with IAQ_Kothari as a proxy for target AQ. See Appendix 1 for variable definitions. Robust standard errors are used to control for heteroskedasticity. Robust t-statistics are shown in parentheses, significant at following levels: ***p<0.01, **p<0.05, *p<0.1.

| | *Firm-level* | | | *Industry-level* | |
|---|---|---|---|---|---|
| | Without FAQ Model (1) | Without UNC Model (2) | Baseline Model (3) | Without UNC Model (4) | Industry Model (5) |
| FAQ_Kothari | | 0.070*** | 0.070*** | | |
| | | (2.946) | (3.024) | | |
| IAQ_Kothari | | | | 1.569 | 1.500 |
| | | | | (1.239) | (1.172) |
| UNC | -0.017 | | -0.009 | | -0.015 |
| | (-0.372) | | (-0.213) | | (-0.317) |
| IND_LIQ | 0.357 | 0.312 | 0.324 | 0.339 | 0.353 |
| | (1.477) | (1.480) | (1.417) | (1.538) | (1.471) |
| TARG_GROWTH | 0.002** | 0.003*** | 0.003*** | 0.002** | 0.002** |
| | (2.277) | (3.105) | (3.104) | (2.314) | (2.303) |
| ACQ_SIZE | -0.024** | -0.022** | -0.022* | -0.025** | -0.024** |
| | (-2.057) | (-2.056) | (-1.941) | (-2.221) | (-2.106) |
| REL_SIZE | 0.017** | 0.017** | 0.017** | 0.018** | 0.018** |
| | (2.236) | (2.178) | (2.182) | (2.481) | (2.485) |
| CASH | 0.039 | 0.030 | 0.031 | 0.040 | 0.040 |
| | (1.420) | (1.117) | (1.153) | (1.411) | (1.456) |
| SAME_IND | 0.039 | 0.036 | 0.0353 | 0.039 | 0.039 |
| | (1.538) | (1.474) | (1.441) | (1.572) | (1.543) |
| PRIV_TARG | 0.066* | 0.077** | 0.077** | 0.068* | 0.068* |
| | (1.803) | (2.148) | (2.140) | (1.812) | (1.830) |
| Constant | 0.019 | 0.025 | 0.026 | 0.024 | 0.029 |
| | (0.216) | (0.308) | (0.298) | (0.290) | (0.321) |
| Observations | 195 | 185 | 183 | 197 | 195 |
| R-squared | 0.250 | 0.274 | 0.275 | 0.253 | 0.254 |
| Year FE | Yes | Yes | Yes | Yes | Yes |

Comparing to the finding in Lim et al. (2015) in which they also shows a significant positive effect of target AQ on acquirer short-term stock return in South Korea (coef.=0.05; t=1.7), our sample indicates a slightly stronger positive effect of target AQ on acquirer short-term stock return in Sweden. Overall, the result supports that higher target AQ can bring positive effect to acquirer short-term stock return. Specifically, we conclude that the risk of target value uncertainty can be mitigated with higher target AQ as it allows the acquirer to value the target more accurately. The result is also in line with the winner's curse hypothesis explained in section 2.1.2, such that lower target value uncertainty can reduce the magnitude of overpayment and ultimately lead to higher acquisition returns.

In addition, model (3) also shows that acquirer stock return is higher when the target has had higher sales growth (TARG_GROWTH) before the acquisition (t=3.10). Findings from previous research regarding the effect of target pre-acquisition sales growth on acquirer acquisition performance are inconclusive. McNichols and Stubben (2015) find that the acquirer stock return is significantly lower if the target has had higher growth. On the contrary, Dionne et al. (2015) suggest that since target with higher sales growth is often associated with better financial health and good management, it will bring positive signalling effect and result in a positive acquirer short-term stock return. Our result support the explanation from Dionne et al. (2015). However, it is noticed that although the coefficient is statistically significant, the expected effect of TARG_GROWTH on ACQ_CAR is negligible (coef.=0.00). Therefore, we regard the coefficient on target sales growth as not economically significant. Furthermore, model (3) also shows that larger acquirer (ACQ_SIZE) have lower short-term stock returns from acquisition than smaller acquirer (t=-1.94). As explained by Moeller et al. (2004), larger acquirers are more prone to managerial hubris in acquisition decision-making. Together with the fact that larger acquirers can afford a relatively higher acquisition premium than small acquirers, the probability of overpayment by larger acquirers is therefore considered to be higher comparing to smaller acquirers. In addition, model (3) also shows that the acquirer stock return is higher if target is a private firm (PRIV_TARG). This is consistent with Fuller et al. (2002) and Chang (1998) which find that acquirers of private targets have higher abnormal stock returns than those who acquire public targets.

In model (4) and (5), we replace the firm-level measure of target AQ (FAQ_Kothari) with industry level AQ measure (IAQ_Kothari) to test if IAQ_Kothari is a good substitute to represent the target AQ as suggested in McNichols and Stubben (2015). When target AQ is measured by IAQ_Kothari, the coefficient continues to be positive, however it becomes statistically insignificant (coef.=1.50; t=1.17). This is contrary to the finding in McNichols and Stubben (2015) in which industry-level AQ also presents a statistically significant coefficient at the firm-level AQ. Our result raises the question of whether industry level AQ is a good proxy to firm level AQ in acquisition research. The use of industry level AQ in acquisition settings can reduce the selection bias caused by systematically excluding young targets when estimating AQ from the models, however it leads to the problem of specification error by disregarding the unique accounting characteristics of each firm and the difference in AQ of firms within an industry (McNichols and Stubben, 2015).

In conclusion, based on the result from model (3) in which the coefficient of FAQ_Kothari is positive (0.07***) and significant on a 1% level, we reject the null-hypothesis establishes in section 4.3.1. Therefore, we conclude that higher target AQ will lead to higher acquirer short-term CAR than target with lower AQ in Sweden.

## 6.3 Hypothesis 2

Table 9 presents the OLS regression results in which we test *Hypothesis 2* of whether target AQ has positive effect on acquirer operating return. Based on equation (17), model (6), our baseline model to test *Hypothesis 2,* shows that there is no statistically significant relationship between target AQ and acquirer change in operating returns (coef.=0.04; t=0.85). The coefficient on target AQ is also insignificant in model (7) where industry-level AQ is used as a measure of target AQ (coef.=0.66; t=0.48). This result is consistent with Martin and Shalev (2017) in which they also report a statistically insignificant coefficient of target AQ (coef=-0.03; t=-0.96)[11].

One possible explanation for the insignificant result is that acquirer operating performance as well as AQ dominates the effect on the post-acquisition change in operating return. In our sample, the mean and median of targets size relative to that of the acquirers is 0.62 and 0.14 respectively (see Table 5). In other words, majority of the targets are significantly smaller than the acquirers in our sample. Therefore, in the post-acquisition consolidated financial statements, it is possible that the effect of acquirer's own AQ as well as their operating performance dominate the effect of change in ROA in the combined entity. In other words, the effect of target AQ can be neutralized and cannot be sufficiently reflected on this accounting-based measure of acquirer acquisition return. Moreover, another explanation for the insignificant result is that it takes time for the realization of potential synergies as well as for the impact of target AQ to be reflected on the financials of the combined entity, hence it is possible that a longer measurement period for the changes in ROA is needed in order to capture the effect of target AQ on the operating performance measure of the combined entity.

[11] Similar to our study, Martin and Shalev (2017) estimate the target accounting quality by the Jones (1991) model. Nevertheless, they only take the absolute value of the residuals as a proxy to accounting quality rather than multiplying the absolute value of the residuals by –1. Therefore, in their research, the higher the value of the measure indicates a lower accounting quality, whereas in our study the higher the value of the AQ measure indicates the higher the accounting quality.

**Table 9:** *Acquirer's change in returns on assets and target's accounting quality*

Table 9 presents the coefficients and t-statistics of the determinants of acquirer's change in return on assets (ACQ_ROA). Model (6) reports the result from regression in which target AQ is measured using firm-level accounting quality measures (FAQ_Jones). Model (7) report the result from regression in which target accounting quality is measured using industry-level accounting quality measures (IAQ_Jones). See Appendix A for variable definitions. Robust standard errors are used to control for heteroscedasticity. Robust t-statistics are shown in parentheses, significant at the following levels: ***p<0.01, **p<0.05,*p<0.1.

| | Baseline Model (6) | Industry-level Model (7) |
|---|---|---|
| FAQ_Jones | 0.041 | |
| | (0.853) | |
| IAQ_Jones | | 0.668 |
| | | (0.489) |
| UNC | -0.015 | -0.018 |
| | (-0.318) | (-0.373) |
| IND_LIQ | 0.228 | 0.240 |
| | (0.968) | (0.997) |
| TARG_GROWTH | -0.002*** | -0.003*** |
| | (-5.005) | (-4.453) |
| ACQ_SIZE | -0.013 | -0.015 |
| | (-0.799) | (-0.915) |
| REL_SIZE | 0.004 | 0.005 |
| | (0.480) | (0.539) |
| CASH | 0.012 | 0.016 |
| | (0.398) | (0.487) |
| SAME_IND | 0.023 | 0.021 |
| | (0.672) | (0.605) |
| PRIV_TARG | 0.016 | 0.010 |
| | (0.236) | (0.144) |
| Constant | 0.129 | 0.135 |
| | (0.834) | (0.877) |
| Observations | 158 | 169 |
| R-squared | 0.131 | 0.124 |
| Year FE | Yes | Yes |

Model (6) also shows that acquirer operating return is lower when target has had higher growth (t=-5.01). This is contrary to the result in model (3) where acquirer stock return instead of acquirer operating return is used as the dependent variable. As highlighted in section 6.2, the result from previous research regarding the effect of targets pre-acquisition sales growth on acquirer acquisition performance are inconclusive. One possible explanation for the negative effect of target sales growth on acquirer ROA can be due to the omission of explanatory variable in our model. Specifically, an additional variable which has potential positive effect to the ACQ_ROA and negative effect to the TARG_GROWTH or vice versa should be included, such as investment on assets.[12] Nevertheless, one should notice that the expected effect of targets' sales growth on ACQ_ROA is negligible (coef.=-0.00). Therefore, we do not regard the effect as economically significant. Other control variables are not statistically significant in model (6).

Given the statistically insignificant coefficient on target AQ, we cannot reject the null hypothesis establishes in section 4.3.2. Therefore, the relationship between target AQ and acquirer operating return cannot be established in our sample from model (6).

## 6.4 Hypothesis 3

Table 10 presents the results from the logistic regression in which we test *Hypothesis 3* of whether higher target AQ increases the probability of cash offer in acquisitions. Model (8), our baseline model to test *Hypothesis 3,* presents the logistic regression in which the dependent variable is an indicator variable equals one if the deal was completely settled in cash and zero otherwise. Model (9) presents the logistic regression in which the dependent variable is an indicator variable equal one if the deal was completely settled in equity and zero otherwise.

The coefficient on target AQ (FAQ_Kothari) in model (8) is significantly positive (p=0.05), indicating that higher target AQ increases the likelihood of the deal to be settled in cash. On the other hand, in model (9) the coefficient on target AQ is significantly negative (p=0.00), indicating that higher target AQ reduces the likelihood of the deal to be settled in equity.

[12] Intuitively speaking, a higher sales growth usually comes along with higher investment on fixed or current assets. However, as total asset is the denominator in ROA, hence given that the earning is constant, the higher the amount of total assets, the lower the ROA.

**Table 10:** *Acquirer's payment method and target's accounting quality*

Table 10 presents the coefficients and p-value of the results from the logistic regression. In Model (8), the dependent variable is CASH, which is an indicator variable that is equal to one if the deal was fully settled in cash and zero otherwise. In Model (9), the dependent variable is EQUITY, which is an indicator variable that is equal to one if the deal was fully settled in equity and zero otherwise. The difference in the number of observations is due to the fact that there is no acquisition in 2008 that was completely settled in equity. See Appendix A for variable definitions. Robust standard errors are used to control. Robust p-value are shown in parentheses, significant at the following levels: ***p<0.01, **p<0.05, *p<0.1.

| | CASH | EQUITY |
|---|---|---|
| | Model (8) | Model (9) |
| FAQ_Kothari | 0.813** | -1.542*** |
| | (0.046) | (0.001) |
| UNC | -0.920 | -0.140 |
| | (0.175) | (0.865) |
| IND_LIQ | 3.433 | -11.202 |
| | (0.442) | (0.211) |
| TARG_GROWTH | -0.002 | 0.003 |
| | (0.861) | (0.802) |
| ACQ_SIZE | 0.409** | -0.308* |
| | (0.012) | (0.090) |
| REL_SIZE | 0.010 | 0.009 |
| | (0.921) | (0.949) |
| SAME_IND | -0.671** | -0.241 |
| | (0.043) | (0.533) |
| PRIV_TARG | 1.288* | -1.989*** |
| | (0.072) | (0.003) |
| Constant | -2.179 | 2.467 |
| | (0.163) | (0.165) |
| Observations | 183 | 173 |
| Pseudo R-squared | 0.141 | 0.175 |
| Year FE | Yes | Yes |

The possible explanation for these results is that acquirer choice of payment is influenced by the underlying value uncertainty of the target such that acquirer is more likely to make cash offer when the target value uncertainty is low. As documented in Hansen (1987), equity has a contingent-pricing effect which is used as a mean to protect acquirers against the adverse selection. To be precise, the key difference between cash and share offer is that share value depends on the acquisition profitability while the cash value is fixed and unaffected by acquisition profitability (Fishman, 1989). In other words, in a share offer, target inherently accepts to bear the risk derived from its value uncertainty on acquisition profitability. On the contrary, in a cash offer, acquirers need to bear the consequence of targets value uncertainty on their own. Base on the above analysis, it is expected that acquirer is more likely to make cash offer when their certainty over target value is high, holding other factors constant. Therefore, it shows that payment method in acquisition is not only the preference of acquirers but instead it is a choice to make with the aim of mitigating the risk of target value uncertainty.

The results in model (8) also shows that the larger the acquirer the more likely the deal will be settled in cash (p=0.01). One possible explanation can be due to the fact that larger acquirers in general have more liquid assets and higher borrowing ability than smaller acquirers to make cash offer. Model (8) also shows that if the target is in the same industry (SAME_IND) as the acquirer, the likelihood of cash offer will decrease (p=0.04). Moreover, if the target is a private firm (PRIV_TARG), it is more likely for the acquirer to make cash offer (p=0.07). The coefficients in both SAME_IND as well as PRIV_TARG are inconsistent with our expectation. Intuitively speaking, target value uncertainty shall be lower if target is in the same industry as the acquirer and therefore more likely to make cash offer in acquisition. Similarly, if the target is a private firm, given the limited availability of information, the value uncertainty is expected to be higher than that of public target and hence the likelihood of cash offer should be lower. These opposite relationship obtained from our models highlight the fact that in addition to information availability and value uncertainty, there are other attributes of these non-accounting target characteristics other than their implication on the degree of value uncertainty can influence the choice of payment.

Given that the coefficient on target AQ in model (8) is significant at 5% confidence level, we can reject the null hypothesis establishes in section 4.3.3 and conclude that higher target AQ increases the likelihood of the deal being settled in cash.

# 7. Discussion

In this chapter, section 7.1 presents the sensitivity tests on our model to see if changes in the model specifications as well as variable computation methods will influence our main results. Thereafter, section 7.2 presents the result of the robustness tests on our three main models.

## 7.1 Sensitivity analysis

### 7.1.1 Excluding finance industry and pharmaceutical industry

In Table 11, we perform the sensitivity analysis by excluding two industry groups to test *Hypothesis 1, Hypothesis 2 and Hypothesis 3,* respectively. First of all, targets from the finance industry are excluded due to their unique business model and operating environment. Specifically, their reporting is highly regulated and also the nature of accruals can be different from other industries which can affect our results (Othman and Zeghal, 2006).[13] Moreover, targets from the pharmaceutical industry are excluded as they usually have a lot of capitalized research and development (R&D) expenditure which can make their long-term accruals (i.e. amortization) different from other industries.[14]

In Panel A, we exclude the aforementioned two industries from model (3) where we test *Hypothesis 1*. The coefficient on ACQ_SIZE becomes statistically insignificant (-0.02) after excluding targets from the finance industry. But overall, the strength and significance of other coefficients after excluding targets from the finance industry and the pharmaceutical industry are consistent with the main result in model (3). In Panel B, the results from excluding the finance industry and the pharmaceutical industry are consistent with the main result in model (6). In Panel C, the coefficient on FAQ_Kothari (0.78**) is slightly smaller than that in model (6) after we exclude targets from the finance industry. Furthermore, the coefficients on ACQ_SIZE, SAME_IND and PRIV_TARG show a smaller effect on the likelihood of cash offer after excluding the finance industry (0.36**, -0.65** and 1.21* respectively). On the other hand, when targets from the pharmaceutical industry are excluded, the coefficient on FAQ_Kothari (0.85**) is slightly stronger than in the main model but the coefficient of PRIV_TARG become statistically insignificant (1.13).

[13] Companies with Fama French code 44 (Banking) and 45 (Insurance) are excluded.
[14] Companies with Fama French code 13 (Pharmaceutical products) are excluded.

Based on the signs and strength of the coefficients in Panel A and Panel B, we conclude that our main results from model (3) and (6), where we test *Hypothesis 1* and *Hypothesis 2*, are not sensitive to the exclusion of targets from the finance industry and the pharmaceutical industry. However, the main result from model (8), where we test *Hypothesis 3*, is sensitive to the exclusion of the finance industry and the pharmaceutical industry.

### 7.1.2 Choice of cumulative abnormal return measurement period

We also test whether the effect of target AQ on ACQ_CAR will change if the length of the window changes. As shown in Table 12, instead of using CAR (-3, +3) as our measure of ACQ_CAR, we use CAR (-1, +1) and CAR (-10, +10) when testing *Hypothesis 1*. In model (19), where CAR (-1, +1) is used in ACQ_CAR, the coefficient of FAQ_Kothari (0.04**) is weaker than in model (3) and the coefficients on TARG_GROWTH, ACQ_SIZE and PRIV_TARG become statistically insignificant. Moreover, in model (20), where CAR (-10, +10) is used as the ACQ_CAR, the coefficient on FAQ_Kothari (0.07*) is the same as in model (3). Regarding the coefficients on other control variables, IND_LIQ and SAME_IND become statistically significant (0.53* and 0.07* respectively), whereas the coefficients on ACQ_SIZE and REL_SIZE become statistically insignificant (-0.03 and 0.01 respectively). Overall, the control variables have the same coefficient signs as those estimated in model (3). In sum, given that the significant level and strength of the coefficients vary when different CAR calculation window is used, we regard our main result from model (3), where we test *Hypothesis 1*, as sensitive to the change in the length of window used in calculating ACQ_CAR.

### 7.1.3 Choice of accounting quality model

In order to test the sensitivity of our results to the change in AQ model, we re-estimate the three main models (equation 16, 17 and 18 respectively) by using the modified Dechow and Dichev (MDD) model suggested by McNichols (2002).

From Table 13 Panel D, the coefficient on FAQ_MDD is negative but statistically insignificant (-0.00). The coefficients signs and significance level of all other control variables are consistent with those estimated in model (3). In Panel E, the coefficient on FAQ_MDD is negative but insignificant (-0.00). The coefficient signs and significance level of all other control variables are consistent with those in model (6). Last but not least, in Panel F, the coefficient on FAQ_DD is positive but statistically insignificant. The coefficient on UNC becomes statistically significant

in this model (-1.17*). All of the coefficients on other control variables have the same sign and significance level as model (8).

All in all, our main results from both model (3), (6) and (8) are found to be sensitive to the change in AQ model. The result obtained from Panel E is inconsistent with the research findings in Lim et al. (2015) where the use of both the Kothari model and the MDD model generate similar statistically significant positive effect on acquirer acquisition return. One possible explanation for the inconsistent results we obtained can be due to the use of a different computation method for the accounting data used in estimating the MDD model compared to previous research. Specifically, since the accounting information from the statement of cash flow is not available in our sample, we need to follow the indirect approach suggested by Francis et al. (2005). Following the indirect approach, which we compute the annual cash flow from operation (CFO) as well as the change in working capital accruals (WCA) based on the accounting information from the balance sheet and the income statements. As a result, there is a potential risk that the CFO and WCA computed can deviate from the actual figures in the statement of cash flow, especially when the balance sheet and income statement contain a lot of non-operating items such as translation differences.

## 7.2 Robustness test

In order to provide confidence on our results, we performed the following robustness tests.

### 7.2.1 Heteroskedasticity

Heteroskedasticity occurs when the variance of error terms differs across the observations. The existence of heteroskedasticity will not lead to biased and inconsistent estimates from OLS regression, however, it will result in biased standard errors which make t-statistics and f-statistics invalid for us to draw any inference from. In order to test for the existence of heteroskedasticity in our models, we perform the Breusch-Pagan/Cook-Weisberg test as well as the White test. From Figure 2, excluding the Breusch-Pagan/Cook-Weisberg test for model (6), the p-value of other tests are more than alpha (5% significance level). All in all, we conclude that heteroskedasticity is not substantial in both our baseline models (3) and (6). However, in order to control for the potential presence of heteroskedasticity, robust regressions are still performed in all models in order to relax the assumption of homoskedasticity.

### 7.2.2 Multicollinearity

Multicollinearity exists when two or more independent variables in a multiple regression are highly correlated. The high correlation between independent variables can increase the variance of the coefficients estimated which makes the coefficients very unstable and difficult to interpret. Based on the Pearson coefficient correlation presented in Table 7, no significantly strong correlation is identified between the independent variables used in each of the models. Therefore, we conclude that multicollinearity is not present in our data.

# 8. Conclusion

Our study aims to investigate whether higher target's accounting quality (AQ) can lead to higher acquirer's acquisition return by reducing the target value uncertainty. Moreover, we also investigate if the likelihood of the deal being settled in cash increases when target has higher AQ. Using a sample of Swedish acquisitions with both public and private targets between 2002-2015, two AQ models are employed to assess the value relevance of AQ in an acquisition setting.

This study finds that acquirer's short-term stock return is higher when the target has higher AQ estimated by the Kothari model. It is therefore concluded that higher target AQ can mitigate the valuation uncertainty which helps to increase the accuracy of acquisition pricing and ultimately results in a higher short-term stock return for the acquirer. Nevertheless, due to the statistically insignificant result, no conclusion can be drawn regarding the relation between target AQ and change in operating return in the combined entity. Therefore, further research is needed to examine the effect of target AQ on acquirer's accounting-based acquisition return given that it takes time to realize synergies in the combined entity.

Last but not least, this study also finds that higher target AQ increases the likelihood of acquisition being settled in cash. This empirical evidence is in line with previous research which state that since the value of share offer is contingent on acquisition profitability, hence acquirers will use share offer as a mean to mitigate the value uncertainty and the subsequence risk of overpayment with the targets. Conversely, since cash offer does not carry this contingent pricing feature, acquirers are more likely to settle the deal with cash when they are more certain in the target’s value. Given the statistically significant results we obtained, the positive linkage between target AQ and cash offer is concluded. Specifically, higher target AQ can reduce the degree of value uncertainty and hence increase the likelihood of cash offer.

In sum, the results in this study affirms the value relevance of accounting information in acquisition settings by examining the effect of target’s AQ on acquirer's short-term stock return as well as the choice of payment method. However, the sensitivity tests show that our results are sensitive to change in the estimation period of acquirer's stock return as well as the use of alternative AQ models. Therefore, the interpretation as well as the generalisation of the results beyond our sample and model design should be handled with caution.

## 8.1 Limitations

The validity of the study depends on the ability to draw conclusion from the results we find regarding the value relevance of accounting quality (AQ) on acquirer post-acquisition performance and choice of payment method. Since AQ is unobservable, accrual quality has been used as a proxy for the general AQ of accounting information in previous studies. Therefore, the validity of this study needs to address the possible measurement error from our side that could have occurred.

Regarding industry-specific AQ (IAQ) and firm-specific AQ (FAQ), there is a trade-off between validity and reliability. The validity of IAQ is dependent upon whether we can assume that all firms in a specific industry possess the same AQ. However, this can be a strong assumption and is the reason why we do not use IAQ in our baseline models. At the same time, the reliability of the study would be higher if we use IAQ since we can run the models with a larger sample than with FAQ.

The reliability of our study affects the ability for other researchers to replicate our study given the assumptions described as well as the chosen research methods used. Potential measurement errors mainly come from the computation of target AQ as well as the estimation of acquirer post-acquisition performance. Such kind of measurement errors can occur if we have inaccurately interpreted and computed the models or managed the data inappropriately. To further ensure the reliability of the study, financial data retrieved from Serrano as well as Datastream have been cross-checked with the annual reports from the Swedish Companies Registration Office (Bolagsverket). Overall, no significant error is identified that can affect the reliability of our study.

Finally, the generalisability outside the scope of Swedish public acquirers and Swedish public and private targets during our sample period are considered to be moderate. Nevertheless, applying our result in other settings than mentioned in our research boundaries and research methods are not guaranteed to yield the same results as in our study and therefore should be interpreted carefully.

## 8.2. Suggestion for further research

This study aims to investigate the effect target accounting quality (AQ) has on acquirer acquisition performance and decision-making in a Swedish context. However, there are many aspects in the field of study that require further research. First of all, it could be interesting to

examine the possibility of applying AQ models beyond academic research and allow practitioners to quantify and integrate AQ into acquisition assessment proactively. Moreover, given that target AQ can affect the acquirer choice of payment and it is common that acquirers use a mixed of cash and equity to settle the acquisition, it is also of interest to see if the proportion of cash and share offer is affected by the underlying target AQ and whether acquirer can structure it in a way that helps to effectively mitigate the risk of target value uncertainty caused by different target AQ. Finally, since we follow the stream of previous research which assumes that target do not have enough time to perform earnings management to attract potential acquirers, it will also be of interest to investigate if there is any indication that targets perform earnings management to attract potential acquirers, in this case a time-series study is needed.

# References


Andrade, G., Mitchell, M.L. & Stafford, E. 2001, "New evidence and perspectives on mergers", *Journal of Economic Perspectives,* vol. 15, no. 2, pp. 103-120.

Asquith, P., Bruner, R.F. & Mullins, D.W. 1983, "The gains to bidding firms from merger", *Journal of Financial Economics,* vol. 11, no. 1-4, pp. 121-139.

Baker, M., Ruback, R. & Wurgler, J. 2007, "Behavioral corporate finance: A survey." In The Handbook of Corporate Finance: Empirical Corporate Finance, edited by Espen Eckbo. New York: Elsevier/North Holland"

Ball, R. & Brown, P. 1968, "An Empirical Evaluation of Accounting Income Numbers", *Journal of Accounting Research,* vol. 6, no. 2, pp. 159-178.

Barber, B.M. & Lyon, J.D. 1997, "Detecting long-run abnormal stock returns: The empirical power and specification of test statistics", *Journal of Financial Economics,* vol. 43, no. 3, pp. 341-372.

Bazerman, M.H. & Samuelson, W.F. 1983, "I won the auction but don't want the prize", *Journal of Conflict Resolution,* vol. 27, no. 4, pp. 618-634.

Bernard, V.L. & Thomas, J.K. 1989, "Post-Earnings-Announcement Drift: Delayed Price Response or Risk Premium?", *Journal of Accounting Research,* vol. 27, pp. 1-36.

Biddle, G.C., Hilary, G. & Verdi, R.S. 2009, "How does financial reporting quality relate to investment efficiency?", *Journal of Accounting and Economics,* vol. 48, no. 2–3, pp. 112-131.

Black, B.S. 1989, "Bidder Overpayment in Takeovers", *Stanford law review,* vol. 41, no. 3, pp. 597-660.

Boone, A.L. & Harold Mulherin, J. 2008, "Do auctions induce a winner's curse? New evidence from the corporate takeover market", *Journal of Financial Economics,* vol. 89, no. 1, pp. 1-19.

Brown, S.J. & Warner, J.B. 1985, "*Using daily stock returns*: *the case of event studies*", Journal of Financial Economics vol.14, pp 3-31.

Bushman, R.M. & Smith, A.J. 2001, "Financial accounting information and corporate governance", *Journal of Accounting and Economics,* vol. 32, no. 1–3, pp. 237-333.

Campa, J.M. & Hernando, I. 2004, "Shareholder Value Creation in European M&As", *European Financial Management,* vol. 10, no. 1, pp. 47-81.

Capen, E.C., Clapp, R.V. & Campbell, W.M. 1971, "Competitive bidding in high-risk situations", *Journal of Petroleum Technology,* vol. 23, no. 06, pp. 641-653.

Chang, S. 1998, "Takeovers of Privately Held Targets, Methods of Payment, and Bidder Returns", *The Journal of Finance,* vol. 53, no. 2, pp. 773-784.

Cox, J.C & Isaac, R.M. 1984, "In search of the winner's curse", *Economic inquiry,* vol. 22, no. 4, pp. 579-592.

Dechow, P.M. & Dichev, I.D. 2002, "The Quality of Accruals and Earnings: The Role of Accrual Estimation Errors", *The Accounting Review,* vol. 77, pp. 35-59.

Dechow, P.M., Sloan, R.G. & Sweeney, A.P. 1995, "Detecting Earnings Management", *The Accounting Review,* vol. 70, no. 2, pp. 193-225.

Dechow, P., Ge, W. & Schrand, C. 2010, "Understanding earnings quality: A review of the proxies, their determinants and their consequences", *Journal of Accounting and Economics,* vol. 50, no. 2–3, pp. 344-401.

Dionne, G., La Haye, M. & Bergeres, A. 2015, "Does Asymmetric Information Affect the Premium in Mergers and Acquisitions?", *Canadian Journal of Economics,* vol. 48, no. 3, pp. 819-852.

Dodd, P. 1980, "Merger proposals, management discretion and stockholder wealth", *Journal of Financial Economics,* vol. 8, no. 10, pp. 105-137

Dyer, D. & Kagel, J.H. 1996, "Bidding in common value auctions: How the commercial construction industry corrects for the", *Management Science,* vol. 42, no. 10, pp. 1463.

Eckbo, B.E. & Thorburn, K.S. 2000, "Gains to Bidder Firms Revisited: Domestic and Foreign Acquisitions in Canada", *Journal of Financial and Quantitative Analysis,* vol. 35, no. 1, pp. 1-25.

Fama, E.F. 1998, "Market efficiency, long-term returns, and behavioral finance1", *Journal of Financial Economics,* vol. 49, no. 3, pp. 283-306.

Fama, E.F. 1970, "Efficient Capital Markets: A Review of Theory and Empirical Work", *The Journal of Finance,* vol. 25, no. 2, pp. 383-417.

Fama, E.F., Fisher, L., Jensen, M.C. & Roll, R. 1969, "The Adjustment of Stock Prices to New Information", *International Economic Review,* vol. 10, no. 1, pp. 1-21.

Fama, E.F. & French, K.R. 1997, "Industry costs of equity", *Journal of Financial Economics,* vol. 43, no. 2, pp. 153-193.

Fama, E.F. & French, K.R. 1993, “Common risk factors in the returns on stocks and bonds”, *Journal of Financial Economics,* vol. 33, no. 1, pp. 3.56

Fishman, M.J. 1989, "Preemptive Bidding and the Role of the Medium of Exchange in Acquisitions", *The Journal of Finance,* vol. 44, no. 1, pp. 41-57.

Francis, J., LaFond, R., Olsson, P. & Schipper, K. 2005, "The market pricing of accruals quality", *Journal of Accounting and Economics,* vol. 39, no. 2, pp. 295-327.

Fuller, K., Netter, J. & Stegemoller, M. 2002, "What Do Returns to Acquiring Firms Tell Us? Evidence from Firms That Make Many Acquisitions", *The Journal of Finance,* vol. 57, no. 4, pp. 1763-1793.

Grant, R.M., Jammine, A.P. & Thomas, H. 1988, "Diversity, Diversification, and Profitability among British Manufacturing Companies 1972-84", *Academy of Management Journal,* vol. 31, no. 4, pp. 771-801.

Guay, W.R., Kothari, S.P. & Watts, R.L. 1996, "A Market-Based Evaluation of Discretionary Accrual Models", *Journal of Accounting Research,* vol. 34, pp. 83-105.

Halpern, P. 1983, "Corporate Acquisitions: A Theory of Special Cases? A Review of Event Studies Applied to Acquisitions", *The Journal of Finance,* vol. 38, no. 2, pp. 297-317.

Hansen, R.G. 1987, "A Theory for the Choice of Exchange Medium in Mergers and Acquisitions", *The Journal of Business,* vol. 60, no. 1, pp. 75-95.

Hansen, R.G. & Lott, J.R. 1996, "Externalities and Corporate Objectives in a World with Diversified Shareholder/Consumers", *The Journal of Financial and Quantitative Analysis,* vol. 31, no. 1, pp. 43-68.

Healy, P.M. 1985, “The effect of bonus schemes on accounting decisions”, *Journal of Accounting and Economics*, vol. 7, no. 1-3, pp. 85-107

Hitt, M., Harrison, J., Ireland, R.D. & Best, A. 1998, "Attributes of Successful and Unsuccessful Acquisitions of US Firms", *British Journal of Management,* vol. 9, no. 2, pp. 91-114.

Hope, O., Thomas, W.B. & Vyas, D. 2013, "Financial Reporting Quality of U.S. Private and Public Firms", *Accounting Review,* vol. 88, no. 5, pp. 1715-1742.

Hribar, P. & Collins, D.W. 2002, "Errors in Estimating Accruals: Implications for Empirical Research", *Journal of Accounting Research,* vol. 40, no. 1, pp. 105-134.

Imhoff Jr., E.A. 1992, "Asset Securitization: Economic Effects and Accounting Issues", *Accounting Horizons,* vol. 6, no. 1, pp. 5-16.

Jensen, M.C. 1986, "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers", *The American Economic Review,* vol. 76, no. 2, pp. 323-329.

Jensen, M.C. & Meckling, W.H. 1976, "Theory of the firm: Managerial behavior, agency costs and ownership structure", *Journal of Financial Economics,* vol. 3, no. 4, pp. 305-360.

Jensen, M.C. & Murphy, K.J. 1990, "Performance Pay and Top-Management Incentives", *Journal of Political Economy,* vol. 98, no. 2, pp. 225-264.

Jones, J.J. 1991, "Earnings Management During Import Relief Investigations", *Journal of Accounting Research,* vol. 29, no. 2, pp. 193-228.

Kent, P., Routledge, J. & Stewart, J. 2010, "Innate and discretionary accruals quality and corporate governance", *Accounting & Finance,* vol. 50, no. 1, pp. 171-195.

Kothari, S.P., Leone, A.J. & Wasley, C.E. 2005, "Performance matched discretionary accrual measures", *Journal of Accounting and Economics,* vol. 39, no. 1, pp. 163-197.

Lim, J., Lee, J. & Chang, j. 2015, "Financial reporting quality of target companies and acquirer returns: evidence from Korea", *International Journal of Accounting & Information Management,* vol. 23, no. 1, pp. 16-41.

Lintner, J. 1965, "Security Prices, Risk and Maximal Gains from Diversification", *The Journal of Finance,* vol. 20, no. 4, pp. 587-615.

Loughran, T. & Vijh, A.M. 1997, "Do Long-Term Shareholders Benefit From Corporate Acquisitions?", *The Journal of Finance,* vol. 52, no. 5, pp. 1765-1790.

Lubatkin, M. & Shrieves, R.E. 1986, "Towards Reconciliation of Market Performance Measures to Strategic Management Research", *The Academy of Management Review,* vol. 11, no. 3, pp. 497-512.

Lyon, J.D., Barber, B.M. & Tsai, C. 1999, "Improved Methods for Tests of Long-Run Abnormal Stock Returns", *The Journal of Finance,* vol. 54, no. 1, pp. 165-201.

MacKinlay, A.C. 1997, "Event Studies in Economics and Finance", *Journal of Economic Literature,* vol. 35, no. 1, pp. 13-39.

Marquardt, C. & Zur, E. 2014, "The role of accounting quality in the M&A market", *Management Science,* vol. 61, no. 3, pp. 604-623.

Martin, X. & Shalev, R. 2017, "Target Firm-Specific Information and Acquisition Efficiency", *Management Science,* vol. 63, no. 3, pp. 672-690.

Martin, X. & Shalev, R. 2009, "Target firm-specific information and expected synergies in acquisition", Washington University in St.Louis, Missouri.

McNichols, M.F. 2002, "The Quality of Accruals and Earnings: The Role of Accrual Estimation Errors: Discussion", *The Accounting Review,* vol. 77, pp. 61-69.

McNichols, M.F. & Stubben, S.R. 2015, "The effect of target-firm accounting quality on valuation in acquisitions", *Review of Accounting Studies,* vol. 20, no. 1, pp. 110-140.

McNichols, M.F. & Stubben, S.R. 2012, "The effect of target-firm accounting quality on valuation in acquisitions", Stanford University, California.

Moeller, S.B., Schlingemann, F.P. & Stulz, R.M. 2007, "How Do Diversity of Opinion and Information Asymmetry Affect Acquirer Returns?", *Review of Financial Studies,* vol. 20, no. 6, pp. 2047-2078.

Moeller, S.B., Schlingemann, F.P. & Stulz, R.M. 2005, "Wealth Destruction on a Massive Scale? A Study of Acquiring-Firm Returns in the Recent Merger Wave", *The Journal of Finance,* vol. 60, no. 2, pp. 757-782.

Moeller, S.B., Schlingemann, F.P. & Stulz, R.M. 2004, "Firm size and the gains from acquisitions", *Journal of Financial Economics,* vol. 73, no. 2, pp. 201-228.

Morck, R., Schleifer, A. & Vishny, R.W. 1990, "Do Managerial Objectives Drive Bad Acquisitions?", *The Journal of Finance,* vol. 45, no. 1, pp. 31-48.

Murphy, K.J. 1985, "Corporate performance and managerial remuneration: An empirical analysis", *Journal of Accounting and Economics, vol. 7, no. 1-3, pp. 11-42.*

Officer, M.S., Poulsen, A.B. & Stegemoller, M. 2009, "Target-Firm Information Asymmetry and Acquirer Returns", *Review of Finance,* vol. 13, no. 3, pp. 467-493.

Othman, H.B. & Zeghal, D. 2006, "A study of earnings-management motives in the Anglo-American and Euro-Continental accounting models: The Canadian and French cases", *The International Journal of Accounting,* vol. 41, no. 4, pp. 406-435.

Papadakis, V.M. & Thanos, I.C. 2010, "Measuring the Performance of Acquisitions: An Empirical Investigation Using Multiple Criteria", *British Journal of Management,* vol. 21, no. 4, pp. 859-873.

Raman, K., Shivakumar, L. & Tamayo, A. 2013, "Target's earnings quality and bidders' takeover decisions", *Review of Accounting Studies,* vol. 18, no. 4, pp. 1050-1087.

Ross, S.A. 1976, "The arbitrage theory of capital asset pricing", *Journal of Economic Theory,* vol. 13, no. 3, pp. 341-360.

Sharpe, W.F. 1964, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk", *The Journal of Finance,* vol. 19, no. 3, pp. 425-442.

Thaler, R.H. 1988, "Anomalies: The Ultimatum Game", *The Journal of Economic Perspectives*, vol. 2, no. 4, pp. 195-206.

Travlos, N.G. 1987, "Corporate Takeover Bids, Methods of Payment, and Bidding Firms' Stock Returns", *The Journal of Finance*, vol. 42, no. 4, pp. 943-963.

Varaiya, N.P. & Ferris, K.R. 1987, "Overpaying in Corporate Takeovers: The Winner's Curse", *Financial Analysts Journal*, vol. 43, no. 3, pp. 64-70.

Walkling, R.A. 1985, "Predicting Tender Offer Success: A Logistic Analysis", *The Journal of Financial and Quantitative Analysis*, vol. 20, no. 4, pp. 461-478.

Wang, C. & Xie, F. 2009, "Corporate Governance Transfer and Synergistic Gains from Mergers and Acquisitions", *Review of Financial Studies*, vol. 22, no. 2, pp. 829-858.

White, H. 1980, "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity", *Econometrica*, vol. 48, no. 4, pp. 817-838.

Zhang, X.F. 2006, "Information Uncertainty and Stock Returns", *The Journal of Finance*, vol. 61, no. 1, pp. 105-137.

*Internet sources:*

The Swedish Accounting Standards Board (Bokföringsnämnden), last updated 20/12/2016, *K-projektet* [Online]. Available: http://www.bfn.se/sv/om-bokforingsnamnden/k-projektet [13/05/17]

# Appendix

## A.1. Variable definitions, source and previous research

| *Control variable* | *Definition* | *Source* | *Prior research* |
|---|---|---|---|
| ACQ_CAR | Seven-day (-3;+3) market-adjusted stock return on acquiring firm, centred on the acquisition announcement (see section 4.2.1) | Datastream | McNichols and Stubben (2015) |
| ACQ_ROA | Change in ROA from the year prior to the acquisition announcement (weighted average of target and acquirer) to the year after (combined entity). (See section 4.2.2) | Datastream and Serrano | Martin and Shalev (2009) |
| FAQ | Firm-level accounting quality (see section 4.1) | Serrano | McNichols and Stubben (2015) |
| IAQ | Industry-level accounting quality (see section 4.1) | Serrano | McNichols and Stubben (2015) |
| UNC | Uncertainty is calculated as one minus the ratio of the target's tangible assets over total assets measured at one fiscal year-end prior to the announcement | Datastream, Serrano | McNichols and Stubben (2012), Boone and Mulherin (2008) |
| REL_SIZE | Relative size is the ratio of the target's sales over the acquirer's sales measured at one fiscal year-end prior to the announcement | Datastream | Fama and French (1993), Moeller et al. (2004), Asquith et al., (1983 |
| TARG_GROWTH | Target growth is the average of target's annual sales growth two year prior to the announcement | Datastream | Dionne et al., 2015 |
| IND_LIQUID | Industry liquidity is calculated as the sum of all deal prices reported by SDC per year and per Fama French industry classification code divided by total book value of assets of all firms in particular announcement year | SDC and Serrano | McNichols and Stubben (2015), Moeller et al. (2004) |
| SAME_IND | Same industry is a dummy variable that is equal to one if target and acquire have the same Fama French industry classification code | SDC | McNichols and Stubben (2015), Morck et al. (1990) |
| CASH | Consideration paid with cash is an indicator variable that is equal to one if the acquisition is paid with 100% cash | SDC | McNichols and Stubben (2015), Officier et al. (2009), Moeller et al. (2004); Travlos (1998) |
| EQUITY | Consideration paid with equity is an indicator variable that is equal to one if the acquisition is paid with 100% equity | SDC | McNichols and Stubben (2015), Officier et al. (2009), Moeller et al. (2004); Travlos (1998) |
| ACQ_SIZE | Acquirer size is the natural logarithm of the acquirer's market value of equity one fiscal-year prior to the acquisition | Datastream | McNichols and Stubben (2015) |
| PRIV_TARG | Non-listed targets is an indicator variable that is equal to one if target is non-listed | SDC | Moeller et al. (2004), Fuller et al., (2002); Chang, (1998) |

## A.2. Sample selection for industry coefficients

**Table 2:** *Sample selection for the estimation of industry coefficients for the Kothari model and Jones model*

| | No. of firms | No. of firm-years observations |
|---|---|---|
| Total observations of limited companies (Aktiebolag) between 1998-2015 | 746,402 | 5,951,442 |
| *Less:* | | |
| Inactive firms observations | (176,947) | (1,553,806) |
| Missing SNI codes | (39,799) | (193,412) |
| Firms without at least two years financial history | (90,235) | (429,403) |
| Missing data to estimate the model | (114,227) | (1,333,846) |
| **Observations used in estimating in Kothari and Jones model** | **325,194** | **2,434,975** |

**Table 3:** *Sample selection for the estimation of industry coefficients for the modified Dechow and Dichev model*

| | No. of firms | No. of firm-years observations |
|---|---|---|
| Total observations of limited companies (Aktiebolag) between 1998-2015 | 746,402 | 5,951,442 |
| *Less:* | | |
| Inactive firms observations | (176,947) | (1,553,806) |
| Missing SNI codes | (39,799) | (193,412) |
| Firms without at least four years financial history | (192,876) | (679,463) |
| Missing data to estimate the model | (21,800) | (1,223,915) |
| **Observations used in estimating in modified Dechow and Dichev model** | **314,900** | **2,300,846** |

## A.3. Sample distribution

**Table 4:** *Sample distribution by announcement year*

| Year | Number of deals | Percentage | ACQ_CAR | ACQ_ROA | FAQ_Kothari | FAQ_Jones |
|---|---|---|---|---|---|---|
| 2002 | 15 | 4.70% | 0.005 | 0.049 | -0.346 | -0.372 |
| 2003 | 14 | 4.39% | 0.155 | 0.069 | -0.098 | -0.097 |
| 2004 | 24 | 7.52% | 0.045 | 0.226 | -0.043 | -0.046 |
| 2005 | 17 | 5.33% | 0.005 | 0.045 | -0.067 | -0.068 |
| 2006 | 36 | 11.29% | 0.007 | -0.114 | -0.175 | -0.157 |
| 2007 | 45 | 14.11% | 0.025 | -0.041 | -0.079 | -0.242 |
| 2008 | 19 | 5.96% | 0.049 | -0.052 | -0.161 | -0.134 |
| 2009 | 19 | 5.96% | 0.037 | 0.090 | -0.301 | -0.305 |
| 2010 | 34 | 10.66% | 0.096 | 0.051 | -0.073 | -0.076 |
| 2011 | 24 | 7.52% | 0.083 | 0.110 | -0.076 | -0.091 |
| 2012 | 22 | 6.90% | 0.027 | -0.027 | -0.051 | -0.068 |
| 2013 | 11 | 3.45% | -0.089 | -0.009 | -0.167 | -0.229 |
| 2014 | 13 | 4.08% | 0.050 | -0.020 | -0.049 | -0.063 |
| 2015 | 26 | 8.15% | 0.071 | 0.146 | -0.142 | -0.20 |
| **Total** | **319** | **100%** | **0.043** | **0.030** | **-0.200** | **-0.264** |

**Table 6:** *Frequency of acquiring firms and target firms by Fama-French 48 industry classifications*

| Fama-French Code | Industry | Number of acquirers | Percentage of acquirers | Number of targets | Percentage of targets |
|---|---|---|---|---|---|
| 1 | Agriculture | 1 | 0.31% | 0 | 0.00% |
| 2 | Food Products | 1 | 0.31% | 2 | 0.63% |
| 3 | Candy & Soda | 1 | 0.31% | 1 | 0.31% |
| 6 | Recreation | 0 | 0.00% | 1 | 0.31% |
| 7 | Entertainment | 10 | 3.13% | 5 | 1.57% |
| 8 | Printing and Publishing | 2 | 0.63% | 1 | 0.31% |
| 9 | Consumer Goods | 3 | 0.94% | 4 | 1.25% |
| 10 | Apparel | 1 | 0.31% | 2 | 0.63% |
| 11 | Healthcare | 3 | 0.94% | 4 | 1.25% |
| 12 | Medical Equipment | 7 | 2.19% | 7 | 2.19% |
| 13 | Pharmaceutical Products | 15 | 4.70% | 16 | 5.02% |
| 14 | Chemicals | 3 | 0.94% | 0 | 0.00% |
| 15 | Rubber and Plastic Products | 0 | 0.00% | 2 | 0.63% |
| 16 | Textiles | 0 | 0.00% | 2 | 0.63% |
| 17 | Construction materials | 4 | 1.25% | 5 | 1.57% |
| 18 | Construction | 2 | 0.63% | 7 | 2.19% |
| 19 | Steel Works etc. | 0 | 0.00% | 1 | 0.31% |
| 20 | Fabricated Products | 1 | 0.31% | 4 | 1.25% |
| 21 | Machinery | 18 | 5.64% | 9 | 2.82% |
| 22 | Electrical Equipment | 2 | 0.63% | 4 | 1.25% |
| 23 | Automobiles and Trucks | 4 | 1.25% | 2 | 0.63% |
| 25 | Shipbuilding, Railroad Equipment | 0 | 0.00% | 1 | 0.31% |
| 27 | Precious Metals | 1 | 0.31% | 0 | 0.00% |
| 28 | Non-Metallic and Industrial Metal Mining | 2 | 0.63% | 3 | 0.94% |
| 30 | Petroleum and Natural Gas | 1 | 0.31% | 3 | 0.94% |
| 31 | Utilities | 2 | 0.63% | 2 | 0.63% |
| 32 | Communication | 17 | 5.33% | 12 | 3.76% |
| 33 | Personal Services | 5 | 1.57% | 5 | 1.57% |
| 34 | Business Services | 97 | 30.41% | 112 | 35.11% |
| 35 | Computers | 8 | 2.51% | 3 | 0.94% |
| 36 | Electronic Equipment | 10 | 3.13% | 10 | 3.13% |
| 37 | Measuring and Control Equipment | 2 | 0.63% | 6 | 1.88% |
| 38 | Business Supplies | 1 | 0.31% | 2 | 0.63% |
| 39 | Shipping Containers | 0 | 0.00% | 2 | 0.63% |
| 40 | Transportation | 5 | 1.57% | 7 | 2.19% |
| 41 | Wholesale | 22 | 6.90% | 15 | 4.70% |
| 42 | Retail | 4 | 1.25% | 9 | 2.82% |
| 43 | Restaurants, Hotels, Motels | 7 | 2.19% | 7 | 2.19% |
| 44 | Banking | 35 | 10.97% | 18 | 5.64% |
| 45 | Insurance | 0 | 0.00% | 2 | 0.63% |
| 46 | Real Estate | 22 | 6.90% | 21 | 6.58% |
| **Total** | | **319** | **100%** | **319** | **100%** |

## A.4. Descriptive statistics

**Table 7:** *Correlations among regression variables*

This table shows the Pearson correlation coefficient for the variables used in the study. Significant levels *** p<0.01, **p<0.5, *p<0.1

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ACQ_CAR | 1.000 | | | | | | | | | | | | | | | |
| 2 | ACQ_ROA | 0.095 | 1.000 | | | | | | | | | | | | | | |
| 3 | IAQ_Kothari | 0.067 | -0.001 | 1.000 | | | | | | | | | | | | | |
| 4 | FAQ_Kothari | 0.125* | 0.154** | 0.104 | 1.000 | | | | | | | | | | | | |
| 5 | IAQ_Jones | 0.004 | -0.015 | 0.212*** | 0.174** | 1.000 | | | | | | | | | | | |
| 6 | FAQ_Jones | 0.088 | 0.093 | 0.017 | 0.630*** | 0.226*** | 1.000 | | | | | | | | | | |
| 7 | FAQ_MDD | 0.016 | 0.007 | 0.059 | -0.004 | -0.042 | -0.007 | 1.000 | | | | | | | | | |
| 8 | UNC | -0.031 | -0.023 | -0.098 | -0.030 | -0.103 | -0.076 | 0.136* | 1.000 | | | | | | | | |
| 9 | IND_LIQ | -0.022 | 0.006 | -0.025 | 0.052 | 0.020 | 0.062 | 0.021 | 0.071 | 1.000 | | | | | | | |
| 10 | TARG_GROWTH | 0.206*** | -0.146* | 0.024 | -0.376*** | 0.088 | -0.352*** | 0.019 | -0.022 | -0.024 | 1.000 | | | | | | |
| 11 | ACQ_SIZE | -0.231*** | -0.017 | 0.008 | 0.015 | -0.035 | -0.071 | 0.017 | -0.131* | 0.121** | -0.176** | 1.000 | | | | | |
| 12 | REL_SIZE | 0.140** | 0.057 | -0.056 | 0.008 | -0.077 | 0.034 | 0.026 | -0.005 | -0.045 | 0.002 | -0.030 | 1.000 | | | | |
| 13 | CASH | -0.046 | -0.123** | 0.024 | 0.132* | 0.090 | 0.065 | 0.088 | -0.079 | 0.042 | -0.053 | 0.203*** | -0.037 | 1.000 | | | |
| 14 | EQUITY | 0.056 | 0.184*** | -0.032 | -0.224*** | -0.065 | -0.146* | -0.147* | -0.000 | -0.075 | 0.057 | -0.155*** | 0.030 | -0.636*** | 1.000 | | |
| 15 | SAME_IND | 0.009 | 0.031 | 0.018 | 0.049 | 0.037 | -0.026 | 0.090 | 0.040 | -0.043 | -0.009 | -0.083 | -0.086 | -0.142** | 0.014 | 1.000 | |
| 16 | PRIV_TARG | 0.077 | 0.029 | -0.009 | -0.034 | -0.059 | -0.073 | -0.036 | 0.063 | 0.042 | 0.017 | -0.142** | -0.169* | 0.130** | -0.217*** | -0.048 | 1.000 |

## A.5. Sensitivity analysis

**Table 11:** *Sensitivity analysis – Exclusion of industry groups*

**Panel A: Regression model to test *Hypothesis 1***

Panel A presents the coefficients and t-statistics of the determinants of acquirer's seven-day market-adjusted abnormal return (ACQ_CAR). Model (10) reports the result from model (3) by excluding targets from the finance industry. Model (11) reports the result from model (3) by excluding targets from the pharmaceutical industry. See Appendix A for variable definitions. Robust standard errors are used to control for heteroscedasticity. Robust t-statistics are shown in parentheses, significant at following levels: ***p<0.01, **p<0.05, *p<0.1.

| | Exclude finance industry<br>Model (10) | Exclude pharmaceutical industry<br>Model (11) |
|---|---|---|
| FAQ_Kothari | 0.0701*** | 0.0703*** |
| | (2.951) | (3.032) |
| UNC | -0.00731 | -0.0123 |
| | (-0.170) | (-0.254) |
| IND_LIQ | 0.317 | 0.334 |
| | (1.389) | (1.295) |
| TARGET_GROWTH | 0.00275*** | 0.00272*** |
| | (3.062) | (2.900) |
| ACQ_SIZE | -0.0183 | -0.0226** |
| | (-1.512) | (-2.036) |
| REL_SIZE | 0.0169** | 0.0262** |
| | (2.170) | (2.354) |
| CASH | 0.0300 | 0.0340 |
| | (1.112) | (1.176) |
| SAME_IND | 0.0342 | 0.0318 |
| | (1.348) | (1.230) |
| PRIV_TARG | 0.0828** | 0.0806** |
| | (2.252) | (2.083) |
| Constant | 0.000844 | 0.0180 |
| | (0.00887) | (0.195) |
| Observations | 177 | 171 |
| R-squared | 0.273 | 0.285 |
| Year FE | Yes | Yes |

**Panel B: Regression model to test *Hypothesis 2***

Panel B presents the coefficients and t-statistics of the determinants of acquirer's change in return on assets (ACQ_ROA). Model (12) report the result from model (6) by excluding targets from the finance industry. Model (13) report the result from model (6) by excluding targets from the pharmaceutical industry. See Appendix A for variable definitions. Robust standard errors are used to control for heteroscedasticity. Robust t-statistics are shown in parentheses, significant at the following levels: ***p<0.01, **p<0.05,*p<0.1.

| | Exclude finance industry Model (12) | Exclude pharmaceutical industry Model (13) |
|---|---|---|
| FAQ_Jones | 0.0571 | 0.0439 |
| | (1.070) | (0.871) |
| UNC | -0.0304 | -0.0130 |
| | (-0.652) | (-0.247) |
| IND_LIQ | 0.262 | 0.238 |
| | (1.186) | (0.960) |
| TARG_GROWTH | -0.00247*** | -0.00232*** |
| | (-4.944) | (-4.187) |
| ACQ_SIZE | -0.0240 | -0.0137 |
| | (-1.428) | (-0.812) |
| REL_SIZE | 0.00450 | 0.00220 |
| | (0.547) | (0.152) |
| CASH | 0.0146 | 0.0142 |
| | (0.462) | (0.411) |
| SAME_IND | 0.0121 | 0.0251 |
| | (0.364) | (0.685) |
| PRIV_TARG | -0.00684 | 0.0233 |
| | (-0.0981) | (0.299) |
| Constant | 0.242 | 0.129 |
| | (1.500) | (0.750) |
| Observations | 157 | 150 |
| R-squared | 0.135 | 0.129 |
| Year FE | Yes | Yes |

**Panel C: Regression model to test *Hypothesis 3***

Panel C presents the coefficient and p-value of the results from the logistic regression. Model (14) reports the result from model (8) by excluding targets from the finance industry. Model (15) reports the results from model (8) by excluding targets from the pharmaceutical industry. The difference in the number of observations is due to the fact that there is no acquisition in 2008 that was completely settled in equity. See Appendix A for variable definitions. Robust standard errors are used to control for heteroscedasticity. Robust p-value are shown in parentheses, significant at the following levels: ***p<0.01, **p<0.05, *p<0.1.

| | Exclude finance industry<br>Model (14) | Exclude pharmaceutical industry<br>Model (15) |
|---|---|---|
| FAQ_Kothari | 0.785** | 0.853** |
| | (2.060) | (2.014) |
| UNC | -1.004 | -0.742 |
| | (-1.462) | (-1.065) |
| IND_LIQ | 3.669 | 3.351 |
| | (0.829) | (0.736) |
| TARG_GROWTH | -0.00238 | -0.000210 |
| | (-0.199) | (-0.0162) |
| ACQ_SIZE | 0.359** | 0.421** |
| | (2.062) | (2.486) |
| REL_SIZE | 0.00525 | -0.0445 |
| | (0.0541) | (-0.324) |
| SAME_IND | -0.650** | -0.669** |
| | (-1.967) | (-1.963) |
| PRIV_TARG | 1.210* | 1.136 |
| | (1.675) | (1.561) |
| Constant | -1.763 | -2.136 |
| | (-1.069) | (-1.334) |
| Observations | 177 | 171 |
| Pseudo R-squared | 0.124 | 0.146 |
| Year FE | Yes | Yes |

**Table 12:** *Sensitivity analysis – change of CAR calculation window*

Table 12 presents the coefficient and t-statistics of the determinants of acquirer's cumulative abnormal return (ACQ_CAR). Model (19) reports the result from model (3) by changing the CAR estimation window to (-1,+1) days. Model (20) reports the result from model (3) by changing the CAR estimation window to (-10,+10) days. See Appendix A for variable definitions. Robust standard errors are used to control for heteroscedasticity. Robust t-statistics are shown in parentheses, significant at following levels: ***p<0.01, **p<0.5, *p<0.1.

| | CAR(-1,+1)<br>Model (19) | CAR(-10,+10)<br>Model (20) |
|---|---|---|
| FAQ_Kothari | 0.0394** | 0.0745* |
| | (1.994) | (1.858) |
| UNC | 0.0341 | 0.0628 |
| | (1.055) | (0.859) |
| IND_LIQ | 0.0436 | 0.525* |
| | (0.296) | (1.760) |
| TARG_GROWTH | 0.00107 | 0.00259* |
| | (1.263) | (1.740) |
| ACQ_SIZE | -0.0109 | -0.0256 |
| | (-1.020) | (-1.466) |
| REL_SIZE | 0.00736* | 0.0117 |
| | (1.916) | (1.249) |
| CASH | 0.00304 | 0.0384 |
| | (0.130) | (0.964) |
| SAME_IND | 0.0208 | 0.0701* |
| | (0.951) | (1.684) |
| PRIV_TARG | 0.0602 | 0.0462 |
| | (1.648) | (0.768) |
| Constant | -0.00547 | 0.0384 |
| | (-0.0608) | (0.253) |
| Observations | 183 | 182 |
| R-squared | 0.129 | 0.205 |
| Year FE | Yes | Yes |

**Table 13:** *Sensitivity analysis – choice of accounting quality model*

**Panel D: Regression to test *Hypothesis 1***

Panel D presents the coefficient and t-statistics of the determinants of acquirer's seven-day market-adjusted abnormal return (ACQ_CAR). Model (21) reports the result of model (3) by using the modified Dechow and Dichev model to estimate the firm-specific accounting quality (FAQ_MDD). See Appendix A for variable definitions. Robust standard errors are used to control for heteroscedasticity. Robust t-statistics are shown in parentheses, significant at following levels: ***p<0.01, **p<0.05,*p<0.1.

| | ACQ_CAR<br>Model (21) |
|---|---|
| FAQ_MDD | -0.00398 |
| | (-0.951) |
| UNC | -0.0144 |
| | (-0.310) |
| IND_LIQ | 0.357 |
| | (1.467) |
| TARG_GROWTH | 0.00243** |
| | (2.284) |
| ACQ_SIZE | -0.0236** |
| | (-2.051) |
| REL_SIZE | 0.0174** |
| | (2.225) |
| CASH | 0.0400 |
| | (1.432) |
| SAME_IND | 0.0395 |
| | (1.550) |
| PRIV_TARG | 0.0655* |
| | (1.766) |
| Constant | 0.0168 |
| | (0.187) |
| Observations | 165 |
| R-squared | 0.250 |
| Year FE | Yes |

**Panel E: Regression to test *Hypothesis 2***

Panel E presents the coefficient and t-statistics of the determinants of acquirer's change in return on assets (ACQ_ROA). Model (22) reports the result of model (6) by using the modified Dechow and Dichev model to estimate the firm-specific accounting quality (FAQ_MDD). See Appendix A for variable definitions. Robust standard errors are used to control for heteroscedasticity. Robust t-statistics are shown in parentheses, significant at following levels: ***p<0.01, **p<0.05,*p<0.1.

| | ACQ_ROA |
|---|---|
| | Model (22) |
| FAQ_MDD | -0.00394 |
| | (-0.750) |
| UNC | -0.0176 |
| | (-0.388) |
| IND_LIQ | 0.254 |
| | (1.085) |
| TARG_GROWTH | -0.00273*** |
| | (-4.535) |
| ACQ_SIZE | -0.0149 |
| | (-0.921) |
| REL_SIZE | 0.00452 |
| | (0.534) |
| CASH | 0.0178 |
| | (0.554) |
| SAME_IND | 0.0223 |
| | (0.636) |
| PRIV_TARG | 0.00670 |
| | (0.0963) |
| Constant | 0.132 |
| | (0.847) |
| Observations | 151 |
| R-squared | 0.123 |
| Year FE | Yes |

**Panel F: Regression to test *Hypothesis 3***

Panel F presents the coefficients and p-value of the result from the logistic regression. Model (23) reports the result of model (8) by using the modified Dechow and Dichev model to estimate the firm-specific accounting quality (FAQ_MDD). See Appendix A for variable definitions. Robust standard errors are used to control for heteroscedasticity. Robust p-value are shown in parentheses, significant at following levels: ***p<0.01, **p<0.05,*p<0.1.

| | CASH<br>Model (23) |
|---|---|
| FAQ_MDD | 0.409 |
| | (0.997) |
| UNC | -1.178* |
| | (-1.703) |
| IND_LIQ | 3.678 |
| | (0.823) |
| TARG_GROWTH | -0.00552 |
| | (-0.416) |
| ACQ_SIZE | 0.400** |
| | (2.467) |
| REL_SIZE | 0.0147 |
| | (0.158) |
| SAME_IND | -0.693** |
| | (-2.104) |
| PRIV_TARG | 1.279* |
| | (1.772) |
| Constant | -2.200 |
| | (-1.394) |
| Observations | 165 |
| Pseudo R-squared | 0.136 |
| Year FE | Yes |

## A.6. Robustness tests

**Figure 2:** *Results of heteroskedasticity test*

*Model (3):*

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of OMX30CAR3days3

         chi2(1)      =     0.10
         Prob > chi2  =   0.7494


White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(170)    =    185.73
         Prob > chi2  =    0.1938
```

*Model (6):*

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of ChangesinROA

         chi2(1)      =    12.64
         Prob > chi2  =   0.0004

White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(157)    =    162.18
         Prob > chi2  =    0.3719
```

Figure 2 shows the results of Breusch-Pagan Cook-Weisberg test as well as the White's test on model (3) and model (6) where we test *Hypothesis 1* and *Hypothesis 2.*