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# Board Interlocks and Earnings Management Contagion

The spread of financial reporting behaviour through networks of shared directors in Sweden

Cecilia Hällzon
23434@student.hhs.se

Daniel Öhman
23353@student.hhs.se

**Abstract**

Manipulation of stated earnings can have a severely negative impact on financial reporting quality and is a topic of interest to regulators and investors alike. This study investigates whether earnings management spreads through networks of shared directors between boards of Swedish listed companies. We use two accrual-based models to identify instances of earnings management and combine it with board member data in a sample period of 2010-2014. Our test is designed to determine whether earnings management spreads, incubates, and reappears in companies that did not previously manage earnings, analogous to how viral infections spread among humans. The findings are suggestive, but not conclusive, that earnings management is contagious and spreads through board interlocks. This is in line with previous research on U.S. data. However, we do not find support for that the board position held by the interlocked director affects the likelihood for earnings management to spread.

**Tutor:** Katerina Hellström

**Keywords:** Board interlocks, earnings management, social influence, network theory, discretionary accruals.

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## 1. Introduction

Social influence affects human behaviour in many ways and corporate decision making is no exception. The key strategic decisions made by company boards affect all of the firm's stakeholders; owners, employees and creditors, to name a few. In the corporate world it has become practice that directors of listed firms serve on several boards simultaneously, which allows networks of directors to form between them. A single link in such a network, formed by two companies sharing the same director, is called a *board interlock*. Research on the prevalence and consequences of board interlocks has studied their effects on the monitoring ability of directors (Prevost & Puthenpurackal, 2009), value relevance in regards to return on investment (Bunting, 1976) and role in the spread of certain events, including acquisitions (Haunschild, 1993) and private equity offers (Stuart & Yim, 2010).

A relatively new field within board interlock research concerns the spread of financial reporting behaviour and earnings management in particular. Earnings management is a term comprising the opportunity for managers to exercise discretion over a company's reported earnings. The discretion in accounting choices can have both negative and positive impacts on financial reports. It can make them more informative by making use of management's knowledge of the firm, or more deceptive by becoming a method for management to mislead investors about the actual economic performance of the firm (Healy & Wahlen, 1999). When the latter is true, earnings management can have a severely negative impact on financial reporting quality (Dechow & Schrand, 2004). Earnings management can be detected in two ways; through external indicators and through models using accounting data to estimate instances of earnings management. The most commonly used models study accruals and are used to find situations when accruals diverge substantially from what the models forecast them to be, indicating that earnings manipulation has occurred.

According to research conducted on U.S. firms, board interlocks and earnings management are related. We are inspired by Chiu et al. (2013) who find that board interlocks can facilitate the spread of financial reporting behaviour, in particular earnings management, between companies. This relation between board interlocks and financial reporting behaviour is of interest for investors and regulators alike, but is yet to be established in jurisdictions outside the U.S. This may partly be due to lack of data concerning earnings restatements, which in the U.S. constitute a readily available database of external indicators of earnings management.

We apply the research method of Chiu et al. (2013) together with accrual-based models to detect earnings management. This enables us to research the spread of financial reporting behaviour through board interlocks in Sweden, a jurisdiction where restatements are not available. We find suggestive, but not conclusive, support for earnings management contagion in Swedish listed firms. When investigating whether the role of a linked director affects the contagiousness of earnings management, we do not find support for a director who is CEO or board chairman to be particularly contagious.

### 1.1. Purpose

The purpose of this study is to investigate whether earnings management spreads between companies through board interlocks in a Swedish setting. We also study whether it is of importance that the shared director is an opinion leader, in our case defined as being the CEO or the board chairman. Board interlock research sheds light on how behaviour spreads through the network in which much of the power in today's corporate world is concentrated, making it of interest to many different stakeholders. Its connection to earnings management makes it highly relevant for capital market actors, who depend on financial reports as a key source of information. Similarly, knowledge of how financial reporting behaviour spreads is of interest to regulators as it lies at the core of corporate governance.

### 1.2. Contribution

This study contributes to the existing literature in two ways. First, it increases the knowledge of the prevalence of board interlocks in a Swedish setting and the impact they have on earnings management. We can confirm suggestive, but not conclusive, support for earnings management to be contagious through board interlocks in Sweden, adding to research based on U.S. firms. Second, we contribute with a novel application for accrual-based models when finding a proxy for earnings management in studies where the test design requires the variable indicating earnings management to be dichotomous. This facilitates the study of earnings management in jurisdictions where external indicators such as restatements are not available.

### 1.3. Scope

The scope of our study is limited to Swedish non-financial companies listed on the Nasdaq Stockholm Stock Exchange during 2010-2014. Our study concerns only companies on the main market because such a delimitation is common within earnings management research and increases the comparability of our study. In Sweden, listed companies are also required to follow the same reporting standards. Our study does not attempt to explain the incentives of

earnings management in relation to board interlocks and neither do we investigate whether earnings are inflated or downplayed when manipulated.

To identify earnings management incidents, we use accrual-based models. They have been dominating the field of earnings management research and their ability to detect earning management is well documented (Kighir et al., 2014; Healy & Wahlen, 1999). We limit ourselves to the use of the Modified Jones Model and the McNichols Model to estimate discretionary accruals, but several other accrual-based models exist. Our choice of models is discussed in section 2.3.5. Further, other methods exist to detect earnings management, which we do not use. They include the study of manipulation of real transactions using discretionary expense models, and the use of non-financial measures (Brazel et al., 2009).

### 1.4. Disposition

This study consists of eight sections. Section 2 introduces established theories regarding behaviour, board interlocks and earnings management. Section 3 connects the theory to our two hypotheses and explains the methodology of our tests in detail. Section 4 describes how the sample was selected and the data collected. In section 5, descriptive statistics, Pearson correlations and the test results are presented. Analysis of the results follows in section 6. It includes robustness tests and a discussion about the research method of the study. Suggestions for further research are presented in section 7. Section 8 concludes the study.

## 2. Theory

This section provides the theoretical background that our study is built on. First, to give a foundation as to why there is reason to believe that any type of behaviour, including financial reporting behaviour, can spread through social interaction and social networks, we review literature in psychology, sociology and network theory. Second, we present research on board interlocks, including what they are, the motives behind them, and their consequences. Lastly, we look at earnings management and the incentives behind it, and discuss research on how it can be detected.

### 2.1. Behavioural theory

#### 2.1.1. Social influence theory

*Social norms* are often referred to as an explanation for human behaviour. Gino et al. (2009) hypothesize that social norms relating to dishonesty affect an individual's propensity to act dishonestly. Differentiating between in-group and out-group members, their results show that

the dishonesty of an in-group member makes observers more prone to act dishonestly, whilst the same observation of an out-group member has the opposite effect. This implies that individuals tend to look to people in the same group as them (in-group members) for clues on what course of action is socially acceptable. Company boards are groups in which people are linked together through their formal board membership and affiliation to the same company. We believe they are typical in-groups and that the social norms of the board can influence members to change their views of what norms are prevalent, that is, what most people typically approve of and what action they take in certain situations. Thus, if the social norms of a board to a certain degree allow for dishonest courses of action to be discussed and evaluated, director members should be influenced to perceive such actions to be socially acceptable.

Crime theory offers a second explanation, suggesting that *rational decision making using a cost-benefit analysis* can explain human behaviour. The main inputs into a simple cost-benefit analysis of crime participation are the benefit, the punishment and the perceived risk of getting caught (Allingham & Sandmo, 1972; Becker, 1968). A low risk of getting caught naturally translates into a low expected punishment, making a dishonest course of action more attractive. The notion of risk perception is specifically highlighted by Sah (1991). He develops a model to explain crime participation rates and finds that the propensity for an individual to commit a crime increases when other individuals in the vicinity successfully partake in criminal activities. In a corporate setting, a director's view of the risk of repercussions may change after being active on a board of a company at which earnings management behaviour goes undetected. The more firms that manage earnings, the smaller may interlocked directors view the risk of getting caught.

The potency of both norm-driven and rational analysis-driven behavioural mechanisms as presented above can be affected by which individuals in a group that act as influencers. Individuals who consistently exercise influence over a group of people are *opinion leaders*. Opinion leadership is a type of informal leadership, characterized by a strong ability to influence other individuals' ideas or attitudes (Rogers, 2003). Since the most noticeable characteristics of opinion leaders are their unique position in a communications network and high exposure to external communications, the CEO and board chairman are likely to occupy this role in the social group of the board. As research suggests that opinion leaders act as a social model for members of a group, there is reason to believe the CEO and board chairman to be particularly influential in affecting the financial reporting behaviour of the board.

### 2.1.2. Network theory

Having laid out the foundations of social influence, network theory broadens our perspective to what mechanisms are active in *networks* of boards linked by shared directors. Interlocked directors serve as communication links between boards, allowing information to be passed on from one company to another. To which extent financial reporting behaviour is passed on can be explained by the theory of diffusion of innovation (Rogers, 2003). For instance, a certain type of earnings management consisting of the manipulation of a specific accounting item can be considered an innovation. Several factors affect how fast an innovation may spread, including (1) relative advantages to a preceding idea, (2) how observable the results of the implementation of the innovation are and (3) how compatible the innovation is with the existing values, experiences and needs of adopters (Rogers, 2003). All of these are relevant to earnings management, which can (1) be viewed superior to previous practices by inducing monetary rewards to board members, (2) become observable through the interlocking of board directors and (3) find resistance or facilitation in its spread when encountering the existing values and experiences of a board in an adopting company. Further, *informational cascades* (Bikhchandani et al., 1992) have successfully been used to explain behavioural change in several parts of society. An informational cascade occurs when individuals follow the behaviour of those before them, such as other firms in the network, while disregarding their own information. In a corporate setting, it could explain how knowledge about a specific new way to manage earnings, say the treatment of operating leases, can spread quickly when non-manipulating firms share information with successful manipulators.

## 2.2. Board interlocks

### 2.2.1. Board responsibilities

*"The board of a company is responsible for the organization of the company and tending to issues concerning the company. It shall continuously assess the economic situation of the company and ensure that the organization is designed so that the accounting, management of company resources and other economic matters are managed in a satisfying way."* (SFS 2005:551, Chapter 8 4§ Aktiebolagslagen)

The main responsibilities as outlined by Swedish law give Swedish company boards broad and principle-based responsibilities. In practice, the responsibilities of boards also include matters such as appointment of the CEO and setting the strategic direction of the company. As board service is not a full-time job, members are allowed time to serve on several boards, which has

become practice in the corporate world of large listed companies. This allows networks of directors to form between companies. A single link in such a network, formed by two companies sharing the same director, is called a *board interlock.*

### 2.2.2. Motives

Research on the prevalence and consequences of board interlocks as part of corporate governance became relevant after the Pujo Committee, a U.S. congressional subcommittee active between 1912-1913, identified board interlocks as a problem in concentrating much of the power of the country's finances amongst a small group of business leaders (Mizruchi, 1996). A popular discourse within the literature is the antecedents or outcomes of interlocks, revolving around the question "What do interlocks do?" (Lamb & Roundy, 2015). Our study too focuses on the outcome of interlocks and their effect on earnings management in particular. When hypothesizing the effects, it is helpful to consider the motives for board interlocks from both a firm perspective and a director perspective.

From a firm perspective, interlocking activities can act to mediate resource exchange among companies and link a firm with its environment (Shrader et al., 1991), improve the monitoring ability of the firm (Carpenter & Westphal, 2001), signal high quality by interlocking with a firm with a strong reputation (Galaskiewicz et al., 1985) and to directly access human capital perceived by the current board to be attractive for the firm (Lamb & Roundy, 2015).

From the perspective of an interlocking director, the two main areas of study have been the advancement of the director's career and the gaining of social ties. For instance, joining several boards may increase a director's pay and help him acquire contacts and build prestige, all useful in career advancement. Being a director of a large corporation will also increase the chance of finding similar appointments after the current tenure ends (Stuart, 2012).

### 2.2.3. Implications

The firm and director motives of board interlocks have led researchers to study a range of potential impacts of interlocks, including whether they affect the monitoring ability of the directors (Prevost & Puthenpurackal, 2009), their value relevance in regards to return on investment (Bunting, 1976) and the diffusion of certain behaviours, including poison pill adoption (Davis, 1991), acquisitions (Haunschild, 1993) and private equity offers (Stuart & Yim, 2010). Within this field, we are inspired by a study conducted by Chiu et al. (2013) on

whether board interlocks facilitate the spread of financial reporting behaviour, and earnings management in particular. By using data from the U.S. Government Accountability Office's (GAO) release of restatements of financial reports, Chiu et al. (2013) test if firms with board links to firms that had restated earnings were more likely to also restate earnings and find it to be the case.

While no similar study has been conducted for Swedish firms, corporate governance studies in a Swedish setting have found evidence of a tightly connected network of owners compared to the other Scandinavian countries, the U.S. and the U.K. (Stafsudd, 2009). What impact this may have on earnings management contagion through board interlocks is however not obvious, as more interconnected ownership networks does not necessarily translate into more interconnected networks of board directors. Thus, we do not find previous research to indicate a clear direction for whether contagion may be more or less prevalent in Sweden compared to the U.S., but conclude that the answer indeed remains of interest.

## 2.3. Earnings management

### 2.3.1. Definition

*"Earnings management occurs when managers use judgment in financial reporting and in structuring transactions to alter financial reports to either mislead some stakeholders about the underlying economic performance of the company or to influence contractual outcomes that depend on reported accounting numbers." (Healy & Wahlen, 1999)*

*"The flexibility in the choice of accounting methods to indicate the management decision-making on future cash flows." (Sankar & Subramanyam, 2001)*

Previous research provides several definitions of earnings management. The examples above represent the two perspectives that most of the definitions belong to. The definition by Healy and Wahlen (1999) is based on the opportunistic perspective, according to which the purpose of earnings management is to mislead the users of the financial reports. The definition by Sankar and Subramanyam (2001) stems from the beneficial perspective, which shifts focus from managers' vicious intent to the informative aspect of earnings management. There are many definitions along the spectrum between the two perspectives. However, the majority of them emphasize the intent of managers in earnings management and the most established definition among researchers in the field is arguably the one by Healy and Wahlen (1999). Hence, we define earnings management in this study in accordance with them.

There are two main types of earnings management; manipulation of real transactions and manipulation of accruals. Manipulation of real transactions means taking economic actions that affect cash flows. Examples of this type of activity are cutting research and development expenditures and offering price discounts to increase revenue. It is difficult for external parties to identify management of real transactions since it cannot be separated from normal business decisions. Manipulation of accruals, on the contrary, is carried out using accounting techniques that alter financial reports, for example through aggressive revenue recognition or by capitalizing costs that should be expensed.

### 2.3.2. Trade-off between benefits and costs

When a company engages in earnings management it perceives the potential benefits of doing it to be larger than the potential costs. The fact that there are benefits to be reaped from manipulating earnings rests on the assumption that users of financial reports attach importance to them. This is supported by research, as earnings figures in financial reports are found to be a key source of information among capital market actors (Hjelström et al., 2014).

The benefits of engaging in earnings management primarily stem from one of three different reasons (Dechow et al., 1996). The first reason is capital market incentives, which refers to the aim of altering the value of the company stock when it is used as currency in a corporate transaction. There is ample evidence indicating that events where stocks are purchased, sold or in any other way used as currency create incentives to manage earnings to affect the value investors ascribe to the firm. Examples include seasoned equity offers, initial public offers and mergers (Dechow et al., 1996).

The second reason to manage earnings is to meet or exceed analyst or investor expectations. Brown and Caylor (2005) found a significant increase in the number of analysts, the number of firms followed by analysts, the amount of media attention paid to analyst forecasts and the accuracy and precision of analyst forecasts in the last decades. It is suggested that this has caused investors to pay more attention to analyst forecasts. Extensive research has been conducted regarding earnings targets and it has been found that a larger than expected number of firms meet or barely beat analyst forecasts. That a firm consistently just barely meets the consensus forecast is a potential indicator of earnings management (Dechow et al., 1996).

The third reason is related to contracting incentives. Several types of contracting arrangements contain provisions that are a function of earnings, including debt contracts, compensation contracts and regulations such as capital requirements. A distinction of contracting-based incentives for earnings management is that the motivation is evident; the contract specifies a certain number related to earnings that the company must meet to gain a benefit or avoid a cost (Dechow et al., 1996).

The costs of engaging in earnings management arise if the company gets caught. In Sweden, all listed companies must comply with IFRS. According to the IASB, the objective of financial reports is to provide information to its users that is useful for economic decision making; "if financial information is to be useful, it must be relevant and faithfully represent what it purports to represent" (IASB, 2010). A financial report that has been the target for earnings management naturally fails to meet this condition. In Sweden, this is a violation against Bokföringslagen, which can result in a prison sentence for up to six years, if the board member is not granted freedom from liability at the annual general meeting (SFS 1962:700, Chapter 11 5§ Brottsbalken). Another consequence if the company gets caught is that investors will revise the value ascribed to the firm through a shift in share price (Dechow et al., 1996).

While the benefits of managing earnings can be substantial, so can the costs. Lo (2008) finds that firms are mindful of this trade-off and only manipulate earnings when the risk of being exposed is low. Hence, earnings management should generally be difficult to detect.

### 2.3.3. Detection

It is not possible to know with certainty if earnings management has been conducted, but several proxies are available. One of the least controversial proxies is the use of external indicators, which include U.S. Securities and Exchange Committee's (SEC) Accounting and Auditing Enforcement Releases, restatements and internal control procedure deficiencies reported under the Sarbanes Oxley Act. They unambiguously reflect bad financial reporting, categorized into errors and irregularities, with irregularities being more serious violations (Dechow et al., 2010). Chiu et al. (2013) uses restatements from the U.S. GAO Financial Statement Restatement Database to identify earnings management. However, in many jurisdictions, including Sweden, external indicators are not available.

Researchers have developed several methods for detecting earnings management, to be used when external indicators are not available or suitable. Models to detect manipulation of real transactions, such as discretionary expense models, are rarely used since manipulation of real transactions can be difficult to detect. Accrual-based models, which are used to identify manipulation of accruals, dominate the field of earnings management research and their ability to detect earnings management is well documented (Kighir et al., 2014; Healy & Wahlen, 1999). Given this background and the fact that external indicators are not available to us, we apply accrual-based models as a proxy for earnings management in this study.

The accruals of a firm can be thought of as divided into two parts; discretionary accruals and non-discretionary accruals. Discretionary accruals arise as a result of discretionary accounting choices by management, for instance from flexibility in the choice of accounting methods. Non-discretionary accruals are a direct consequence of the company's operations and unaffected by management accounting decisions (Dechow & Schrand, 2004). The aim of accrual-based models is to isolate the discretionary component of total accruals. The accrual-based models have developed over time and have in recent years also branched off in different directions. The most established accrual-based models are presented in section 2.3.4.

### 2.3.4. Accrual-based models

The Jones Model (Jones, 1991) divides total accruals into discretionary accruals and non-discretionary accruals and the discretionary portion of accruals represents earnings management. It controls for the effect of changes in a company's economic circumstances on non-discretionary accruals by regressing lagged total assets, property, plant and equipment and changes in revenue, with the purpose of achieving a more correct classification of discretionary and non-discretionary accruals. An implicit assumption in the model is that revenues are non-discretionary. If the revenue however does include discretionary accruals, there is a risk that the model underestimates the level of discretionary accruals and thus, the level of earnings management. Dechow et al. (1995) relaxes the assumption of non-discretionary revenue in the Jones Model by subtracting the difference in receivables from the difference in revenue and instead assumes that differences in credit sales is a result of earnings management. The modified version of the Jones Model is now the most frequently used alternative for detecting earnings management (Dechow et al., 1995). Kothari et al. (2005) highlights that a firm's discretionary accruals can correlate with its performance since a firm that is trying to grow its sales often invests in working capital to support the growth. The Modified Jones Model does

not fully regard company performance and can therefore incorrectly classify a growing working capital as discretionary accruals in the case of extreme company performance. In response to this Kothari et al. (2005) presents a new version of the Modified Jones Model that matches firm performance on ROA.

Dechow & Dichev (2002) presents a cash flow oriented model in which accruals are modelled as a function of past, present and future cash flows. The standard deviation of the residuals is interpreted as a proxy for earnings quality and they find that companies with larger standard deviations have lower earnings quality. However, the model focuses on short-term accruals and does not address long-term accruals and their relation to cash flows. McNichols (2002) contributes to the model presented by Dechow & Dichev (2002) by incorporating variables from the Jones Model (Jones, 1991). The addition of change in revenue attempts to reflect performance and the addition of property, plant and equipment broaden the model to also address long-term accruals. Francis et al. (2005) modifies the model by McNichols (2002) by decomposing the standard deviation of the residual from the accruals model into an innate component reflecting the firm's operating environment and a discrete component reflecting managerial choice, which allows them to make assumptions about managerial choices (i.e. intentional errors).

### 2.3.5. Choice of accrual-based models

This study will utilize the Modified Jones Model and the McNichols Model to detect earnings management. Below follows a motivation of the choice of models.

The Modified Jones Model presented by Dechow et al. (1995) is the most commonly used model for detecting earnings management. Furthermore, it has a low risk of committing type II errors and it offers high explanatory power (Dechow et al., 2010). The McNichols Model has a cash flow approach which complements the Modified Jones Model since it reduces misspecification, which, in the Jones Model (1991) were caused by residuals being correlated with lagging and leading cash flows. Furthermore, it offers higher explanatory power (McNichols, 2002). The modifications made by Francis et al. (2005) aimed to further improve the McNichols Model by providing an opportunity to analyze managerial choice through the decomposition of the standard deviation of the residual from the accruals model. However, more research is required regarding correct interpretation of the innate component of the standard deviation of the residual (Dechow et al., 2010). Further, since we use accrual-based

models only to estimate levels of discretionary accruals we are not aided by the potential additional information provided by analyzing the standard deviation of the residual. The Kothari model employs performance matching on ROA, a method that has shown to provide the best estimates of discretionary accruals in the case of extreme company performances. Further, it has a lower risk of type I errors (Dechow et al., 2010). However, research has shown that the use of performance matching reduces the amount of discretionary accruals detected by 20-40% and reduces the power of the test by 30-50%. Consequently, the Kothari Model should only be applied when extreme firm performance is an important issue (Keung & Shih, 2014). We do not expect this to be the case in our study.

In response to these findings, we regard the Modified Jones Model and the McNichols Model to be best suited for our study. Hence, they will be used to calculate discretionary accruals.

# 3. Method

In this section our two hypotheses and the expected outcome of our study are introduced. We then present the models used to estimate discretionary accruals in detail, including relevant considerations. This is followed by a presentation of the main regression models used to test our hypotheses and considerations regarding them.

## 3.1. Hypotheses

This study concerns the spread of earnings management through board interlocks. Literature in psychology, sociology and network theory claim that social norms (Gino et al., 2009), rational decision making using cost-benefit analysis (Sah, 1991) and network theory (Rogers, 2003) all can explain why dishonest behaviour can spread between interlocking directors. However, since most directors, apart from the CEO and other executives, are not directly involved in the operational activities of the firm and probably are not the ones performing the actual adjusting of accounting items, what difference do board interlocks make? Swedish company boards are by law obliged to supervise the company's financial reporting and suggest recommendations on how to ensure the reliability of reports (SFS 2005:551, Chapter 8 49b § Aktiebolagslagen). Thus, they carry a significant responsibility in accepting or opposing unethical financial reporting behaviour. Further, members of the board that are also executives, and the CEO in particular, can be expected to exert a substantial influence over operational activities, including manipulation of earnings. Hence, ideas and behaviour that enter the board through a non-operational interlocking director can also directly affect earnings manipulation, either by the

director influencing an operative executive, or by affecting the board's collective tendency to accept unethical financial reporting. In other words, there is strong reason to believe that board interlocks affect financial reporting behaviour, which leads us to our first hypothesis.

**H1:** Exposure via board interlocks to an earnings manipulator increases the likelihood of a company managing its earnings.

Research has shown that some individuals exhibit traits that make them opinion leaders. The opinion leaders are socially accessible, technically competent and their opinions often conform to group norms (Rogers, 2003). It is common that the CEO of a company is chosen by the board to be CEO because he understands and agrees with the board's intended strategy for the company. The board chairman is chosen by shareholders for his competence and is a central part of the board communication network. We believe the CEO and the board chairman to be opinion leaders and that board interlocks which occur through the CEO or the board chairman to have stronger effect on earnings management contagion.

**H2:** Exposure to an earnings manipulator through an interlocked director who is CEO or board chairman increases the likelihood of a company managing its earnings by more than if the interlocked director does not serve as CEO or board chairman.

### 3.2. Accrual-based models

To test our hypotheses we require information about earnings management, which we retrieve through the Modified Jones Model (Dechow et al., 1995) and the McNichols Model (McNichols, 2002). The general process for estimating discretionary accruals using either of the two models is presented below.

1. Total accruals are calculated for each observation. We define the total accruals of a firm to be net income less cash flow from operations as seen in Equation 1. See section 3.3.1. for a motivation of the method for calculating total accruals.[1]

$$TA_{i,t} = NIBE_{i,t} - CFFO_{i,t} \tag{1}$$

2. To find the normal level of accruals we estimate the regressions in Equation 2, the Modified Jones Model, and in Equation 3, the McNichols Model. The normal level of accruals is

[1] $TA_{i,t}$: *Total accruals in firm i year t*

estimated for each year and industry using the cross-sectional approach, see section 3.3.2. for a motivation. All variables are scaled using total assets to decrease heteroscedasticity and increase the comparability between companies (Kothari et al., 2005)

$$\frac{TA_{i,t}}{Assets_{i,t-1}} = \beta_0 + \beta_1 \frac{1}{Assets_{i,t-1}} + \beta_2 \frac{(\Delta Rev_{i,t} - \Delta Rec_{i,t})}{Assets_{i,t-1}} + \beta_3 \frac{PPE_{i,t}}{Assets_{i,t-1}} + \varepsilon$$

Modified Jones Model (2)

$$\frac{TA_{i,t}}{Assets_{i,t-1}} = \beta_0 + \beta_1 \frac{CFFO_{i,t-1}}{Assets_{i,t-2}} + \beta_2 \frac{CFFO_{i,t}}{Assets_{i,t-1}} + \beta_3 \frac{CFFO_{i,t+1}}{Assets_{i,t}} + \beta_4 \frac{\Delta Rev_{i,t}}{Assets_{i,t-1}} + \beta_5 \frac{PPE_{i,t}}{Assets_{i,t-1}} + \varepsilon$$

McNichols Model (3)

3. We use the coefficients estimated in the previous step in Equation 4, the Modified Jones Model, and in Equation 5, the McNichols Model, to find the level of the non-discretionary accruals for each firm-year observation.[2]

$$\frac{NDA_{i,t}}{Assets_{i,t-1}} = \hat{\beta}_1 \frac{1}{Assets_{i,t-1}} + \hat{\beta}_2 \frac{(\Delta Rev_{i,t} - \Delta Rec_{i,t})}{Assets_{i,t-1}} + \hat{\beta}_3 \frac{PPE_{i,t}}{Assets_{i,t-1}}$$

Modified Jones Model (4)

$$\frac{NDA_{i,t}}{Assets_{i,t-1}} = \hat{\beta}_1 \frac{CFFO_{i,t-1}}{Assets_{i,t-2}} + \hat{\beta}_2 \frac{CFFO_{i,t}}{Assets_{i,t-1}} + \hat{\beta}_3 \frac{CFFO_{i,t+1}}{Assets_{i,t}} + \hat{\beta}_4 \frac{\Delta Rev_{i,t}}{Assets_{i,t-1}} + \hat{\beta}_5 \frac{PPE_{i,t}}{Assets_{i,t-1}}$$

McNichols Model (5)

4. The difference between each company's total accruals and non-discretionary accruals, as calculated in Equation 6, is the discretionary accruals. This is our proxy for earnings management.[3]

$$DA_{i,t} = TA_{i,t} - NDA_{i,t} \quad (6)$$

## 3.3. Considerations regarding accrual-based models

### 3.3.1. Balance sheet approach and cash flow approach

In the accrual-based models we use, total accruals must be calculated, which requires data on cash flow from operations. There are two different methods to obtain this data, either indirectly using the balance sheet approach or directly using the cash flow approach. The balance sheet approach uses the connection between changes in working capital in the balance sheet and accrued revenues and expenses on the income statement to estimate the total accruals. This approach has received critique for causing measurement errors in the presence of non-operating activities such as divestures, mergers and acquisitions that lead to incorrect findings of earnings management. These errors can be avoided by using the cash flow approach, by which data on cash flow from operations is collected directly from the cash flow statement. The cash flow

[2] $NDA_{i,t}$: *Non-discretionary accruals in firm i year t*
[3] $DA_{i,t}$: *Discretionary accruals in firm i year t*

approach is therefore considered in recent research to be the more suitable option (Collins & Hribar, 2002). As a result, we use the cash flow approach.

### 3.3.2. Time-series approach and cross-sectional approach

There are two different approaches for estimating the coefficients used to find the non-discretionary component in accrual-based models; the time-series approach and the cross-sectional approach. In the time-series approach, the coefficients are estimated in a pre-event window for each company (Dechow et al., 1995). The time-series approach has received criticism in recent years due to its high data requirements. Furthermore, underperforming companies are systematically excluded from the sample, causing survivorship bias (Subramanyam, 1996). As a result, the cross-sectional approach has become more frequently used. In the cross-sectional approach, the coefficients are estimated for each industry and at a specific point in time (Peasnell et al., 2000). The cross-sectional approach avoids problems with large data requirements, which can facilitate the use of a higher number of observations, increasing the probability of more precise estimates. The shorter time period also decreases the risk of survivorship bias. However, since the cross-sectional approach does not regard the level of non-discretionary accruals for each company individually, but instead assumes it to be the same for all firms within each industry, it can potentially cause misclassification of discretionary accruals (Peasnell et al., 2000). With regards to the criticism faced by the two different approaches, we consider the cross-sectional approach to be the more suitable option and will therefore use for our study.

### 3.3.3. Industry classification standard

The cross-sectional approach for estimating non-discretionary accruals requires a classification of industries. This can be done using several different industry classifications systems. Research comparing the classification systems in regards to estimating discretionary accruals recommends GICS since it generates significantly better estimates compared to SIC, NAICS and Fama-French (Hrazdil & Scott, 2013). Hence, we use GICS industry groups.

### 3.3.4. Absolute and non-absolute discretionary accruals

When estimating earnings management, either absolute or non-absolute values of discretionary accruals can be used. Absolute values will capture earnings management independent of its direction but the direction of the earnings management cannot be interpreted. However, non-absolute values enables us to conclude the direction of the earnings management but if it is carried out in different directions, the effects can cancel each other out and may not be detected. Given the purpose of our study, it is of greater importance to us to identify earnings

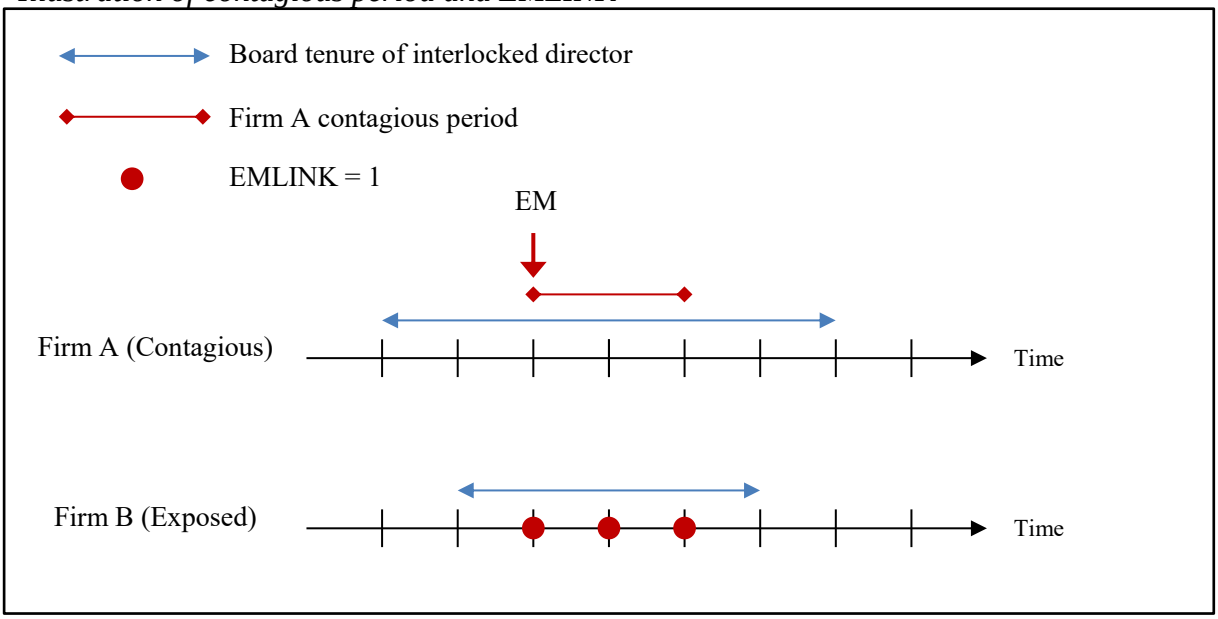
management, rather than to determine the direction of earnings management. Furthermore, since our study aims at covering all types of earnings management conducted by the companies in our sample, we expect earnings management to be in both directions and want to be able to capture it independent of this. We consider absolute values of discretionary accruals to reflect these conditions to a greater extent and it is therefore our method of choice.

## 3.4. Test design

### 3.4.1. Contagious period

Accrual-based models are used to identify firms that manage earnings and in what period this happens. We call a company that manages earnings *contagious*. A company that shares a director with the contagious company during the contagious period through a board interlock is exposed to an earnings management infection and we label it *exposed*. As illustrated in Figure 1, the contagious period starts in the year during which a company manages earnings and ends two years after, creating an event-window of three years during which the company is contagious. We use a multiyear contagious period to allow the infection of earning management to incubate. In the main regression models we then test whether the probability of observing earnings management is higher if a company is currently exposed to an earnings manipulator.

**Figure 1.**
*Illustration of contagious period and EMLINK*



### 3.4.2. Logistic regression model

The test requires a dichotomous situation in which a firm is either managing its earnings (infected) or not (not infected). Further, we use fiscal year accounting data and the events of interest thus occur at discrete points in time. We therefore use a discrete-time logistic regression model as recommended by Allison (1982) as the best alternative when conducting event studies of our type. In discrete-time methods it is easy to incorporate time-varying explanatory variables such as ours and they have successfully been used in accounting research (Stuart & Yim, 2010; Chiu et al., 2013).

### 3.4.3. Threshold for earnings management

As logistic regression requires the dependent variable to be dichotomous, meaning that it takes on the value of either 1 or 0, we need to transform our proxy of earnings management, absolute discretionary accruals, into a dichotomous variable. This is done by using a set threshold for what level of absolute discretionary accruals are defined to be earnings management. There is no previous literature on how to decide a suitable level for the threshold, as discretionary accruals are most often regressed as a continuous variable. Thus, we are investigating a new field of application for accrual-based models.

We find discretionary accruals from the Modified Jones Model and the McNichols model to follow an approximate normal distribution, as seen in Appendix 1. This suggests that extreme observations, as defined by statistical research, can be a viable option when setting the threshold level. A commonly applied method is the mean and two standard deviations, given that the variable follows a normal distribution (Newbold et al., 2012). However, the definition of extreme observations is subjective (Skogsvik, 2002). We apply a threshold level equal to the sum of the mean and two standard deviations for each of the samples of discretionary accruals from the Modified Jones Model and the McNichols Model individually. Given the potentially subjective nature of the choice, we test the robustness of our results in regards to changes in the threshold level. Results of the robustness tests are presented in Appendix 9.

External earnings management indicators such as U.S. GAO records of restatements are a product of the work and judgement of the SEC. Because of obvious differences in identification method between our study and the SEC, we do not expect our descriptive statistics for earnings management variables to mimic those found on U.S. data (Chiu et al., 2013). Instead, an accrual-based threshold method may label a larger portion of firms as earnings manipulators, since an official action from the SEC requires a manipulation to be both severe and visible,

while accrual-based models label all occasions when a firm's accruals substantially diverge from the model's predicted accruals to be earnings management. However, as the purpose of this study is to examine whether financial reporting behaviour is contagious through board interlocks, regardless of how it is measured, we do not consider the method of measurement to affect how our results should be interpreted.

## 3.5. Main regression models

### 3.5.1. The models

To test **H1**, we use the two main regression models presented in Equation 7 and 8.

$$Logit(EM) = F(\beta_0 + \beta_1 EMLINK_m + \beta_2 \#BOARDLINK + \beta_3 EMLINK\_DILUTE_m + \Sigma\, \beta_j Controls_i + Year\ Fixed\ Effects + Industry\ Fixed\ Effects + \varepsilon) \quad (7)$$

$$Logit(EM) = F(\beta_0 + \beta_1 \#EMLINK_m + \beta_2 \#BOARDLINK + \beta_3 \#EMLINK\_DILUTE_m + \Sigma\, \beta_j Controls_i + Year\ Fixed\ Effects + Industry\ Fixed\ Effects + \varepsilon) \quad (8)$$

To test **H2**, we use the main regression model presented in Equation 9.

$$Logit(EM) = F(\beta_0 + \beta_1 EMLINK_m + \beta_2 \#BOARDLINK + \beta_3 EMLINK\_DILUTE_m + \beta_4 EM\_\boldsymbol{X}\_LINK_m + \Sigma\, \beta_j Controls_i + Year\ Fixed\ Effects + Industry\ Fixed\ Effects + \varepsilon) \quad (9)$$

The main regression models are not to be confused with the accrual-based Modified Jones Model and McNichols Model, which are only used to detect earnings management. The relationship between earnings management and board interlocks is then tested using Equation 7, 8 and 9. Variables that are a function of the results of an accrual-based model are denoted with *m*.

### 3.5.2. Dependent variable

*EM* is the dependent variable in the main regression models, see Equation 7, 8 and 9. It is dichotomous, meaning that it takes on either the value 0 or 1. It is the only variable to directly relate to the level of discretionary accruals provided by the Modified Jones Model and the McNichols Model. *EM* is 0 if discretionary accruals for a firm and year are lower than the threshold level explained in section 3.4.3., and 1 if discretionary accruals are higher than the threshold level for the first time within the test period. Since we use two different models to estimate discretionary accruals, our regressions to test **H1** and **H2** will be based on two sets of variables, one corresponding to accruals determined by the Modified Jones Model and one determined by the McNichols Model.

### 3.5.3. Key independent variables

*EMLINK* and *#EMLINK* are tested separately in the main regression models, see Equation 7 and 8. *EMLINK* is dichotomous and equals 1 if a firm is interlocked to a contagious firm through a shared director and 0 otherwise. *#EMLINK* is discrete and takes on the value of the number of board interlocks a firm has to contagious firms. In **H1** we hypothesize that earnings management spreads contagiously through board interlocks. To reject the null hypothesis, the coefficient for *EMLINK* needs to be significant and carry a positive sign in a logistic regression with *EM* as dependent variable. A regression with *EMLINK* tests whether earnings management is contagious through board interlocks in general and a regression with *#EMLINK* tests whether the contagion effect grows stronger as the number of board links to contagious firms increase.

*#BOARDLINK* is a discrete variable equal to the number of board links a firm has to other firms, regardless of whether it is to contagious firms or to non-manipulators. As a board link is required for a contagious link to exist, *#BOARDLINK* is expected to be correlated with both *EMLINK* and *#EMLINK*. To control for the general number of board links when testing for earnings management contagion, we include *#BOARDLINK* in our main regression models. The coefficient of *#BOARDLINK* then indicates whether board links in general transmit good financial reporting behaviour (negative sign) or bad financial reporting behaviour (positive sign). Chiu et al. (2013) find links to non-manipulators to decrease the propensity of a firm to manage earnings, suggesting that good financial reporting behaviour is also contagious.

The terms *EMLINK_DILUTE* and *#EMLINK_DILUTE* pertain to a discussion of Chiu et al., (2013) regarding whether a larger number of board interlocks in general dilute the contagion effect from interlocks to earnings manipulators. In a regression with *EM,* they control for dilution by adding an interaction variable consisting of the product of *#EMLINK* and *#BOARDLINK* and find it to be significant, yielding a p-value of 0.014. We believe a similar effect may be active in our sample and control for this as well. As we have no reason to believe that the dilution effect is limited to only affecting *#EMLINK* and not *EMLINK*, we include interaction variables representing a dilution effect in all our main regression models. In Equation 7, we interact *EMLINK* and *#BOARDLINK* to produce *EMLINK_DILUTE*. In Equation 8 and 9, we interact *#EMLINK* and *#BOARDLINK* to produce *#EMLINK_DILUTE*. The dilution term concludes the list of key independent variables used to test for **H1.**

In **H2,** we hypothesize that board members interlocked to contagious firms who are also the CEO or board chairman of the exposed firm will increase the probability of earnings management to spread. To test this we introduce two more dichotomous variables that determine the role of the interlocked director. *EM_CEO_LINK* equals 1 if a director is interlocked to a contagious firm and serves as CEO in the exposed firm and *EM_BOARDCHAIR_LINK* equals 1 if a director interlocked with a contagious firm is also the board chairman of the exposed firm. We test **H2** through Equation 9, in which the ***X*** in *EM_**X**_LINK* is either *CEO* or *BOARDCHAIR*.

### 3.5.4. Control variables

We continue by explaining our choice of control variables. The selection is made by reviewing which variables previous earnings management research has found to provide explanatory power. After excluding variables for which we lack data and variables that we deem not relevant to our study, we are left with the six control variables listed below. A full explanation of variable computation and source of data for all variables is provided in Appendix 4.

*ROA* is calculated as net income in year t divided by the average of total assets between year t and year t-1. Previous research finds a positive correlation between *ROA* and absolute discretionary accruals (Kothari et al., 2005; Lee et al., 2006).

*Loss* is a dichotomous variable that equals 1 if the firm has a negative income in year t and 0 otherwise. Literature has found negative income to be positively correlated with absolute discretionary accruals, as losses tend to occur in a situation of financial distress where negative accruals such as restructuring costs are common (Dechow & Dichev, 2002).

*Size* controls for firm size and is the natural logarithm of the market value of equity of the firm. Literature suggest that larger firms are less prone to manage earnings due to the higher political costs they carry from being more visible than small firms (Zimmerman, 1990). This implies a negative correlation with earnings management. In accounting research, total assets (Chiu et al., 2013), total revenue (Zimmerman, 1990) and market value of equity (Ali & Zhang, 2015) have been used as proxy for size. We believe market value of equity to be the best indicator of size as it is a common indicator of value applicable to all firms, whereas sales figures and balance sheet size can vary between industries due to different profit margins and asset turnover ratios.

*Leverage* is calculated as the ratio of equity to total assets and controls for the incentive of high-leverage firms to manage earnings to meet debt-related requirements (DeAngelo et al., 1994). A high equity ratio implies less debt and we expect the correlation with *EM* to be negative.

*CFFO* is the cash flow from operations in the current year scaled by total assets in the previous year. Previous research finds positive correlation between *CFFO* and non-discretionary income measures (Subramanyam, 1996). This suggests that strong cash flow from operations corresponds to strong financial performance and reduces the need for discretionary actions from management to inflate earnings figures. Hence, we expect *CFFO* to be negatively correlated with earnings management.

*Board size* is the number of directors on the board. In previous literature it has been included as a board characteristic believed to be indicative of the strength of monitoring by the board (Chiu et al., 2013). We thus expect it to be negatively correlated with earnings management.

## 3.6. Considerations regarding the main regression models

### 3.6.1. Censoring and truncation

As is common when using time to event data, our test design is subject to censoring and truncation problems. In our test, right censoring occurs since we do not have data regarding whether a company that is not infected during the sample period becomes infected after the sample period. However, according to Allison (1982), discrete-time logistic models such as ours handle right censoring appropriately. The problem regarding left truncation is more difficult to address. If a company is exposed to a contagious firm before the sample period but within the incubation period the company will incorrectly not be classified as exposed. Hence, there will be undercounting of *EMLINK*, meaning that *EMLINK* will be 0 instead of 1. This measurement error biases against finding a positive association between *EMLINK* and *EM*.

### 3.6.2. Differences to the replicated study

In contrast to Chiu et al., (2013) we do not use restatements to identify earnings management since this type of information is not available in Sweden. Instead, we use accrual-based models and apply a threshold that defines earnings management, as mentioned above in section 3.4.3. We also divert slightly from the study by Chiu et al. (2013) regarding the interaction variables *EMLINK_DILUTE* and *#EMLINK_DILUTE*. Chiu et al. (2013) control for a dilution effect only in one regression, the one corresponding to our Equation 8. As we have no reason to believe

that such mechanics are only present when regressing *EM* on *#EMLINK*, and not when *EMLINK* is used, we control for it in Equation 7, 8 and 9, as explained in section 3.5.3.

# 4. Empirics

In this section we describe the process of our sample selection. It is followed by an overview of the collection of our data.

## 4.1. Sample selection

The starting point for our sample is companies listed on the Nasdaq Stockholm Stock Exchange sometime during the sample period, 2010-2014. We use the Nasdaq Stockholm Stock Exchange List for December 2014, to which we add back companies delisted between the years 2010-2014. This yields a preliminary sample of 340 companies. Our sample is then gradually reduced through a selection process of six criteria that all companies must meet.

First, we remove firms that miss ISIN since we use WRDS Compustat to collect accounting data and need an ISIN recognized by WRDS. This reduces the sample by 28 companies.[4]

Second, we require the companies to be Swedish because companies belonging to another jurisdiction may report under different rules or regulations, which weakens comparability. This reduces the sample with 47 companies.

Third, the companies must be non-financial. In accordance with GICS, we exclude companies that belong to Banks (4010), certain parts of Diversified Financials (4020) and Insurance (4030). Financial companies are excluded because they do not separate operational and non-operational items in their financial reports and we are therefore unable to calculate accruals in a similar manner as for non-financials. The remaining part of Diversified Financials (4020) that is not removed for being financials, consists of investments companies. The boards of investment companies are often entwined with the boards of their holding companies, which creates "artificially" interlocked directorates. Previous studies on board interlocks in Sweden have excluded investment companies from the population to avoid this bias (Jonnergård & Stafsudd, 2009) and we find it appropriate to do so as well. Hence, all companies with GICS

[4] *When the ISIN was not recognized directly by WRDS Compustat, we controlled for this manually, for example by taking into consideration instances of Class A and Class B shares.*

code 4010, 4020 and 4030 are removed. This reduces the sample by 23 companies. See Appendix 2 for number of firms per GICS industry group and year.

Fourth, the firms must have been listed on Nasdaq Stockholm Stock Exchange for at least four consecutive years during 2008-2015, as our accrual-based models require two years of lagging data and one year of leading data. This reduces the sample by 29 companies.

Fifth, we remove all companies that lack one or more of the data points necessary for calculating discretionary accruals and the control variables for the years that the companies are included in the sample. This reduces the sample by 57 companies.

Sixth, the companies must be part of a GICS industry group with enough observations for us to be able to apply a cross-sectional approach when estimating non-discretionary accruals. Kothari et al. (2005) recommend only using industries with at least ten yearly observations. We make two exceptions and include the GICS industry groups Materials and Health Care Equipment & Services even though they have slightly fewer observations in some years. The deviation from the recommendation is fairly small and it came with the benefit of being able to use GICS industry groups instead of GICS sectors, which are more precise. This should yield better beta estimates in the accrual-based models and a more precise measure of discretionary accruals. This reduces the sample with 27 companies.

The final sample consists of 129 companies from nine GICS industry groups and result in a total of 633 firm-year observations. See Appendix 8 for details on the sample selection process.[5]

## 4.2. Data collection

The accounting data used for the accrual-based models and the control variables is retrieved from WRDS Compustat. Data on market value of equity is obtained from the report "Equity Trading by Company and Instrument" (Nasdaq, 2017). Board data, including board chair and CEO data, which is used to map the board interlocks, is manually extracted from the annual publication "Styrelser och revisorer i Sveriges börsföretag" (Fristedt et al., 2010-2014).

[5] *The number of observations used in regressions vary since GICS industry group 3510 is omitted due to perfect prediction.*

# 5. Results

In this section we first present descriptive statistics for the variables in our main regression models and for board interlocks. Second, we present Pearson correlations for the variables in our main regression models. Lastly, we present the test results of our two hypotheses.

## 5.1. Descriptive statistics

Table 1 shows descriptive statistics for the variables in the main regression models. When the same variables are produced by the Modified Jones Model and the McNichols Model, the mean and median of *EM*, which is triggered the first time a firm manages its earnings during a contagious period, are not significantly different in the two models, as seen in a t-test and a Wilcoxon signed rank test in Appendix 6. However, all other key dependent variables are significantly different at a 5% or 1% level. This indicates that the models produce differences in how and when *EM* is triggered, affecting the number of *EMLINK* and *#EMLINK* observations produced. Due to fewer observations of *EM* = 1 for McNichols, it naturally follows that there are fewer observations of variables which are triggered when *EM* = 1 for McNichols. However, if McNichols would trigger *EM* for approximately the same firms as Modified Jones, but only to a smaller extent, differences in the mean and median of *EMLINK* should be similar to those of *EM*. As this is not the case, our preliminary descriptive statistics suggest that the two models differ in how *EM* is triggered.

**Table 1.**
*Descriptive statistics*

| | Modified Jones | | | McNichols | | |
|---|---|---|---|---|---|---|
| | **Mean** | **Std. Dev** | **Median** | **Mean** | **Std. Dev** | **Median** |
| *EM* | 0.047 | 0.212 | 0 | 0.041 | 0.198 | 0 |
| *EMLINK* | 0.263 | 0.441 | 0 | 0.205 | 0.404 | 0 |
| *#EMLINK* | 0.351 | 0.658 | 0 | 0.257 | 0.555 | 0 |
| *#BOARDLINK* | 2.985 | 2.768 | 2 | 2.985 | 2.768 | 2 |
| *EM_CEO_LINK* | 0.013 | 0.113 | 0 | 0.005 | 0.07 | 0 |
| *EM_BOARDCHAIR_LINK* | 0.089 | 0.286 | 0 | 0.049 | 0.216 | 0 |
| *EM_OTHER_LINK* | 0.208 | 0.406 | 0 | 0.177 | 0.382 | 0 |
| *ROA* | 0.037 | 0.148 | 0.052 | 0.037 | 0.148 | 0.052 |
| *Loss* | 0.197 | 0.398 | 0 | 0.197 | 0.398 | 0 |
| *Size* | 7.402 | 1.929 | 7.066 | 7.402 | 1.929 | 7.066 |
| *Leverage* | 0.505 | 0.188 | 0.475 | 0.505 | 0.188 | 0.475 |
| *CFFO* | 0.076 | 0.159 | 0.084 | 0.076 | 0.159 | 0.084 |
| *Board Size* | 6.468 | 1.461 | 6 | 6.468 | 1.461 | 6 |

Comparing our descriptive statistics with those of U.S. firms (Chiu et al., 2013), our mean of *EM* is higher, suggesting more firms manage earnings in our sample. As mentioned in section 3.4.3., this was expected due to the different methods for identifying earnings management.

Regarding the control variables, most are in line with previous research, except for a few deviations, which are commented on below. The standard deviation of *CFFO* is higher compared to previous research (Ali & Zhang, 2015), meaning that firms in our sample exhibit either more volatile cash flow from operations or a more volatile ratio of cash flow from operations and beginning of the year assets. The mean of *Board Size* is lower in our sample than for U.S. firms, 6.5 compared to 9.6 (Chiu et al., 2013). Fewer directors per board can reflect the size of the companies in the sample, as Swedish firms on average are smaller than U.S. firms and larger companies tend to have larger boards.[6] Descriptive statistics for board interlocks are provided in Appendix 3. In our sample, every fifth director is linked to another board and board chairmen are on average linked twice as many times as CEOs and directors.

### 5.2. Pearson correlations

In Appendix 10, we present Pearson correlations between key independent variables and control variables based on the Modified Jones Model (Panel A) and the McNichols Model (Panel B). Both *EMLINK* and *#EMLINK* are significantly correlated with *#BOARDLINK*. This is natural as a board link is required for a contagious link to exist. Nevertheless, it does indicate that opportunities for earnings management to spread through interlocks are significantly increased when a firm has a large number of interlocks in general. This supports our choice to control for *#BOARDLINK* in all regressions. In a similar fashion, the key independent variables *EMLINK* and *#EMLINK* are strongly and significantly correlated due to the fact that $EM = 1$ whenever $\#EMLINK > 0$. However, as the variables are never used in the same regression this does not create problems with multicollinearity.

Regarding the variable set based on the Modified Jones Model, all control variables are significantly correlated with all key independent variables. Most of the control variables are also correlated with each other. In the variable set based on the McNichols Model, all control variables, except *CFFO* and *ROA*, are correlated with all key independent variables. Several of the control variables are significantly correlated with each other and some with relatively high correlation coefficient. With this in mind, it is appropriate to test for multicollinearity among key independent variables and control variables. The results of VIF-tests for multicollinearity are analyzed in section 6.2.1., and tabulated in Appendix 5.

[6] *As our sample mean of Board Size is smaller compared to samples of U.S. firms, one rightfully expects control variable Size to also be smaller. However, Size is expressed as the natural logarithm of market value of equity in MSEK instead of MUSD used by Chiu et al. (2013).*

### 5.3. Earnings management contagion and board interlocks

Our first hypothesis asks whether the probability of observing *EM* = 1 is higher when *EMLINK* = 1 and a firm is exposed to a firm which has previously managed earnings, than when *EMLINK* = 0 and the firm is not exposed. Table 2 presents test results when *EM* was regressed according to Equation 7 and 8 using the variable sets based on discretionary accruals modelled with the Modified Jones Model (Panel A) and the McNichols Model (Panel B). The interpretation of the results from a logistic regression differs from the interpretation of the results of linear OLS regressions. The coefficients correctly display the signs of the marginal effects of each key independent variable on the dependent variable, but the size of the coefficients cannot be interpreted similarly to linear regressions. Hence, the direction of the coefficients can be interpreted as usual but not the magnitude of them (Wooldridge, 2012).

We begin by reviewing the results from the regressions based on the Modified Jones Model, where both *EMLINK* and *#EMLINK* carry positive signs as expected and are significant at the 10% level. This implies a higher probability of observing earnings management when a firm is interlocked to a contagious firm than when it is not. Hence, we can reject the null hypothesis at a 10% level. *#BOARDLINK* has a positive coefficient, which is on the contrary to our expectations, but it is not significant. Thus, we do not find support for contagion of good financial reporting behaviour through board interlocks for Swedish firms. The interaction variables are significant at a 10% level, indicating that board links to companies that do not manipulate earnings substantially weaken the contagion effect from contagious links. This is in line with the expectations and similar to the results of Chiu et al. (2013). The control variables *ROA* and *CFFO* are significant at a 5% level and a 10% level, respectively. As expected, *ROA* has a positive coefficient while *CFFO* has a negative coefficient. No other control variables are significant. No industry or year is significant. In the regressions based on the McNichols Model, none of the key independent variables are significant and most of the coefficients are the opposite of what was expected. The control variable *CFFO* is the only significant variable of all with a p-value of 0.081. Instead, controls for fixed effects show that the regressions based on the McNichols Model are greatly affected by year fixed effects, as most of the years are significant at the 5% level.

Regarding the explanatory power of the models, the use of a logistic regression model impacts the interpretation of the $R^2$ value. We present McFadden's pseudo $R^2$ value, which can be used to measure the goodness-of-fit of a logistic regression model (McFadden, 1974). The pseudo

$R^2$ value is expected to be lower than the $R^2$ value of a linear regression and a pseudo $R^2$ value of 0.2 or above represents an excellent fit (Hensher & Stopher, 1979). Using the Modified Jones variable set, we obtain pseudo $R^2$ values of 0.088 and 0.092, which are marginally higher than previous research (Chiu et al., 2013). However, when using the McNichols variable set we obtain pseudo $R^2$ values of 0.118 and 0.119, which are notably higher.

**Table 2.**

*Panel A: Earnings management contagion through a contagious link*

Dependent variable: EM

| | Modified Jones | | | | McNichols | | | |
|---|---|---|---|---|---|---|---|---|
| | **Coef.** | **Std. Dev** | **z-Stat** | **P-value** | **Coef.** | **Std. Dev** | **z-Stat** | **P-value** |
| *EMLINK* | 1.5517* | 1.0428 | 1.4881 | 0.0684 | -0.4515 | 1.3463 | -0.3354 | 0.3687 |
| *#BOARDLINK* | 0.0807 | 0.1880 | 0.4296 | 0.6675 | -0.1603 | 0.2327 | -0.6887 | 0.4910 |
| *EMLINK_DILUTE* | -0.6974* | 0.4088 | -1.7062 | 0.0880 | 0.1451 | 0.4449 | 0.3262 | 0.7443 |
| *ROA* | 8.1015** | 3.8793 | 2.0884 | 0.0368 | 4.8329 | 3.6139 | 1.3373 | 0.1811 |
| *Loss* | -1.2236 | 1.1466 | -1.0671 | 0.2859 | -0.7133 | 0.9760 | -0.7308 | 0.4649 |
| *Size* | -0.0158 | 0.1699 | -0.0933 | 0.9257 | -0.0633 | 0.1915 | -0.3303 | 0.7411 |
| *Leverage* | -1.3810 | 1.3157 | -1.0497 | 0.2939 | 0.9314 | 1.3792 | 0.6753 | 0.4995 |
| *CFFO* | -4.0860* | 2.4149 | -1.6920 | 0.0907 | -4.1761* | 2.3936 | -1.7447 | 0.0810 |
| *Board Size* | -0.0052 | 0.1784 | -0.0293 | 0.9767 | -0.0596 | 0.1974 | -0.3020 | 0.7626 |
| Year Fixed Effects | - | | | | ** | | | |
| Firm Fixed Effects | - | | | | - | | | |
| Pseudo $R^2$ | 0.0879 | | | | 0.1183 | | | |

*Panel B: Earnings management contagion through a number of contagious links*

Dependent variable: EM

| | Modified Jones | | | | McNichols | | | |
|---|---|---|---|---|---|---|---|---|
| | **Coef.** | **Std. Dev** | **z-Stat** | **P-value** | **Coef.** | **Std. Dev** | **z-Stat** | **P-value** |
| *#EMLINK* | 1.3630* | 1.0322 | 1.3205 | 0.0934 | -0.3335 | 1.1177 | -0.2983 | 0.3827 |
| *#BOARDLINK* | 0.0977 | 0.1838 | 0.5318 | 0.5948 | -0.0915 | 0.2228 | -0.4109 | 0.6812 |
| *#EMLINK_DILUTE* | -0.6582* | 0.3949 | -1.6669 | 0.0955 | 0.0119 | 0.3246 | 0.0366 | 0.9708 |
| *ROA* | 7.9623** | 3.8677 | 2.0587 | 0.0395 | 4.9187 | 3.6180 | 1.3595 | 0.1740 |
| *Loss* | -1.1874 | 1.1487 | -1.0337 | 0.3013 | -0.7066 | 0.9733 | -0.7260 | 0.4679 |
| *Size* | -0.0144 | 0.1707 | -0.0841 | 0.9330 | -0.0817 | 0.1907 | -0.4283 | 0.6685 |
| *Leverage* | -1.3938 | 1.3098 | -1.0641 | 0.2873 | 0.9577 | 1.3754 | 0.6963 | 0.4863 |
| *CFFO* | -3.9737* | 2.4085 | -1.6499 | 0.0990 | -4.1839* | 2.3914 | -1.7495 | 0.0802 |
| *Board Size* | -0.0051 | 0.1785 | -0.0285 | 0.9773 | -0.0487 | 0.1954 | -0.2495 | 0.8030 |
| Year Fixed Effects | - | | | | ** | | | |
| Firm Fixed Effects | - | | | | - | | | |
| Pseudo $R^2$ | 0.0923 | | | | 0.1194 | | | |

****, **, * indicate significance at 0.01, 0.05, 0.1 levels respectively (1-tailed for EMLINK and #EMLINK, 2-tailed for other variables), number of observations 615*

## 5.4. Earnings management contagion and board positions

In our second hypothesis we test whether the probability of a company managing its earnings increases by more if the interlocked director is an opinion leader than if the director is not an opinion leader. Table 3 presents the regressions based on Equation 9 using the Modified Jones variable set and the McNichols variable set.

**Table 3.**

*Panel A: Earnings management contagion through opinion leader:* ***CEO***

Dependent variable: EM

| | Modified Jones | | | | McNichols | | | |
|---|---|---|---|---|---|---|---|---|
| | **Coef.** | **Std. Dev** | **z-Stat** | **P-value** | **Coef.** | **Std. Dev** | **z-Stat** | **P-value** |
| *EMLINK* | 1.5413* | 1.0476 | 1.4713 | 0.0706 | -0.7884 | 1.5676 | -0.5029 | 0.3075 |
| *#BOARDLINK* | 0.0780 | 0.1880 | 0.4151 | 0.6781 | -0.1589 | 0.2326 | -0.6832 | 0.4945 |
| *EMLINK_DILUTE* | -0.6735 | 0.4109 | -1.6392 | 0.1012 | 0.2745 | 0.5190 | 0.5289 | 0.5969 |
| *EM_CEO_LINK* | (Omitted) | | | | (Omitted) | | | |
| *ROA* | 8.0993** | 3.8790 | 2.0880 | 0.0368 | 4.7967 | 3.6093 | 1.3290 | 0.1839 |
| *Loss* | -1.2172 | 1.1465 | -1.0616 | 0.2884 | -0.7199 | 0.9779 | -0.7361 | 0.4616 |
| *Size* | -0.0122 | 0.1698 | -0.0721 | 0.9425 | -0.0673 | 0.1917 | -0.3509 | 0.7256 |
| *Leverage* | -1.3654 | 1.3158 | -1.0378 | 0.2994 | 0.9290 | 1.3777 | 0.6743 | 0.5001 |
| *CFFO* | -4.1066* | 2.4091 | -1.7047 | 0.0883 | -4.1842* | 2.3908 | -1.7501 | 0.0801 |
| *Board Size* | -0.0045 | 0.1776 | -0.0252 | 0.9799 | -0.0524 | 0.1977 | -0.2653 | 0.7907 |
| Year Fixed Effects | - | | | | ** | | | |
| Firm Fixed Effects | - | | | | - | | | |
| Pseudo $R^2$ | 0.0870 | | | | 0.1190 | | | |

*Panel B: Earnings management contagion through opinion leader:* ***Board Chairman***

Dependent variable: EM

| | Modified Jones | | | | McNichols | | | |
|---|---|---|---|---|---|---|---|---|
| | **Coef.** | **Std. Dev** | **z-Stat** | **P-value** | **Coef.** | **Std. Dev** | **z-Stat** | **P-value** |
| *EMLINK* | 1.3244 | 1.1209 | 1.1815 | 0.1187 | -0.0721 | 1.3889 | -0.0519 | 0.4793 |
| *#BOARDLINK* | 0.0802 | 0.1881 | 0.4265 | 0.6697 | -0.1576 | 0.2321 | -0.6791 | 0.4971 |
| *EMLINK_DILUTE* | -0.6921* | 0.4175 | -1.6578 | 0.0974 | 0.0933 | 0.4561 | 0.2046 | 0.8379 |
| *EM_BOARDCHAIR_LINK* | 0.5759 | 0.8241 | 0.6988 | 0.2424 | (Omitted) | | | |
| *ROA* | 8.2640** | 3.8984 | 2.1199 | 0.0340 | 4.7732 | 3.6219 | 1.3179 | 0.1875 |
| *Loss* | -1.2407 | 1.1465 | -1.0822 | 0.2792 | -0.6392 | 0.9822 | -0.6508 | 0.5152 |
| *Size* | -0.0187 | 0.1705 | -0.1094 | 0.9129 | -0.0632 | 0.1919 | -0.3295 | 0.7418 |
| *Leverage* | -1.4154 | 1.3230 | -1.0699 | 0.2847 | 0.9548 | 1.3813 | 0.6913 | 0.4894 |
| *CFFO* | -4.2199* | 2.4289 | -1.7374 | 0.0823 | -4.0243* | 2.3925 | -1.6821 | 0.0926 |
| *Board Size* | 0.0028 | 0.1800 | 0.0153 | 0.9878 | -0.0611 | 0.1970 | -0.3100 | 0.7566 |
| Year Fixed Effects | - | | | | ** | | | |
| Firm Fixed Effects | - | | | | - | | | |
| Pseudo $R^2$ | 0.0900 | | | | 0.1146 | | | |

As visible in descriptive statistics in Table 1, *EM_CEO_LINK* occurs only in 1.3% of our firm-year observations, corresponding to eight observations. In none of these eight instances

****, **, * indicate significance at 0.01, 0.05, 0.1 levels respectively (1-tailed for EMLINK, EM_CEO_LINK and EM_BOARDCHAIR_LINK, 2-tailed for other variables), number of observations 576*

earnings management spreads through the director who is also CEO, causing perfect prediction. If *EM_CEO_LINK* is forced kept in the regression, it shows a very negative coefficient with a p-value of 0.999. However, to avoid confusion, we present *EM_CEO_LINK* as omitted in tabulated results. Table 3 shows that *EM_BOARDCAHIR_LINK* is not significant at any level when using the Modified Jones variable set and omitted when using the McNichols variable set. Thus, we do not find support for our second hypothesis concerning opinion leaders in any of our tests and do not reject the null hypothesis. The control variable *CFFO* is significant in all of the regressions at the 10% level. The control variable *ROA* is significant at the 5% level using Modified Jones variable set, but not when using McNichols variable set. The coefficients of both *CFFO* and *ROA* are in line with our expectations. When controlling for year fixed effects and industry fixed effects, the models based on the McNichols Model are again strongly affected by year fixed effects.

The McFadden pseudo $R^2$ values of the regression models based on the Modified Jones variable set are 0.087 for *EM_CEO_LINK* and 0.090 for *EM_BOARDCHAIR_LINK*, respectively. For the McNichols variable set, the corresponding pseudo $R^2$ values are 0.119 and 0.114.

# 6. Analysis

In this section we analyze our results. We begin by addressing the substantial differences in test results when using the Modified Jones variable set and the McNichols variable set. In the light of this, we discuss the results of the tests of our two hypotheses. We then perform robustness tests and their outcomes are analyzed. Lastly, we discuss our research method.

## 6.1. Analysis of results

### 6.1.1. Comparison of accrual-based models

When choosing to base the main regression models on both the Modified Jones Model and the McNichols Model, the purpose was to increase the validity of our results. However, as evident in Table 2 and 4, regressions with the variable set from the McNichols Model are greatly impacted by year fixed effects. By examining the data we find this to be a consequence of the uneven distribution of observations where *EM* = 1 over the years of the test period. The McNichols model produces a bias towards triggering *EM* = 1 in the first year, leading to 44% of all observations of *EM* = 1 occurring in 2010, compared to an expected 20% if evenly distributed across five years. The Modified Jones variable set may also induce a bias, as 28% of observations where *EM = 1* occurs in 2010. However, when controlling for year fixed effects,

the results of the tests based on the variable set from the Modified Jones Model are not notably affected and none of the years are significant. We conclude that even if the Modified Jones variable set also exhibit a bias towards triggering *EM* in early years, it is not large enough to affect the validity of our results. Nevertheless, the regressions based on the McNichols variable set pose a problem due to a clear bias.

To combat this problem, attempts were made to adjust the threshold level for identifying earnings management for the McNichols Model. The theoretical justification for an adjustment is that the discretionary accruals calculated by the McNichols model differ from those of the Modified Jones Model in how they are distributed. Theorisation of what exact threshold level this would imply is beyond the scope of this study, but preliminary tests may still be indicative of the effects of different threshold levels. In untabulated results we find that the bias in the McNichols Model does not decrease when the threshold level is altered. We then conclude that the McNichols model is unable to provide an unbiased variable set to be used to test our hypotheses and we therefore disregard its results from further analysis. Using only one accrual-based model decreases the validity of our tests. However, we prefer this choice to analyzing results based on the McNichols variable set as we are reluctant to ascribe explanatory weight to results with a substantial and unavoidable bias. All test results for the McNichols variable set are tabulated, but the analysis will concern the results drawn from the Modified Jones variable set.

### 6.1.2. Earnings management contagion and board interlocks

Our first hypothesis asks if the likelihood of an exposed company to manipulate earnings is significantly positively correlated with the company having a director that serves on the board of a contagious company. Table 2, Panel A, shows that the coefficient of *EMLINK* is positive with a p-value of 0.068 and Panel B shows the coefficient of *#EMLINK* to be positive with a p-value of 0.093. We thus reject the null hypothesis at the 10% level and find support for earnings management contagion through board interlocks to be prevalent in Sweden. Our area of research is yet little-studied, but our results are in line with previous research (Chiu et al., 2013; Granovetter, 1985). Moreover, they are supported by studies on social norms relating to dishonesty and network theory (Gino et al., 2009; Rogers, 2003), board interlocks in Sweden (Stafsudd, 2009) and earnings management motives (Dechow et al., 1996).

A difference to previous studies however, is the significance and coefficient of the second independent variable *#BOARDLINK*. Chiu et al., (2013) find it to be significantly negatively correlated with *EM*, indicating contagion of good financial reporting behaviour, whereas we do not. The general non-spread of good financial reporting behaviour could be explained by the theory of negativity bias and more precisely, the element of negativity dominance. It states that entities, including events and social interactions, of a more negative or destructive nature, have a stronger effect on humans than neutral or positive entities of equal intensity (Royzman & Rozin, 2001). Furthermore, it is found that bad information is processed more thoroughly than good information (Baumeister et al., 2001). Earnings management can be considered negative or bad information in the sense that it is an unethical and sometimes illegal action. The theory of negativity bias then suggests that it is reasonable to assume that directors are more strongly influenced by earnings management than by the absence of it. However, we find no clear indications as to why the negativity bias would be stronger for Swedish boards than for U.S. boards. We hypothesize that it could be related to cultural differences affecting financial reporting norms and corporate governance practices (Angwin et al., 2013).

The independent variables, *EMLINK_DILUTE* and *#EMLINK_DILUTE*, which are constructed as interaction variables from *EMLINK* or *#EMLINK* and *#BOARDLINK*, show that there is a significant dilution effect of earnings management contagion since they have negative coefficients significant at a 5% level. The result is similar to Chiu et al., (2013) and in line with the notion that a larger number of interlocks to non-manipulators dilute the contagion of links to manipulators.

The explanatory power of our tests is slightly higher than in previous research, 0.088 compared to 0.070 and 0.092 compared to 0.075 (Chiu et al., 2013). When removing the control variables from Equation 7 and 8 we find in untabulated results that the additional explanatory power appears to come from the key independent variables rather than from control variables. We hypothesize that the use of a threshold level for absolute discretionary accruals contributes to the creation of the difference, but as our data is also from a different region and time period we cannot deduce exactly what causes the variation.

### 6.1.3. Earnings management contagion and board position

In our second hypothesis we test whether the probability of a company managing its earnings increases by more if the interlocked director is an opinion leader than if the director is not an

opinion leader. As seen in Table 3, Panel A, we do not find support of that a board interlock to a contagious company via a director who is CEO has an increased effect on the spread of earnings management. For the variable *EM_CEO_LINK*, there are no observations where earnings management spreads through a CEO board link. This seemingly perfect prediction of *EM* by *EM_CEO_LINK* can indeed be a result of Swedish CEOs not being inclined to transmit financial reporting behaviour, but it seems unlikely that it never occurs at all. Instead, we believe the omission of *EM_CEO_LINK* to be a result of very few CEOs being linked to a contagious firm, which only occurs eight times in our sample. This is a reflection of two phenomena that both stem from the board composition of Swedish company boards. First, relatively few CEOs are active on their company boards in Sweden. In our sample, 42% of all CEOs are members of their company boards, compared to 2015 data for the U.S., where practically all CEOs of S&P 500 firms are members of their company boards (Stuart, 2016). Second, our study shows CEOs active on boards to have approximately the same number of interlocks as the directors that are not CEOs, see Appendix 3. CEOs on boards in our sample have on average 0.22 number of interlocks, compared to 0.20 number of interlocks for directors that are not CEOs. It then follows naturally that fewer CEOs on company boards in general and CEOs having only an average number of interlocks in general, lead to fewer contagious links for CEOs. We thus conclude that CEO board links are not necessarily less contagious than other board links. Chiu et al. (2013) did not find support for the probability of a company managing its earnings to increase by more if the interlocked director is the CEO than if the directors is not. However, they did so by finding *EM_CEO_LINK* to not be significant and did not have a problem with perfect prediction.

*EM_BOARDCHAIR_LINK* is not significant in any tests as seen in Table 3, Panel B. Thus, no evidence is found of that a board interlock to a contagious company via a director who is board chair has an increased effect on the spread of earnings management. Chiu et al. (2013) found *EM_BOARDCHAIR_LINK* to be significant using U.S. data. A possible explanation to the differing results is the considerable cultural difference between Sweden and the U.S., which also manifests itself in the corporate world. The business culture in the U.S. is characterized by clearer hierarchies and more authoritative leaders, whereas the business culture in Sweden has flatter hierarchies and a more open dialogue. It is therefore reasonable to assume that opinion leaders of U.S. boards possess more power and influence, compared to directors in opinion leader roles of Swedish boards (Angwin et al., 2013). The research on opinion leaders has primarily been conducted in an American context (Rogers, 2003) and it might even be the case

that no certain board position in Sweden by default is authoritative enough to be considered an opinion leader.

The explanatory power of our tests is slightly higher than in previous research, 0.087 for *EM_CEO_LINK* and 0.090 for *EM_BOARDCHAIR_LINK*, compared to 0.071 and 0.073 (Chiu et al., 2013). As in the case of the first hypothesis, we find in untabulated results that the additional explanatory power primarily comes from the key independent variables. Again, we believe this to be caused by the use of a threshold level for absolute discretionary accruals.

#### 6.1.4. Control variables

All of our tests include six control variables previously known to be relevant when testing for earnings management.

*Loss, Size, Leverage* and *Board Size* are all insignificant in all regressions based on the Modified Jones variable set. Apart from *Size*, this is also the case for Chiu et al. (2013). Differences in the relevance of *Size* as an indicator of *EM* can be due to several reasons. First, our sample is retrieved from a later time period, 2010-2014 compared to 1998-2001. As a decade of rapid development of information technology separates the test periods, the political costs, which we presume dictate the relationship between *Size* and *EM*, may have changed. Second, we use Swedish data and not U.S. data. Differences in how earnings management is scrutinized by regulators and the media in the two nations should affect a firm's political costs in regards to its size. *ROA* is significant at the 5% level in all regressions. We find its sign to be positive as anticipated, indicating that firms that manage earnings also exhibit high *ROA*. This is in line with previous research (Kothari et al., 2005; Lee et al., 2006). *CFFO* is significant at 10% in all regressions. It carries a negative coefficient as anticipated, in line with previous research (Subramanyam, 1996). This continues to provide support for the notion that a strong cash flow from operations indicates strong financial performance, reducing the need for management to manipulate earnings.

### 6.2. Robustness tests

#### 6.2.1. Multicollinearity

Multicollinearity is caused by independent variables in a multiple regression model being highly correlated. The consequence of multicollinearity is that the results from the regressions are difficult to interpret since the independent contribution of a variable to the explained variance cannot be distinguished (Farrar and Glauber, 1967). We control for multicollinearity

by calculating the variance inflation factor (VIF) for the variables in Equation 7 and 8. Results are presented in Appendix 5. A common level for which a VIF is considered too high is ten (Wooldridge, 2012). A more conservative measure used as a rule of thumb is a VIF of four. However, the use of set levels in general has been criticised for being too arbitrary as acceptable VIF vary with the type of study and data used (O'Brien, 2007). The majority of our independent variables have VIF below three, but some are closer to five or six. However, all of the variables with VIF above four are either interaction variables or components of the interaction variables. Jaccard and Turrisi (2003) state that multicollinearity between an interaction variable and its components is not considered to be a problem. In untabulated results we also find VIF for all variables to be smaller than four when interaction variables are removed. Consequently, we note that there is a risk that multicollinearity could affect the interpretation of our results, but we do not find it to be substantial and it should not affect our main conclusions.

### 6.2.2. Impact of extreme observations

Extreme observations can bias the results of regressions. If they are not considered to be representative for the population they belong, they should potentially be removed. Several previous earnings management studies exclude extreme values from the sample (Dechow & Dichev, 2002; Kothari et al., 2005). To investigate if our results are robust when excluding extreme observations, we remove the 1st and 99th percentile of observations of the continuous variables in the tests of our first hypothesis. Results are presented in Appendix 7. Overall, our results remain similar. The coefficients remain significant and carry the same sign as before, with the exception of *CFFO*, which becomes marginally insignificant with p-values of 0.117 and 0.129 for Equation 7 and 8. The pseudo $R^2$ values decrease by 0.0088 when we test for contagion using *EMLINK* and by 0.0082 when using *#EMLINK*. The decrease is small but unexpected, as it is common that the explanatory power increases when extreme observations are removed since extreme observations tend to deviate from the model predictions. In our case however, extreme observations do provide a part of the explanatory power of the model. This is presumably related to the construction of our dependent variable *EM*, which is triggered when extreme levels of discretionary accruals are observed. The control variables *ROA* and *CFFO* are both significant in regressions with *EM*, suggesting in turn that absolute discretionary accruals are correlated with both *ROA* and *EM*. Hence, removal of extreme values of *ROA* and *CFFO* should bias towards a removal of the model's dependent variable as well, explaining the drop of the pseudo $R^2$. Regardless of whether such dynamics are in place, none of our key

independent variables exhibit a notable change of sign of coefficient or p-value and we conclude our tests to be robust to the removal of extreme observations.

### 6.2.3. Changing the threshold level determining earnings management

The dependent variable *EM,* the key independent variables *EMLINK* and *#EMLINK* and the interaction variables *EMLINK_DILUTE* and *#EMLINK_DILUTE* are all directly or indirectly based on the threshold level of absolute discretionary accruals for a firm and year which triggers *EM* = 1. This threshold is discussed in section 3.4.3. and set as the sum of the mean of the discretionary accruals plus two standard deviations, calculated separately for discretionary accruals determined by the Modified Jones Model and the McNichols Model. To see if our results are robust to changes in the threshold, we again test our first hypothesis using variables based on two new thresholds; a lower one and a higher one. The purpose of this robustness test is to determine whether the chosen threshold arbitrarily produces significant results due to a group of companies, which also happen to be earnings manipulators, have *EM* triggered by chance rather than through the logic explained in section 3.4.3. Hence, the alternative thresholds should be close enough to the original level to follow the same reasoning but far away enough to prompt a slightly different selection of observations to be triggered as *EM* = 1. We determine these levels to be the mean plus 1.8 standard deviations and the mean plus 2.2 standard deviations. To see if our results are robust, we test our first hypothesis with these thresholds. The results of these tests are presented in Appendix 9.

There are deviations in our results when we change the threshold but they are generally small. This indicates that the selection of firms for which *EM* was triggered changed, but that it did not substantially alter the results. When the threshold is lowered, test results for our first hypothesis do not change dramatically. The p-values of *EMLINK* and *#EMLINK* drop from 0.068 to 0.046 and from 0.093 to 0.066 respectively, making *EMLINK* significant at the 5% level. *Board Size* changes sign but remains far from significant. All other variables remain relatively unchanged with only slight deviations in p-values. When the threshold is increased, test results change somewhat more. P-values of *EMLINK* and *#EMLINK* only change about half of a decimal point, but the dilution terms *EMLINK_DILUTE* and *#EMLINK_DILUTE* go from p-values of 0.088 to 0.174 and 0.096 to 0.152, respectively. While the change of p-values of interaction variables weaken the support for the notion that honest directors prohibit the spread of bad financial reporting behaviour of dishonest directors, the change is not substantial enough to affect the interpretation of our results in regards to general contagion of earnings

management. The coefficient of *#BOARDLINK* changes sign, but similar to *Board Size* it remains far from significant. Other variables exhibit only marginal changes in coefficients and p-values, including *ROA,* even though it becomes marginally insignificant with a higher threshold. We conclude that changing the threshold does have a slight effect on results, but that our key independent variables *EMLINK* and *#EMLINK* are robust to the test.

## 6.3. Analysis of research method

### 6.3.1. Validity

The validity of the study affects the possibility to draw relevant conclusions regarding our hypotheses. Validity can be evaluated by considering the relevance of the data in relation to the hypotheses and the ability of the models to measure what they are intended to measure.

The hypotheses of this study concerns whether earnings management spreads from one company to another through the network formed by directors who serve on several boards. While our test is specifically designed to test for such a mechanism, it defines earnings management to be a function of only absolute discretionary accruals. Earnings management as defined in section 2.3.1. is however not limited to manipulation of accruals. Proxies based on the Modified Jones Model and the McNichols Model is hence reflective of a subset of all accounting practices used to manage earnings, namely those related to accruals manipulation. It is possible that a combination of different earnings management models and/or external indicators provide a better proxy for earnings management. We discuss a suggestion to improve on the proxy further in section 7.

Regarding the models' ability to measure what they are intended to measure, three factors can affect the validity. First, the accrual-based models ability to estimate the discretionary accruals correctly should be assessed. The use of accrual-based models is an established research method within earnings management research and is considered to estimate discretionary accruals relatively well. However, the models have been found to incorrectly include non-discretionary accruals that are not part of companies' normal business as discretionary (Subramanyam, 1996). In our study, this would cause *EM* to be triggered too often for firms that do not manage earnings. However, if *EM* is triggered more often for such firms, this should dilute the explanatory power ascribed to *EMLINK*, as random triggers of *EM* for non-manipulators more often than not would occur when *EMLINK* = 0. Thus, if the models used to calculate discretionary accruals carry a lot of noise, we would expect the bias to be against finding *EMLINK* and *#EMLINK* significant, if anything. Second, we use a threshold to determine what

level of absolute discretionary accruals that corresponds to earnings management. It is possible that the threshold arbitrarily classifies companies to be manipulators, which would affect several of the variables in the main regression models. However, when performing a robustness test for alternative thresholds the results were robust to both upward and downward adjustments of the threshold level. Third, our regression model is potentially subject to left truncation, which would result in an undercounting of *EMLINK*, meaning that *EMLINK* will be 0 in cases when it should be 1. This measurement error biases against finding *EMLINK* significant.

### 6.3.2. Reliability

The reliability of the study is considered to be relatively high. Our references are trustworthy and many of them are well-known within their respective research field. We only use established sources for data collection. Accounting data is retrieved from WRDS Compustat, board interlock data is retrieved from reports of board member data in Swedish listed firms published by SIS Ägarservice (Fristedt et al., 2010-2014) and market value of equity is retrieved directly from Nasdaq Stockholm. A potential source of error despite this is the quality of the data. The accounting data was evaluated by comparing it with the annual reports of randomly selected companies in the sample. Some minor differences were found, but the quality was overall high. The board interlock data is gathered manually, which could be a source of error. However, the data was thoroughly checked for errors using controls for duplicates, typing errors and director name changes. Hence, the identified potential sources of errors should not risk the reliability of the study. We consider our study to be replicable, as the data collected comes from accessible sources and the applied methods and assumptions are clearly stated.

### 6.3.3. Comparability

The comparability of our study is restricted with regards to time, regulatory environment and the fact that all sample firms are listed firms. In regards to time period, several studies within earnings management, (Dechow et al., 2010; McNichols, 2002; Collins & Hribar, 2002) cover a full business cycle, but ours do not. A longer test period opens up the possibility to include several contagious periods in the same study, but due to the manual collection of board interlock data it is beyond the scope of this study. Accounting rules and regulations differ between jurisdictions and our results should consequently not be interpreted as applicable in countries with substantially different regulatory environments. Our use of companies listed on the main market enhances the comparability of our study since most studied within our field use data on this type of companies. However, our results should not be extended to unlisted companies.

## 7. Suggestions for future research

The conduction of this study has given rise to ideas of areas suitable for further study. Some are related to our findings and results and some build on our research methodology. They are here presented as suggestions for future research.

Board interlocks are of interest as they concentrate much of a country's economic resources amongst a small group of business leaders (Mizruchi, 1996). Though board interlocks have been analyzed thoroughly in the U.S., little research has been conducted concerning board interlocks in Sweden. Our study finds support of an important consequence of board interlocks in Sweden; the spread of earnings management. The comparison with the U.S. is of particular interest as the Swedish corporate governance code differs from American corporate governance practices and is unique in the sense that it is based on the "Comply or explain" principle (Swedish Corporate Governance Board, 2017). Whether the differences in our findings compared to U.S. studies are a result of a unique corporate governance code would be of interest to standard-setters internationally. Having shown that the Swedish board network can be readily mapped, we invite future research on board interlocks in Sweden.

The study that we are inspired by (Chiu et al. 2013) uses restatements to identify earnings manipulators. Since this type of data is not available to us and our test requires a dichotomous indicator of earnings management, we use established accrual-based models and set a threshold that represents earnings management. Our method is a new form of application of accrual-based models, which we find to be robust to upward and downward adjustments to the threshold. This novel approach can broaden the field of application for accrual-based models and facilitate the study of other questions within earnings management that require a dichotomous indicator when external indicators of earnings management are not available. We encourage future research to further investigate the applications of a threshold in accrual-based models. First, it is interesting to study the effect of using other types of accrual-based models to estimate accruals as we found the results of the McNichols Model to induce a bias in our main regression models. Second, by comparing occasions when accrual-based models employing a threshold level predict a firm to be manipulating earnings with external indicators, the understanding of the relation between the two methods can be improved.

Although we find support for that earnings management can spread through board interlocks in a Swedish setting, our findings are not as conclusive as those of Chiu et al. (2013). We therefore

propose that our study could be extended by using a more extensive proxy for earnings management. Irregularity restatements, as used by Chiu et al. (2013), cover all types of earnings management, including manipulation of real transactions and manipulation of accruals. By combining accrual-based models and, for instance, discretionary expense models, one might be able to create a better proxy for earnings management.

## 8. Conclusion

This study examines whether earnings management spreads through board interlocks in Swedish listed companies. In line with previous research, we find that a board interlock to a company that has previously managed earnings increases the propensity of a company that has not recently managed earnings to do so. We believe our results to be suggestive, but not conclusive, as they are significant only at the 10% level. They are of interest to regulators and investors alike, since earnings management can severely impact the quality of financial reports (Dechow & Schrand, 2004). Earnings figures in particular are a key source of information among capital market actors (Hjelström et al., 2014). When examining whether the board position of the interlocked director impacts the contagiousness of earnings management, we do not find the CEO or board chairman to be particularly influential compared to other directors.

Our study introduces a novel approach of classifying earnings management when external indicators of earnings management are not available. Our approach is to use accrual-based models to estimate absolute discretionary accruals and define a set threshold level that represents earnings management, to produce a dichotomous variable indicating earnings management. The test results are robust to changes in the threshold level and we believe the method to have relevant application in future earnings management research.

The study offers suggestions for future research in three directions. First, our results suggest that board interlocks are relevant determinants of the spread of financial reporting behaviour in Sweden. This invites future research on the role of board interlocks in Sweden, which is of special interest due to the unique corporate governance code. Second, the new approach to classify earnings management should be compared to results when using external indicators. Third, since our results are not as conclusive as previous research, we propose extending our method by using a more extensive proxy for earnings management.

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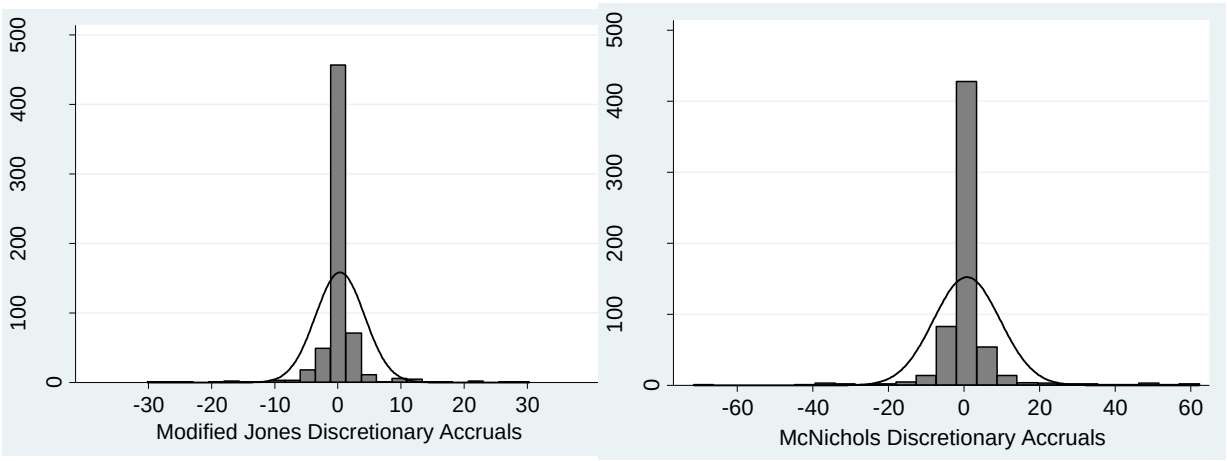
# Appendix

## Appendix 1.

*Distribution of discretionary accruals*




## Appendix 2.

*Distribution of sample firms across GICS industry group and year*

| GICS Code | Industry Group Name | 2010 | 2011 | 2012 | 2013 | 2014 | Total |
|---|---|---|---|---|---|---|---|
| 1510 | Materials | 10 | 10 | 9 | 9 | 7 | **45** |
| 2010 | Capital Goods | 31 | 31 | 31 | 31 | 31 | **155** |
| 2020 | Commercial & Professional Services | 16 | 16 | 16 | 15 | 14 | **77** |
| 2520 | Consumer Durables & Apparel | 10 | 10 | 10 | 10 | 10 | **50** |
| 2550 | Retailing | 10 | 10 | 10 | 10 | 10 | **50** |
| 3510 | Health Care Equipment & Services | 8 | 8 | 8 | 8 | 8 | **40** |
| 3520 | Pharmaceuticals, Biotechnology & Life Sciences | 12 | 12 | 12 | 12 | 12 | **60** |
| 4510 | Software & Services | 18 | 17 | 16 | 14 | 13 | **78** |
| 4520 | Technology Hardware & Equipment | 16 | 16 | 16 | 16 | 14 | **78** |
| | **Total** | **131** | **130** | **128** | **125** | **119** | **633** |

## Appendix 3.

*Board interlock descriptive statistics*

| | |
|---|---|
| Total number of directors 2010-2014 | 1005 |
| Average number of | |
| directors per board | 6.47 |
| CEOs per board | 0.43 |
| interlocks per board | 2.99 |
| interlocks per director | 0.20 |
| interlocks per CEO | 0.22 |
| interlocks per Chairman | 0.48 |

## Appendix 4.

*Panel A: Accrual-based models variable definitions*

| Variable Name | Definition | Data Source |
|---|---|---|
| *ΔRev* | Total revenue in year t less total revenue in year t-1 | WRDS Compustat. Item code: REVT |
| *ΔRec* | Total receivables in year t less total receivables in year t-1 | WRDS Compustat. Item code: RECT |
| *PPE* | Property, plant and equipment | WRDS Compustat. Item code: PPEGT |
| *Assets* | Total assets | WRDS Compustat. Item code: AT |
| *CFFO* | Net cash flow from operating activities | WRDS Compustat. Item code: OANCF |
| *NIBE* | Net income before extraordinary items | WRDS Compustat. Item code: IB |
| *TA* | Total Accruals: Net income before extraordinary items less *CFFO* | WRDS Compustat. Item codes: IB; OANCF |
| *NDA* | Non-discretionary accruals as calculated using the Modified Jones Model or the McNichols Model | |
| *DA* | Total accruals less non-discretionary accruals | |

*Panel B: Main regression models variable definitions*

| Variable Name | Definition | Data Source |
|---|---|---|
| *EM* | Equals 1 if absolute value of discretionary accruals for a firm-year observation is larger than the earnings management threshold level, else 0 | |
| *EMLINK* | Equals 1 if the firm shares a director with a firm which is currently contagious. A firm is contagious during the year it has had *EM* = 1 for the first time in the test period, and the two following years. A firm which has *EMLINK* = 1 we label as exposed | |
| *#BOARDLINK* | The number of board links a firm has to other firms in general | SIS Ägarservice |
| *EMLINK_DILUTE* | Product of *EMLINK* and *#BOARDLINK* | |
| *#EMLINK_DILUTE* | Product of *#EMLINK* and *#BOARDLINK* | |
| *EM_CEO_LINK* | Equals 1 if the firm shares a director with a firm which is currently contagious, and the director is also the CEO of the exposed firm | |
| *EM_BOARDCHAIR_LINK* | Equals 1 if the firm shares a director with a firm which is currently contagious, and the director is also the board chairman of the exposed firm | |
| *ROA* | Net income before extraordinary items divided by the average of total assets in year t and year t-1 | WRDS Compustat. Item codes: IB; AT |
| *Loss* | Equals 1 if Net income before extraordinary items is negative, else 0 | WRDS Compustat. Item code: IB |
| *Size* | Natural logarithm of the market value of equity in MSEK | Nasdaq Stockholm |
| *Leverage* | Total common equity divided by total assets | WRDS Compustat. Item codes: CEQ; AT |
| *CFFO* | Net cash flow from operating activities | WRDS Compustat. Item code: OANCF |
| *Board Size* | Total number of board members | SIS Ägarservice |

## Appendix 5.

*Panel A: Multicollinearity in Equation 7*

Dependent variable: EM

| | Modified Jones | | McNichols | |
|---|---|---|---|---|
| | **VIF** | **Tolerance** | **VIF** | **Tolerance** |
| *EMLINK* | 4.80 | 0.21 | 5.17 | 0.19 |
| *#BOARDLINK* | 2.29 | 0.44 | 1.95 | 0.51 |
| *EMLINK_DILUTE* | 6.27 | 0.16 | 5.99 | 0.17 |
| *ROA* | 3.80 | 0.26 | 3.80 | 0.26 |
| *Loss* | 1.95 | 0.51 | 1.95 | 0.51 |
| *Size* | 2.59 | 0.39 | 2.67 | 0.37 |
| *Leverage* | 1.48 | 0.68 | 1.44 | 0.70 |
| *CFFO* | 2.94 | 0.34 | 2.94 | 0.34 |
| *Board Size* | 1.87 | 0.53 | 1.90 | 0.53 |

*Panel B: Multicollinearity in Equation 8*

Dependent variable: EM

| | Modified Jones | | McNichols | |
|---|---|---|---|---|
| | **VIF** | **Tolerance** | **VIF** | **Tolerance** |
| *#EMLINK* | 6.50 | 0.15 | 5.47 | 0.18 |
| *#BOARDLINK* | 2.12 | 0.47 | 1.91 | 0.52 |
| *#EMLINK_DILUTE* | 7.67 | 0.13 | 6.16 | 0.16 |
| *ROA* | 3.80 | 0.26 | 3.80 | 0.26 |
| *Loss* | 1.95 | 0.51 | 1.95 | 0.51 |
| *Size* | 2.58 | 0.39 | 2.66 | 0.38 |
| *Leverage* | 1.47 | 0.68 | 1.44 | 0.70 |
| *CFFO* | 2.94 | 0.34 | 2.94 | 0.34 |
| *Board Size* | 1.87 | 0.53 | 1.88 | 0.53 |

## Appendix 6.

*T-test and Wilcoxon's signed rank test for mean and median differences of Modified Jones variable set and McNichols variable set*

| | **t-test** | **Wilcoxon** |
|---|---|---|
| | **t-stat** | **z-stat** |
| *EM* | (0.853) | (0.853) |
| *EMLINK* | (3.564)*** | (3.530)*** |
| *#EMLINK* | (4.033)*** | (3.614)*** |
| *#BOARDLINK* | - | - |
| *EM_CEO_LINK* | (2.243)** | (2.236)** |
| *EM_BOARDCHAIR_LINK* | (3.684)*** | (3.647)*** |
| *EM_OTHER_LINK* | (2.019)** | (2.014)** |

## Appendix 7.

*Panel A: Removal of extreme observations in Equation 7*

Dependent variable: EM

| | Modified Jones | | | | McNichols | | | |
|---|---|---|---|---|---|---|---|---|
| | **Coef.** | **Std. Err** | **z-Stat** | **P-value** | **Coef.** | **Std. Err** | **z-Stat** | **P-value** |
| *EMLINK* | 1.5355* | 1.0381 | 1.4792 | 0.0696 | -0.4798 | 1.4542 | -0.3299 | 0.3707 |
| *#BOARDLINK* | 0.0783 | 0.1925 | 0.4068 | 0.6841 | -0.1933 | 0.2404 | -0.8039 | 0.4215 |
| *EMLINK_DILUTE* | -0.6984* | 0.4060 | -1.7202 | 0.0854 | 0.0997 | 0.4781 | 0.2085 | 0.8349 |
| *ROA* | 7.5192* | 4.3920 | 1.7120 | 0.0869 | 6.7090 | 4.9804 | 1.3471 | 0.1780 |
| *Loss* | -1.1635 | 1.1876 | -0.9797 | 0.3272 | (Omitted) | | | |
| *Size* | 0.0167 | 0.1872 | 0.0890 | 0.9291 | -0.0644 | 0.2296 | -0.2805 | 0.7791 |
| *Leverage* | -1.2916 | 1.4301 | -0.9031 | 0.3665 | 0.6016 | 1.6480 | 0.3651 | 0.7151 |
| *CFFO* | -4.6555 | 2.9683 | -1.5684 | 0.1168 | -2.3286 | 3.3333 | -0.6986 | 0.4848 |
| *Board Size* | -0.0047 | 0.1827 | -0.0259 | 0.9794 | 0.0329 | 0.2054 | 0.1600 | 0.8729 |
| Year Fixed Effects | | - | | | | - | | |
| Firm Fixed Effects | | - | | | | - | | |
| Pseudo R2 | | 0.0791 | | | | 0.0982 | | |

*Panel B: Removal of extreme observations in Equation 8*

Dependent variable: EM

| | Modified Jones | | | | McNichols | | | |
|---|---|---|---|---|---|---|---|---|
| | **Coef.** | **Std. Err** | **z-Stat** | **P-value** | **Coef.** | **Std. Err** | **z-Stat** | **P-value** |
| *#EMLINK* | 1.3413* | 1.0267 | 1.3065 | 0.0957 | -0.4127 | 1.2192 | -0.3385 | 0.3675 |
| *#BOARDLINK* | 0.0963 | 0.1881 | 0.5121 | 0.6086 | -0.1352 | 0.2322 | -0.5822 | 0.5604 |
| *#EMLINK_DILUTE* | -0.6574* | 0.3921 | -1.6765 | 0.0936 | 0.0022 | 0.3605 | 0.0061 | 0.9951 |
| *ROA* | 7.3983* | 4.3813 | 1.6886 | 0.0913 | 6.7945 | 4.9655 | 1.3683 | 0.1712 |
| *Loss* | -1.1261 | 1.1914 | -0.9452 | 0.3446 | (Omitted) | | | |
| *Size* | 0.0169 | 0.1882 | 0.0897 | 0.9286 | -0.0754 | 0.2295 | -0.3287 | 0.7424 |
| *Leverage* | -1.3126 | 1.4251 | -0.9211 | 0.3570 | 0.6632 | 1.6412 | 0.4041 | 0.6861 |
| *CFFO* | -4.5020 | 2.9616 | -1.5201 | 0.1285 | -2.2804 | 3.3326 | -0.6843 | 0.4938 |
| *Board Size* | -0.0037 | 0.1829 | -0.0201 | 0.9839 | 0.0401 | 0.2027 | 0.1978 | 0.8432 |
| Year Fixed Effects | | - | | | | - | | |
| Firm Fixed Effects | | - | | | | - | | |
| Pseudo R2 | | 0.0841 | | | | 0.1008 | | |

## Appendix 8.

*Sample selection*

| **Criteria** | **Effect** | **Sample Size** |
|---|---|---|
| Listed on Nasdaq OMXS at any point between 2010-2014 | | 340 |
| Identifiable by ISIN in WRDS Compustat | -28 | 312 |
| Based in Sweden | -47 | 265 |
| Non-financial | -23 | 242 |
| Data available four consecutive years between 2008-2015 | -29 | 213 |
| All required data available each year | -57 | 156 |
| 10 or more firms in GICS Industry Group | -27 | 129 |
| **Total** | **-211** | **129** |

****, **, * indicate significance at 0.01, 0.05, 0.1 levels respectively (1-tailed for EMLINK and #EMLINK, 2-tailed for other variables), number of observations 576*

## Appendix 9.

*Panel A: Equation 7 robustness to changes in threshold level*

Dependent variable: EM

| | Modified Jones | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean + 1.8 Std. Dev | | | | Mean + 2.2 Std. Dev | | | |
| | **Coef.** | **Std. Dev** | **z-Stat** | **P-value** | **Coef.** | **Std. Dev** | **z-Stat** | **P-value** |
| *EMLINK* | 1.6522** | 0.9823 | 1.6819 | 0.0463 | 1.5776* | 1.0892 | 1.4483 | 0.0738 |
| *#BOARDLINK* | 0.0853 | 0.1884 | 0.4530 | 0.6506 | -0.0643 | 0.1929 | -0.3332 | 0.7390 |
| *EMLINK_DILUTE* | -0.6914* | 0.3897 | -1.7743 | 0.0760 | -0.6012 | 0.4425 | -1.3585 | 0.1743 |
| *ROA* | 8.3363** | 3.7550 | 2.2200 | 0.0264 | 8.0105** | 3.9425 | 2.0318 | 0.0422 |
| *Loss* | -1.3163 | 1.1390 | -1.1557 | 0.2478 | -1.1383 | 1.1503 | -0.9896 | 0.3224 |
| *Size* | -0.0516 | 0.1651 | -0.3127 | 0.7545 | -0.0112 | 0.1750 | -0.0640 | 0.9490 |
| *Leverage* | -1.5421 | 1.3020 | -1.1844 | 0.2363 | -1.0048 | 1.3395 | -0.7501 | 0.4532 |
| *CFFO* | -4.2291* | 2.3533 | -1.7971 | 0.0723 | -3.9901 | 2.4641 | -1.6193 | 0.1054 |
| *Board Size* | 0.0124 | 0.1753 | 0.0705 | 0.9438 | -0.0052 | 0.1859 | -0.0280 | 0.9777 |
| Year Fixed Effects | | - | | | | - | | |
| Firm Fixed Effects | | - | | | | - | | |
| Pseudo R2 | | 0.0907 | | | | 0.0836 | | |

*Panel B: Equation 8 robustness to changes in threshold level*

Dependent variable: EM

| | Modified Jones | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean + 1.8 Std. Dev | | | | Mean + 2.2 Std. Dev | | | |
| | **Coef.** | **Std. Dev** | **z-Stat** | **P-value** | **Coef.** | **Std. Dev** | **z-Stat** | **P-value** |
| *#EMLINK* | 1.4667* | 0.9738 | 1.5062 | 0.0660 | 1.4438* | 1.0803 | 1.3364 | 0.0907 |
| *#BOARDLINK* | 0.1056 | 0.1835 | 0.5754 | 0.5651 | -0.0469 | 0.1879 | -0.2497 | 0.8028 |
| *#EMLINK_DILUTE* | -0.6651* | 0.3756 | -1.7710 | 0.0766 | -0.6089 | 0.4253 | -1.4315 | 0.1523 |
| *ROA* | 8.2026** | 3.7426 | 2.1917 | 0.0284 | 7.9102** | 3.9306 | 2.0125 | 0.0442 |
| *Loss* | -1.2783 | 1.1410 | -1.1204 | 0.2625 | -1.1128 | 1.1520 | -0.9660 | 0.3341 |
| *Size* | -0.0515 | 0.1658 | -0.3107 | 0.7560 | -0.0150 | 0.1748 | -0.0856 | 0.9318 |
| *Leverage* | -1.5612 | 1.2956 | -1.2050 | 0.2282 | -1.0357 | 1.3336 | -0.7766 | 0.4374 |
| *CFFO* | -4.1165* | 2.3449 | -1.7555 | 0.0792 | -3.9134 | 2.4557 | -1.5936 | 0.1110 |
| *Board Size* | 0.0131 | 0.1752 | 0.0750 | 0.9402 | 0.0007 | 0.1853 | 0.0039 | 0.9969 |
| Year Fixed Effects | | - | | | | - | | |
| Firm Fixed Effects | | - | | | | - | | |
| Pseudo R2 | | 0.0944 | | | | 0.0851 | | |

****, **, * indicate significance at 0.01, 0.05, 0.1 levels respectively (1-tailed for EMLINK and #EMLINK, 2-tailed for other variables), number of observations 576*

**Appendix 10.**

*Panel A: Pearson correlations for Modified Jones variable set*

| | *EMLINK* | *#EMLINK* | *#BOARDLINK* | *ROA* | *Loss* | *Size* | *Leverage* | *CFFO* | *Board Size* |
|---|---|---|---|---|---|---|---|---|---|
| *EMLINK* | 1.0000 | | | | | | | | |
| *#EMLINK* | 0.8928*** | 1.0000 | | | | | | | |
| *#BOARDLINK* | 0.4330*** | 0.4541*** | 1.0000 | | | | | | |
| *ROA* | 0.0768* | 0.0711* | 0.1269*** | 1.0000 | | | | | |
| *Loss* | -0.1100*** | -0.0900** | -0.2030*** | -0.6510*** | 1.0000 | | | | |
| *Size* | 0.2417*** | 0.2637*** | 0.4821*** | 0.2732*** | -0.3340*** | 1.0000 | | | |
| *Leverage* | -0.2500*** | -0.2200*** | -0.2100*** | 0.0548 | 0.0620 | -0.1220*** | 1.0000 | | |
| *CFFO* | 0.0675* | 0.0674* | 0.0994** | 0.8026*** | -0.5030*** | 0.2089*** | 0.0736* | 1.0000 | |
| *Board Size* | 0.2203*** | 0.2266*** | 0.4108*** | 0.1439*** | -0.2230*** | 0.6589*** | -0.1730*** | 0.1246*** | 1.0000 |

*Panel B: Pearson correlations for McNichols variable set*

| | *EMLINK* | *#EMLINK* | *#BOARDLINK* | *ROA* | *Loss* | *Size* | *Leverage* | *CFFO* | *Board Size* |
|---|---|---|---|---|---|---|---|---|---|
| *EMLINK* | 1.0000 | | | | | | | | |
| *#EMLINK* | 0.9120*** | 1.0000 | | | | | | | |
| *#BOARDLINK* | 0.3236*** | 0.3608*** | 1.0000 | | | | | | |
| *ROA* | 0.0708* | 0.0605 | 0.1269*** | 1.0000 | | | | | |
| *Loss* | -0.0890** | -0.0810** | -0.2030*** | -0.6510*** | 1.0000 | | | | |
| *Size* | 0.0781* | 0.1010** | 0.4821*** | 0.2732*** | -0.334*** | 1.0000 | | | |
| *Leverage* | -0.1320*** | -0.1200*** | -0.2100*** | 0.0548 | 0.0620 | -0.1220*** | 1.0000 | | |
| *CFFO* | 0.0584 | 0.0477 | 0.0994** | 0.8026*** | -0.5030*** | 0.2089*** | 0.0736* | 1.0000 | |
| *Board Size* | 0.1490*** | 0.1485*** | 0.4108*** | 0.1439*** | -0.2230*** | 0.6589*** | -0.1730*** | 0.1246*** | 1.0000 |

****, **, * indicate significance at 0.01, 0.05, 0.1 levels respectively, number of observations 615*