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The Interrelation between Accounting Information, Corporate Governance and Insider Trading

Autor:

Alexandra Elvira Scarlat

Director:

José M. Marín

DEPARTAMENTO DE ECONOMÍA DE LA EMPRESA

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Firma del Tribunal Calificador:

	Nombre y Apellidos	Firma
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1

Summary

This dissertation consists of three essays that examine the way in which accounting information and corporate governance mechanisms relate to the extent to which insiders exploit opportunities to trade in the stock of their own company.

The first essay, "CEO and CFO Gender and Firm-Wide Insider Trading", coauthored with Karin Shields and Iain Clacher, examines insiders' trading profitability female executives using a sample of US firms between 2003 and 2011. The results suggest a significant decrease in firm-wide insider trading profitability following switches from male-to-female CEOs and CFOs. These findings are supported under different empirical specifications, including difference-in-differences, propensity score matching and instrumental variable approach. This evidence is consistent with female executives changing the ethical climate in their organization via a stronger "tone-at-the-top" that limits insiders' opportunistic trading.

In the second essay, "Insider Trading Restrictions and Earnings Management", a joint work with Beatriz Garcia Osma and Karin Shields, we propose and find that firms enjoy lower levels of earnings management following the adoption of firm self-imposed insider trading restrictions. We base our measure of insider trading restrictions on the extent to which transactions performed by insiders take place in the allowed trading window, and we develop a methodology to identify the quarter when each firm has adopted such restrictions. We find a significant negative relation between our insider trading restrictions measure and earnings management levels, even after controlling for previously documented determinants of earnings management.

The third essay, "Price Discovery for Connected Boards", coauthored with Dimas Peña, focuses on board connections as a potential channel through which flows of confidential information to institutional investors affect the dynamics of information arrival into prices. We capture the timing of private information flows by estimating the timeliness of price discovery over quarterly earnings cycles. We develop a measure of board connectedness of listed companies and institutional investors, and document an association between this measure of board connectedness and the speed of price discovery. This evidence is consistent with firms having a more timely price discovery the higher the number of common board members they share with institutional investors.

***

Esta tesis consiste de tres ensayos que examinan la forma en que la información contable y los mecanismos de gobierno corporativo se relacionan con las transacciones basadas en información privilegiada.

El primer ensayo, "CEO and CFO Gender and Firm-Wide Insider Trading", trabajo que ha tenido a Karin Shields y a Iain Clacher como coautores, examina la rentabilidad de las transacciones basadas en información privilegiada cuando los gerentes son mujeres utilizando una muestra de empresas estadounidenses entre 2003 y 2011. Los resultados sugieren una disminución

significativa en la rentabilidad de las transacciones basadas en información privilegiada a nivel de la empresa después de contratar a una gerenta ejecutiva. Estos hallazgos son consistentes con diferentes especificaciones empíricas, incluyendo differencias-en-differencias, *propensity score matching* y variables instrumentales. Esta evidencia es consistente con las ejecutivas cambiando el clima ético en su organización a través de un fuerte *tone-at-the-top* que limita las transacciones oportunistas dentro de la empresa.

En el segundo ensayo, "Insider Trading Restrictions and Earnings Management", un trabajo conjunto con Beatriz García Osma y Karin Shields, proponemos y encontramos que las empresas disfrutan de niveles más bajos de manipulación de beneficios tras la adopción de restricciones de uso de información privilegiada autoimpuestas por las empresas. Para identificar el trimestre cuando cada empresa ha adoptado este tipo de restricciones, medimos la proporción de trasacciones que ocurren en el periodo aprobado por la empresa respecto del total de transacciones trimestrales. Encontramos una relación negativa entre las restricciones de transacciones basadas en información privilegiada y el nivel de manipulación de los beneficios, incluso después de controlar por los factores previamente documentados como determinantes de la manipulación de los ingresos.

El tercer ensayo, "Price Discovery for Connected Boards", trabajo que tiene como coautor a Dimas Peña, se centra en conexiones entre las juntas directivas como un posible canal a través del cual fluye la información confidencial a los inversores institucionales, afectando la dinámica de la llegada información en los precios. Capturamos la llegada de los flujos de información privada mediante la estimación del descubrimiento de precios durante los ciclos de ganancias trimestrales. Desarrollamos una medida del nivel de conectividad entre juntas directivas de las sociedades cotizadas y los inversores institucionales, y documentamos una asociación entre la conexión entre los comités de los directores y la velocidad de formación de precios. Esta evidencia es consistente con la idea que las empresas tienen una formación de precios más rápida cuanto mayor sea el número de miembros del comités de los directores que comparten junta con los inversores institucionales.

2

Introduction

Insider trading has long received substantial attention both from regulators and from the academic literature in accounting and finance. With the purpose to enhance investor protection, the Securities and Exchange Act of 1934 and the amendments made to the Act via the Sarbanes-Oxley (SOX) Act of 2002 require trades performed by insiders to be publicly disclosed to the SEC within two business days from their execution. Moreover, firms seem to support regulators' efforts by adopting self-imposed insider trading restrictions and in an attempt to reduce the costs that insider trading carries to the organization: higher asymmetries of information, higher bid-ask spreads, lower liquidity in the market for the company's shares, to name a few.

Despite increased efforts to limit the ability of insiders' to exploit their access to private information at the expense of other investors, recent studies continue to document that insiders gain abnormal returns from trading opportunistically. This dissertation revolves around insider trading opportunities and the way that accounting information and internal corporate governance mechanisms of the firm can affect the extent to which insiders are able to extract private benefits from trading in the stocks of their own companies.

Chapter 3 of this dissertation largely consists of my job market paper. This essay analyzes the role played by the gender of the CEO or CFO of the company as a corporate governance mechanism restricting opportunistic behavior within the organization, as measured by firm-wide insider trading. By using a set of specifications that aim to isolate the gender effect from alternative explanations (including difference-in-differences, propensity score matching and instrumental variable), we find that a company's insiders are less likely to engage in opportunistic trading when the CEO or CFO is a female. We also show that firms that switch back to a male executive experience an increase in the profitability of insider trading. These results do not seem to be a consequence of the adoption of insider trading restrictions, nor of changes in the financial reporting environment of the company; rather, the mechanism driving our results seems to be a change in the *tone-at-the-top* following the switch from a male to a female executive, which translates into a more ethical climate and less opportunistic behavior like firm-level insider trading within the firm.

Chapter 4 focuses on the relation between the financial reporting environment of the firm and insider trading opportunities. Specifically, this essay examines whether insider trading represents an incentive for managers to manipulate earnings. Given that insider trading has been shown to be more profitable in environments of high information asymmetries and low financial reporting quality, it may provide incentives for managers to adversely influence the quality of their firms' financial reporting practices. Our findings support this prediction. We document a decrease in the level of earnings management, both accruals-based and real transaction management, following the adoption of firm-level insider trading restrictions. By focusing on a self-imposed, internal corporate governance mechanism of the firm, we show that such blackout periods effectively limit managerial incentives to manipulate earnings. In this sense, we differ from previous studies that have mostly focused on the consequences of mandatory regulation intended to improve earnings management, and have documented an unwanted substitution effect between reduced accruals management and increased real transaction management following such measures.

In *Chapter 5*, we adopt a broader understanding of the insider trading concept, in line with recent concerns of regulators. Specifically, during the last years, indirect forms of insider trading have received attention from the specialized literature. This essay aims to identify and isolate trading based on flows of private information facilitated by board interlocks between a listed firm and an institutional investor by measuring the speed of price discovery around earnings announcements for connected firms. We develop a measure of board connectedness that counts the number of connections that a company has to institutional investors. In order to capture the timeliness of price discovery, we compute a measure of how quickly information is impounded into price around earnings announcements. We provide preliminary evidence that the higher the number of connections to institutional investors a company has, the more timely the price discovery over quarterly earnings circles is. This result is consistent with the idea that the more institutional investors are connected to the board of the firm, the more pervasive their insider trading becomes in influencing the speed of price discovery during earnings cycles.

3

CEO and CFO Gender and Firm-Wide Insider Trading

3.1 Introduction

Following the recent Volkswagen scandal on falsifying emission tests, Matthias Mueller, the new chief executive, called upon the car maker's executives to help change the one ingredient that is believed to have caused the biggest challenge in the 78-year-old history of the company: corporate ethical climate[1].

The ethical climate of an organization is understood as the extent to which individuals within the institution act with integrity - that is, *not* opportunistically. In the last years, financial regulators have become aware of the fact that a sound ethical environment is critical not only for a healthy organization, but for smoothly functioning markets in general. In this sense, the Financial Stability Board issued in 2014 a framework for assessing risk culture in companies, where it highlights that ethical weaknesses of individuals within institutions are at the core of the global financial crisis. The report concludes by stressing the necessity to devote efforts towards a better understanding of *how* can managers help disseminate an ethical climate and shape non-opportunistic behavior within the company.

This study is the first to document that the ethical climate of the firm as reflected in the profitability of insider trading performed by employees depends on a key attribute of the company's executives: their gender. Managerial personal characteristics have a significant effect on corporate decision making. Perhaps more interestingly, personal attitudes and values of top executives are reflected into a firm's culture and disseminate throughout the firm, influencing the behavior of other employees of the company. One such key characteristic is the gender of the executive.

Gender differences have been extensively studied in fields such as psychology, but little is known about the effects of these behavioral differences on the extent of opportunistic behavior within the firm. Women tend to be more ethical in business across a range of practices, including being more critical of ethical issues and less loyal to the company in questionable situations (Ford and Richardson (1994); Craft (2013)). Cesarini et al. (2010) finds that the only significant difference between men and women's choice of pension funds is that women are more prone to opt for funds that invest in environmental-friendly companies or avoid investment in tobacco, alcohol, and the arms industry.

Top executives are the starting point for establishing the core values that build the ethical climate of their firms - a mechanism known as the "tone-at-the-top". Moreover, their own actions and

[1] Volkswagen's New CEO Says Car Maker Must Change Its Corporate Culture. September 28, 2015, *The Wall Street Journal*. Available at: http://www.wsj.com/articles/volkswagens-new-ceo-says-car-maker-must-change-its-corporate-culture-1443464516?alg=y

behaviors "will be emulated by the rest of the institution", as the Financial Stability Board puts it. Empirical findings support that employees' behavior is influenced by their leaders' behavior (Jong and Hartog (2007); Starke (2012)). These findings, together with the gender behavioral differences previously mentioned, suggest that the gender of the executive may translate into a different ethical climate that disseminates throughout the organization and encourages different types of individual behavior.

We study the effect of executives' gender on the opportunistic behavior of employees in the organization, measured by firm-level insider trading profitability. Insider trading profits are related to weak internal control over financial reporting and a weak "tone-at-the-top" (Skaife et al. (2013)). We consider the insider trading behavior of the employees in an organization as a representation of the strength of the tone-at-the-top within the company: specifically, we interpret the presence of profitable insider trading within a firm as a symptom for weak "tone-at-the-top". Given the documented concern of women with ethical issues and integrity, we propose that when women are appointed to key positions such as CEO or CFO, they change the "tone-at-the-top" of their firm to discourage opportunistic behavior like insider trading.

Consistent with our prediction, we find that insider trading profitability decreases in the period following a switch from a male to a female executive. Using a difference-in-differences approach, we find that following an executive turnover, firms that switch from male-to-female executives experience lower levels of insider trading profitability in the period after the switch than firms that change from male-to-male executives.

We conduct additional tests to distinguish the "tone-at-the-top" effect from alternative explanations. First, we examine whether our result is explained by a change in the financial reporting quality following the appointment of a new executive. Our proxy for financial reporting quality is the level of earnings management as measured by the Lagged Jones model, where higher financial reporting quality is assumed to result in lower levels of discretionary accruals. As a first step we estimate the effect of male-to-female executive switches on the level of discretionary accruals and find no significant result. As a second step, we include the earnings management proxy as a control in the estimation of insider trading profitability and find that the negative association between a switch to a female executive and insider trading profitability remains. Taken together, these findings suggest that the effect of gender on insider trading profitability is not explained by an improvement in financial reporting quality following a male-to-female executive switch.

Second, we examine whether our findings are explained by the new executive implementing firm-wide insider trading restrictions. The results of this analysis show that the decrease in profitability after hiring a female executive is not explained by the firm imposing blackout periods. The evidence from these tests supports the interpretation that female executives change the tone-at-the-top and the ethical culture of the company, which translates into less firm-wide opportunistic insider trading.

We acknowledge that causal inferences may be challenged by the fact that female executives may not be randomly assigned to firms. While the difference-in-difference approach likely mitigates potential endogeneity issues by comparing insider trading behavior before and after switches from a male to a female executive with a control sample of male-to-male switches, we conduct additional tests to ensure the reliability of our result. First, we use a propensity score matching framework and match firms by characteristics that make them likely to hire a female executive. Estimations based on the resulting matched control sample support our main finding.

Second, we develop an instrumental variable approach to correct for potential endogeneity issues. The instrument we use is an index of gender equality by states (we employ the more recent index values calculated in Di Noia (2002), built based on the gender equality index developed

by Sugarman and Straus (1988)). This measure is a good candidate for an instrument: we expect that the likelihood of a firm to have a female executive is higher in states that have higher levels of gender equality (Huang and Kisgen (2013)), and there is no obvious reason why the index would explain the prevalence of insider trading in firms. We use a two-stage least square instrumental variable setting. Both the coefficient of the gender equality index from the first stage and the instrumented variable in the second stage of the estimation are highly significant.

Third, in order to avoid drawing inferences about our prediction in the case when other unobservable changes within the company could coincide with the decision to hire a female executive, we study the trading patterns in firms that switch back to a male executive. Out of the 86 firms that change their CEO or CFO from a male to a female, 24 firms switch back to a male executive over our sample period. We find a reversal in the trading profitability for this subsample: insiders' profits are significantly higher in the period following the change back to a male executive. Taken together, these findings support our prediction that where women are appointed to key positions such as the CEO and CFO, there is a change in insiders' opportunistic behavior.

Our paper makes contributions to several strands of literature. Regulators state that the ethical climate of a company influences the extent to which individuals behave with integrity, and encourage efforts to understand the mechanism facilitating this effect within organizations. The extent of opportunism among insiders depends on individuals' values, norms and attitudes that are difficult to measure empirically. We take a step towards this ambitious objective by analyzing how executives' gender differences influences firm-wide insider trading profitability. Our findings can be interpreted as a mapping of the way executives influence the extent of ethical behavior that then disseminates throughout the company, influencing employees' opportunistic behavior. Our results suggest that a sound ethical climate plays a critical role in correcting the opportunistic behaviors of individuals within the organization as measured by firm-wide insider trading.

Further, we add to the relatively recent body of research analyzing the influence of managers' personal attributes (beyond the effect of firm characteristics) on the corporate environment of the firm. Gender has been found to be a relevant decision making factor in studies from fields like psychology, but evidence about its effect in corporate decision making is relatively scarce and inconsistent. In this sense, our results add to the discussion on another issue of great concern for regulators in many countries: mandatory quotas for female representations within the board of directors

Finally, we identify a channel that mitigates insiders' incentives to extract profits at the expense of shareholders. Regulators and firms themselves make efforts to restrict insider trading through internal trading policies (Bettis et al. (2000); Roulstone (2003)) or other corporate governance mechanisms (Jagolinzer et al. (2011)). We contribute to this growing body of work by showing that the presence of women in key positions limits the scope for rent extraction from shareholders via insider trading.

The rest of the paper is structured as follows. Section 2 discusses the background and predictions motivating our tests. Section 3 outlines our sample and chosen insider trading measures. Section 4 presents our research design. Section 5 presents our empirical results and section 6 summarizes and concludes.

3.2 Background and predictions

3.2.1 The tone-at-the-top and gender behavioral differences

Prior studies suggest ethical decision making is an influential factor underlying opportunistic behavior such as insider trading (Skaife et al. (2013)). We consider that a manager exerts a strong "tone-at-the-top" if they promote ethical behavior within the company. This would encompass acting with integrity, complying with policies and procedures, and not taking actions in their own self interest. A relatively poor "tone-at-the-top" may manifest itself in less monitoring of undesirable behaviors within the firm, such as insider trading. Below we provide an excerpt showing policymakers' emphasis on the role that top executives play in establishing the corporate culture in their company and an example of an auditor's assessment[2] of a firm's weak "tone-at-the-top":

The board and senior management, consistently within their specific roles and responsibilities, promote through behaviours, actions and words, a risk culture that expects integrity. [...] Senior management is subject to the same expectations for integrity [...] as all other employees. [...] An environment that promotes integrity should be created across the institution as a whole.

(Financial Stability Board (2014))

Senior management did not establish and maintain a proper tone as to internal control over financial reporting. Specifically, senior management did not emphasize, through consistent communication, the importance of internal control over financial reporting and adherence to the code of business conduct and ethics.

(Bearingpoint Inc., Form 10-K, 1/31/2006)

We predict that a weak "tone-at-the-top" translates into a weak ethical climate, and vice-versa. Our understanding of ethical climate is, consistent with Guiso et al. (2015) and Bushman et al. (2015), as the system of shared values that define [][]appropriate attitudes and behaviors for organizational members (O'Reilly and Chatman (1996)). We also follow Hodgson (1996) in assuming that the ethical climate of the firm is able to influence the behavior of individuals and induce them to internalize a set of norms, as opposed to the view of Kreps (1990) where culture is simply seen as the reputation that an organization has built over time.

A very recent strand of literature examines the role played by executives in the way that norms disseminate within their organization. For example, Bushman et al. (2015) finds that CEOs drive the corporate culture in banks and documents that employees in banks with materialistic CEOs (as evidenced by managers' ownership of luxury goods) have a higher likelihood to exploit insider trading opportunities relative to executives at banks with frugal CEOs. Materialistic executives promote a loose control environment with high probabilities of other insiders perpetrading fraud during their tenure (Davidson et al. (2015)). Finally, purchases performed by non-CEOs are

[2] SOX 404 requires auditors to assess managerial integrity if the actions of management promote an unethical work environment. Excerpt from Skaife et al. (2013).

more profitable in firms run by materialistic managers than in firms run by frugal managers (Davidson et al. (2014)).

We propose that the ethical climate promoted and disseminated throughout the organization differs with the gender of the executives. Men and women differ in their decision making. Firms with female executives make different acquisition decisions compared to firms with male executives, and investors react more favorably to corporate decisions made by companies with female CEOs and CFOs (Huang and Kisgen (2013)). A recent article in *Financial Times* suggests that hedge funds with female executives differ in their portfolios and performance from funds managed by men.[3] Recent studies have also identified differences in the trading patterns of male and female insiders: survey evidence shows that more men than women state that they would be likely to engage in unethical trading (Terpstra et al. (1993)), which may explain the finding that women insiders earn significantly lower returns on their trades than men (Bharath et al. (2009); Hillier et al. (2014)).

These results are in line with results from the business ethics literature suggesting that women tend to be more ethical in business across a range of practices, including being more critical of ethical issues, less loyal to the company in questionable situations, and show a greater concern for environmental issues and human wellbeing (Ford and Richardson (1994); Craft (2013)). Further, in a study of the impact of gender variation in pension investment options, Cesarini et al. (2010) finds that the only significant difference between men and women's financial decisions is that women are more prone to opt for "ethical" funds[4]. These empirical findings suggest that the executive's gender may affect the way in which corporate culture disseminates throughout the organization, influencing employees' opportunistic behavior.

The "tone-at-the-top" significantly improves with the presence of females in the board of directors. For example, Abbott et al. (2012) finds that the presence of at least one female board member is associated with a decline in the number of financial restatements facilitated by an improvement in the "tone-at-the-top". Increased board gender diversity is associated with greater transparency for shareholders through better accounting practices (Krishnan and Parsons (2008); Barua et al. (2010); Habib and Hossain (2013); Francis et al. (2015); Abbott et al. (2012)).[5] Gender-diverse boards allocate more efforts to oversight and monitoring by promoting better board attendance and demanding greater accountability from managers for poor performance, and female directors are more likely to take up monitoring positions on audit and corporate governance committees (Adams and Ferreira (2009)). Moreover, Gul et al. (2011) shows that board diversity improves stock price informativeness via better managerial monitoring. Companies with more women in senior management positions are moreprofitable and enjoy higher returns over a longer time period (Krishnan and Parsons (2008)).

Top management behavior exerts a significant influence on their employees' behavior (Jong and Hartog (2007); Starke (2012)). Consistent with this idea, Skaife et al. (2013) finds a link between a weak "tone-at-the-top" and insider trading profitability within the firm.

In light of these empirical findings, we propose that firms with female executives have a different ethical climate than firms with male executives. Given the documented higher concerns regarding ethical issues among women than men in business, we expect that top female executives set a stronger "tone-at-the-top" that translates into a sound ethical corporate environment. We expect that these values "leak" throughout the organization and discourage opportunistic behavior

[3] Put women at the top and lift hedge funds higher, *Financial Times*, September 17, 2015.

[4] The authors define an "ethical" fund as one that either uses this word in its title or one with a self-described investment strategy favoring environmental-friendly companies or avoiding investment in tobacco, alcohol, and the arms industry.

[5] For a recent review of the effect of gender differences on the level of ethics in business, see Craft (2013).

among employees. Specifically, we predict that firm-wide insider trading profitability decreases following the appointment of a female CEO or CFO.

Given the relatively small representation of women in top positions in our sample, our prediction that the trades of insiders in firms with female executives earn lower profits may be puzzling. There are several potential explanations for the low number of women in top positions (Huang and Kisgen (2013)). It may be that women and men perform better across different dimensions of shareholder value creation; that is, finding that are more prone to monitor and change the opportunistic behavior of the employees does not challenge the idea that male executives make better decisions for the firm along other shareholder value creation dimensions.

It may also be that female executives may be discriminated against - that is, they may not be hired by discriminating firms, despite the higher cost of discrimination (Becker (1971)). Those women who are able to overcome discriminatory preferences and be hired therefore perform better. Regardless of which of these theories explains the low representations of women Regardless of which of these theories explains the low representation of women and the different "tone-at-the-top" they promote, we believe that examining whether they exert a distinct effect compared to male executives on firm-wide opportunistic behavior is an issue of great interest for policymakers, for the corporate environment and for academic research likewise.

3.2.2 Insider trading as rent extraction from shareholders

The trading behavior of insiders has received substantial attention both from regulators and from academic literature in accounting and finance. Extant studies have consistently found that insiders are better informed and earn abnormal returns (Rozeff and Zaman (1988); Seyhun (1988)) and therefore have the potential to undertake actions that are detrimental to shareholders and investors. Specifically, previous studies have identified two channels through which insider trading crowds out outside investors. First, insider trading limits the gains from stock research and makes it less profitable for outside investors (Fernandes and Ferreira (2009)). Second, insider trading opportunities motivate insiders to disclose low-quality information to outsiders in order to increase their own informational advantage and their trading profits, despite the higher cost of capital and lower stock prices for the firm implied by their trading behavior (Zhang and Zhang (2012)).

Regulators in many countries have imposed restrictions on insider trading in order to decrease the effect of the asymmetry of information between insiders and outsiders. The Securities and Exchange Act of 1934, and the amendments made to the Act via the Sarbanes-Oxley (SOX) Act of 2002, require insiders' trades to be publicly disclosed via the filing of Form 4 to the SEC within two business days.[6] Firms seem to support regulators' efforts and often adopt self-imposed insider trading restrictions[7] (Bettis et al. (2000); Jagolinzer et al. (2011)). These efforts have not eliminated insiders' use of their informational advantage, as trades based on information already impounded in share prices should lead to the average profitability being zero. Research continuously documents that insider trades gain positive risk-adjusted returns over the 180 days following the transaction (Seyhun (1986); Lakonishok and Lee (2001); Jagolinzer et al. (2011)), suggesting that insiders use their informational advantage by trading on private information.

[6] Insiders are under the Act defined as directors, officers, and principal stock- holders with a stake of 10 percent or more. Prior to SOX, the requirement to disclose trades by insiders was by the end of the month in which the trading occurred (Brochet (2010)).

[7] Firm-imposed insider trading restrictions are justified by the costs it carries to the organization by increasing asymmetries of information, which leads to higher bid-ask spreads, lower liquidity in the market for the company's shares, and a higher discount rate (Bettis et al. (2000)).

Requirements regarding gender quotas on board of directors are an issue of increasing interest for regulators worldwide.[8] However, the mixed results of studies examining the effect of mandatory quotas on corporate decisions may explain the heterogeneity in countries regulation regarding gender quotas. For example, Ahern and Dittmar (2012) documents a negative relation between firm value and the increase in the percentage of women due to gender quotas in Norway. With these discussions underway, it is important to investigate what impact such requirements may have on corporate policies. Our setting is based on a non-quota environment where increases in female executive directors happen voluntarily. This should reduce any potential bias introduced by situations where there are quotas and the selection of women and men may be based on different merits.

3.3 Sample and measurement choice

In order to explore the gender effect on insider trading behavior, we compare the trading behavior of insiders in a firm before and after a switch to a female CEO or CFO. We use the annual cumulated trading profitability of all insiders within the firm as a measure of insider trading.

3.3.1 Sample data

The accounting information used in this study is obtained from Compustat yearly database. We use open-market transactions between 2003-2011 from Thomson Financial Insider Filings and additionally employ information for daily share prices and returns from Center for Research in Security Prices (CRSP). Our choice sample period is post-Sarbanes-Oxley (SOX) Act of 2002, which imposed stricter disclosure requirements for insider trades. We compile our executive gender data from ExecuComp and Institutional Shareholder Services (ISS). As in Huang and Kisgen (2013), we focus both on CEO and CFO transitions in order to increase the sample size, as it would otherwise be too small to allow for a meaningful analysis. Subsequent tests are based, unless otherwise specified, on a final sample of 86 male-to-female transitions and 1276 male-to-male transitions over the period 2003-2011.

3.3.2 Insider trading measures

Our measure of insider trading is supported by the notion that insider trades do not necessarily reflect private information. Only trades based on private information earn profits in an efficient market. In order to distinguish between informed trades and trades made in order to meet insiders' liquidity needs, we follow Jagolinzer et al. (2011) and compute insider trading profitability. For every trading day, we net the transactions of all insiders at the firm in terms of the number of traded shares to arrive at the daily firm-wide net transaction and identify whether this is a purchase or a sale. We estimate the following four-factor Fama and French (1993) and Carhart (1997) model over the 180 days following each transaction:

[8] Legal quotas for female directors are already being enforced in Norway, Belgium, Iceland, Italy, the Netherlands and Spain. France will enforce a 40% quota in 2016 and, in Germany, there will be a vote on a draft law introducing a requirement for at lest 30% women on companies' boards from 2016 (**Nienaber, 2014**).

$$R_i - R_f = \alpha + \beta_1(R_m - R_f) + \beta_2 SMB + \beta_3 HML + \beta_4 UMD + \varepsilon \tag{3.1}$$

where R_i is firm's i daily return, R_f is the daily risk-free interest rate, R_m is the CRSP value-weighted market return, and *SMB*, *HML* and *UMD* are the Size, Book-to-Market and Momentum factors from the four-factor Fama & French (1997) and Carhart (1997) model. The proxy for insider trading obtained from the above model, *TradingProfit*, is given by the average daily risk-adjusted returns as measured by the intercept α. A positive α for insider purchases would indicate that trades earn an average positive return over the following 180 days, i.e. are profitable. Conversely sales are profitable in instances of a negative α.[9]

The insider trading measure we use for our tests, *Annual average trading profitability*, is given by the firm-wide mean trade day profitability for the year.

3.3.3 Identifying CEO/CFO switches

For identifying male to female CEO and CFO switches, we collect the name, gender, and rank of the executive for all firms from ExecuComp and ISS. For obtaining our main sample, we exclude financial firms (Standard Industrial Classification between 6000 and 6999) and impose the condition that the predecessor executive is a male (that is, our treatment sample solely consists of male-to-female CEO and CFO turnover and our control sample consists of male-to-male CEO and CFO turnover). We require that any new executive holds that position for a minimum of two consecutive years transition year included), to insure enough time for a managerial effect within the firm. We also require that before any switch there is as a minimum one year of financial data available. This matching procedure identifies 86 cases of male-to-female CEO and CFO turnover and 1276 cases of male-to-male executive turnover.

3.3.4 Descriptive statistics

Table 3.1 and 3.2 present summary statistics. Table 3.1, Panel A indicates a more homogenous preference between hiring male and female executives in the latest years, with a slight preference for female executives: in the first 3 years of our sample 25,58% of the total changes to female executives and almost 33% of the switches to male executives took place, while a higher 28% of the switches to female executives and a significantly lower 26,65% of the switches to men executives are concentrated in the last 3 years of the sample. Panel B presents the distribution of executive switches by industry. Similar to Huang and Kisgen (2013), we find that women are more highly represented in consumer products firms, followed by companies in the health, manufacture, and utilities industries.

[Insert Table 3.1 about here]

[9] Appendix B presents an illustrative example of the steps taken in order to compute TradingProfit (e.g., α from the four-factor model above).

Table 3.2 presents summary statistics of the main variables employed for our main tests for all the years of data before and after an executive transition from a male to either a male or a female CEO or CFO. For either type of switch, a decrease in the median and mean insider trading profitability can be observed after the executive switch. Interestingly, firms that choose to hire a female executive record more profitable trades by insiders in the years preceding the executive transition than their male-to-male counterparts, but reach to similar insider trading profitability values as the male-to-male firms in the years after the switch. These values are consistent with a relatively stronger "tone-at-the-top" of female executives compared to male executives, but they suggest that our research design must take into account the fact that firms that choose to hire female or male executives may differ in their decision because they are different across other dimensions as well. In the following section we present the methods we employ to control for this possibility.

[Insert Table 3.2 about here]

3.4 Research design

In order to study the effect of female executives on insider trading behavior at firm level we take the following steps.

We start by studying the effect of the CEO or CFO gender on the daily profitability of insider trading. However, female executives may not be randomly assigned to firms. While the gender of an executive could be considered random, boards could discriminate based on gender, or women may self-select into certain types of firms (Huang and Kisgen (2013)). If firms discriminate based on gender, then our results could be driven by the firm characteristics that are associated with discriminatory behavior. In order to correct for such potential endogeneity issues, we additionally use a difference-in-difference, a propensity score matching and an instrumental variable framework.

Moreover, in order to investigate whether our inferences are drawn by unobservable characteristics of firms that hire women rather than by the gender of the executive, we examine the effect of gender on the measure of insider trading profitability on a subsample of firms that choose to hire back a man as a CEO or CFO after the male-to-female switch. Finally, the last step of our analysis aims to identify the channel through which the analyzed effect takes place.

3.4.1 Average daily insider trading profitability and executive gender

Our first test investigates the average daily trade profitability of firms with a female CEO or CFO as compared to that of firms with a male CEO or CFO. For this test we use the entire sample of executives switches (i.e., male-to-male, male-to-female, female-to-female and female-to-male). We exclude financial firms and require that any new executive holds that position for a minimum of two consecutive years (transition year included), and that before any switch there is minimum one year of financial data available. We keep three years before and after each executive switch, excluding the transition year. *TradingProfit* is the average daily risk-adjusted return estimated over the 180 days following each trading day (i.e., α stored from the four-factor Fama-French and Carhart model), as outlined in section 3.2 and *Appendix B*. This measure of insider trading is regressed on the gender of both the CEO and CFO in our combined sample, as well as separately.

We control for the market value, book to market ratio and return on assets. Our coefficient of interest is β_1, and we predict that it is negative and significant.

$$TradingProfit_{i,t} = \alpha + \beta_1 Exec\_Female_{i,t} + \beta_2 Controls_{i,t} + \varepsilon_{i,t} \tag{3.2}$$

Female executives may not be randomly assigned to firms. While the gender of an executive could be considered random, boards could discriminate based on gender, or women may self-select into certain types of firms (Huang and Kisgen (2013)). If firms discriminate based on gender, then our results could be driven by the firm characteristics that are associated with discriminatory behavior. In order to correct for this potential endogeneity issues, we additionally use a difference-in-difference and a propensity score matching framework.

3.4.2 Insider trading and male to female CEO/CFO switches

We test the effect of male-to-female CEO/CFO turnover using three different approaches. Each of them is described into detail below.

3.4.2.1 Insider trading profitability and male-to-female switches

First, we examine how insiders' trading behavior changes in the period following a male-to-female CEO/CFO turnover. For this analysis we use only the male-to-female firm-years. The empirical model is as follows:

$$Profitability_{i,t+1} = \mu + \beta_1 Post_{i,t+1} + \beta_2 Controls_{i,t} + \gamma_i + \tau_t + \varepsilon_{i,t} \tag{3.3}$$

where $Profitability_{i,t+1}$ is our measure for insider trading measured at the end of year *t+1*, γ_i are industry fixed effects, τ_t are time fixed effects and the other variables are as described in Appendix A. Our coefficient of interest is β_1, and we predict that it is negative and significant.

3.4.2.2 Difference-in-difference approach

In order to remove the effect of other potential time series changes within the firm contemporaneous to the CEO or CFO turnovers, similar to Francis et al. (2015) and Huang and Kisgen (2013), we employ a difference-in-differences approach. This framework allows us to compare insider trading behavior before and after male-to-female CEO or CFO turnover with a control sample of male-to-male CEO or CFO turnover. Compared to a simple panel data with fixed effects approach, the difference-in-difference has a series of benefits (Huang and Kisgen (2013)). First, to ensure that the executive has sufficient time to make an impact on corporate policy, he or she is required to be in the position for a minimum period of two years. Second, we condition all tests on the occurrence of any type of CEO or CFO turnover. Specifically,

the controls for our female-to-male CEO or CFO turnover firms are a sample of male-to-male CEO or CFO turnover firms. Third, the difference-in-differences approach allows us to control for time-invariant unobservable firm effects by comparing the insider trading behavior after a male-to-female CEO/CFO turnover with that before the switch.

We keep three years before and after each executive switch, excluding the transition year. As suggested in Huang and Kisgen (2013), we require minimum two years of data before the executive turnover event. Our main regression is the following:

$$Profitability_{i,t+1} = \mu + \beta_1 Post_{i,t+1} + \beta_2 Post_{i,t+1} * Female_i + \beta_3 Controls_{i,t} + \nu_i + \tau_t + \varepsilon_{i,t} \quad (3.4)$$

where $Profitability_{i,t+1}$ is our measure for insider trading measured at the end of year *t+1*, ν_i are firm fixed effects, τ_t are time fixed effects and the rest of the variables are as described in *Appendix A*. Our coefficient of interest is β_2, and we predict that it is negative and significant.

3.4.2.3 Propensity score matching approach

The propensity score matching approach uses a matched-pair research design that matches a treatment firm with a control firm that is similar across a series of relevant variables. This setting allows us to compare changes in insider trading behavior between firms that experience a male-to-female CEO or CFO turnover event and firms that are similar to the treated firms across a set of relevant observable characteristics, but encounter a male-to-male CEO or CFO turnover event instead.

We estimate a probit propensity-score model, which is the probability that an executive is a female (i.e., the treatment) conditional on observable features of the firm's environment. We follow Huang and Kisgen (2013) and Francis et al. (2015) in choosing the variables that predict the likelihood of having a female CEO or CFO, namely, profitability, size, market-to-book (all of which are included with a one-year lag), year and industry, and a CEO indicator variable. The fitted values of the probit model represent the propensity scores. We select the match for a treatment firm as a firm that encounters a male-to-male CEO or CFO turnover event in the same year, and is the closest to the treatment firm in terms of propensity scores; the set of obtained matched are referred to as the propensity score matching control group[10]. We then estimate the following regression on the matched sample to examine the gender differences in insider trading:

$$Profitability_{i,t+1} = \mu + \beta_1 Female_i + \beta_2 Controls_{i,t} + \nu_i + \tau_t + \varepsilon_{i,t} \quad (3.5)$$

Our coefficient of interest is β_1, and we predict that it is negative and significant.

[10] More details of the propensity score matching methodology are provided in *Appendix B*.

3.4.3 Instrumental variable approach

In order to rule out any alternate explanation of other unobserved changes in a firm's preference for executives' gender, we also use an instrumental variable approach. The instrument we use is a gender equality index developed by Sugarman and Straus (1988) that measures the extent to which a U.S. state is friendly to gender equality. We use the more recent values of the index calculated in a subsequent study by Di Noia (2002). We expect that the higher the level of gender status equality is in a state, the higher the likelihood for a firm situated in that state to hire a female executive (Huang and Kisgen (2013)). Additionally, since there are no obvious reasons why this index would explain insider trading profitability, it is a good candidate for an instrument.

Based on its headquarters location, we identify the corresponding value of the gender equality index for each firm in the entire sample of executives switches (i.e., male-to-male, male-to-female, female-to-female and female-to-male). As before, we exclude financial firms and require that any new executive holds that position for a minimum of two consecutive years (transition year included), and that before any switch there is minimum one year of financial data available. We keep three years before and after each executive switch, excluding the transition year.

We then estimate the following two-stage least squares (2SLS) model:

$$\begin{aligned}(I) &: Female_i = \varphi + \rho GenderEqIndex_i + \theta Controls_{i,t} + \tau_t + \xi_{1,i,t} \\ (II) &: Profitability_{i,t} = \mu + \beta InstrumentedFemale_i +_{i,t} + \tau_t + \xi_{2,i,t}\end{aligned} \tag{3.6}$$

where $Profitability_{i,t}$ is our measure for insider trading measured at the end of year t, $Female_i$ is an indicator variable that equals 1 if the firm switches to a female executive and 0 otherwise, and $InstrumentedFemale_i$ is the fitted value of the female indicator from the first-stage regression. Our coefficient of interest is β, and we predict that it is negative and significant.

3.4.4 Insider trading profitability in reversal firms

One final alternative explanation for our result is that it is caused by unobservable changes in corporate governance within the firm that coincide with the switch to a female executive. We conjecture that changes in corporate governance views of the firm are relatively infrequent over a 9-years long sample. We study the impact of executive gender on that subsample of the 86 male-to-female firms that, after hiring a female executive, switch back to a male executive. We call these firms *reversal firms*. Finding that insider trading profitability increases following a switch back to a male CEO or CFO would support the prediction that the effect studied in this paper is consistent with gender differences in the "tone-at-the-top" that reflect into insiders' trading incentives.

We estimate the following regression on the subsample of reversal firms:

$$Profitability_{i,t+1} = \mu + \beta_1 Post_{i,t+1} + \beta_2 Controls_{i,t} + \tau_t + \varepsilon_{i,t} \tag{3.7}$$

Our coefficient of interest is β_1, and we predict that it is negative and significant.

3.4.5 Alternative channels

After examining the effect of the gender of the executive on insider trading profitability, we aim to identify the mechanism through which this effect takes place. We conjecture that there will be more profitable insider trading in firms where the manager exerts a relatively poorer "tone-at-the-top", manifested into less opportunistic behaviors within the firm.

In this section, we study whether the effect of the executives' gender on insider trading comes as a consequence of differences in the "tone-at-the-top" exerted by male and female executives, or as a consequence of male and female executives implementing within the firm distinct mechanisms that affect insiders' incentives to trade.

The first channel we analyze is financial reporting quality. Previous studies have found that insider trading yields higher returns in firms with more information asymmetries and lower reporting quality (Aboody et al. (2005); Frankel and Li (2004); Huddart and Ke (2007)). Therefore, we examine whether the effect we study is a consequence of a change in the financial reporting quality of the firm following a male-to-female CEO or CFO switch, that translates into lower profits that can be extracted from insider trading. Our proxy for financial reporting quality is earnings management as measured by the Lagged Jones model.

The second channel we study is the extent to which the firm itself imposes restrictions on insider trading. A large number of firms choose to impose blackout periods, when trades by insiders are not permitted before important events for the firm (for example, earnings announcements). Roulstone (2003) finds that blackout periods are imposed in the last two thirds of the period between two consecutive quarterly earnings announcements. Since the extent to which firms restrict insider trading internally is not directly observable, we follow Roulstone (2003) in using the observable effect of timing policies to build a measure for insider trading restrictions. Bettis et al. (2000) shows that trading during restricted periods is approximately three times less likely than during allowed trading windows. Therefore, the higher the percentage of trades executed in the short period of allowed trading window (i.e., on average during the last 30 days after the earnings announcements), the more restricted insider trading is considered to be within the firm[11]. We examine whether female executives adopt such restrictions within the firm after being hired, and whether this measure reflects itself into less profitable transactions by insiders.

As in Gul et al. (2011), we examine how each of these channels affects the relation between gender executive and insider trading in two stages. First, we study the effect of female executives on the discretionary accruals and on the insider trading restriction measure, respectively. Second, we examine the change in insider trading profitability following a male-to-female executive switch in a research setting where we include an additional control for each channel separately. Specifically, we estimate the following regressions on the sample of male-to-female executive switches:

$$X_{i,t} = \mu + \beta_1 Post_{i,t+1} + \beta_2 Controls_{i,t} + \gamma_i + \tau_t + \varepsilon_{i,t} \tag{3.8}$$

$$Profitability_{i,t+1} = \mu + \beta_1 Post_{i,t+1} + \beta_2 Controls_{i,t} + \beta_3 X_{i,t} + \gamma_i + \tau_t + \varepsilon_{i,t} \tag{3.9}$$

where $X_{i,t}$ is either the measure of discretionary accruals or of insider trading restrictions and the other variables are as previously described. Together, these tests are insightful as to the mechanism through which executive gender affects insider trading.

[11] Details about the computation of the insider trading restriction proxy are presented in *Appendix D.*

3.5 Empirical results

3.5.1 Insider trading and female executives

[Insert Table 3.3 about here]

Table 3.3 reports the average parameters for the transaction-day specific regressions. If trading is based on private information we expect profitability to be positive and significant. Consistent with this, we find that for net purchase trades and net sales trades combined, the profitability of trades is positive and significant. However, in contrast to prior research (Lakonishok and Lee (2001); Jagolinzer et al. (2011)), we find that these results are driven by net sales transactions and that net purchase transactions incur a significant negative risk-adjusted profitability.

The results for the estimation of *Eq. (3.2)* are presented in Table 3.4. If the gender of the CEO and CFO matters for firm wide insider trading profitability, we would expect to see a significant coefficient for the variable *Exec_Female*. Consistent with the proposition that women in key positions such as CEO and CFO impose more ethical trading behavior within their firm, we document a significant negative coefficient for *Exec_Female* on the combined CEO and CFO sample; however, results seem to be driven by the CEO sample. Insider trades are significantly less profitable when there is a woman CEO or CFO, and the results are robust to the inclusion of control variables.

[Insert Table 3.4 about here]

3.5.2 Insider trading profitability and male-to-female CEO/CFO turnover

Table 3.5 presents the results on the effect of male-to-female CEO/CFO turnover on *Annual Average Trading Profitability.* In Column 1, we include *Post* as the only independent variable, in Column 2 we add the control variables, and in Column 3 we include industry and year effects.

[Insert Table 3.5 about here]

The coefficient of *Post* is negative across all specifications, suggesting that, on average, the profitability of trades made by insiders decreases in the period following a male-to-female CEO/CFO turnover. The significance of the coefficient is consistent across all specifications.

3.5.3 Difference in difference analysis

The results for the regression in *Eq. (3.3)* are presented in Table 3.6, Panel A. The dependent variable is the *Annual Average Trading Profitability* measure. In the first column we report results of tests with year and industry fixed effects, while in the second column industry fixed effects are replaced by firm fixed effects.

[Insert Table 3.6 about here]

Consistent with our prediction, the negative and significant coefficient of the interaction term *Female x Post* in Column 2 suggests that under female executives, the profitability of insiders decreases by 0.12 percentage points.

3.5.4 Propensity score matched samples

Panel B in Table 3.6 reports the results using propensity score matching. The negative and significant coefficient of *Female* suggests that under female executives, insiders' trading profitability decreases.

3.5.5 Instrumental variable approach

Column 1 of Table 3.7, Panel A presents the results from the first-stage ordinary least squares regressions of the instrumental variable estimation. The coefficient of the gender equality index in this first-stage is highly significant, suggesting a strong relation between the likelihood of a firm appointing a female executive and the extent to which a state is friendly toward gender equality. The *F-statistic* from the first-stage estimation is 13.92, higher than the rule of thumb threshold of 10 of Stock and Yogo (2005) for strong instruments.

[Insert Table 3.7 about here]

The second column reports the results of the second-stage OLS estimation. The negative and significant coefficient of the instrumented variable supports our main prediction that firms with female executives have lower levels of insider trading profitability.

3.5.6 Reversal firms

Out of the 86 firms that switch from a male to a female executive, 24 firms switch back to a male throughout our sample period. Results from estimating *Eq. (3.7)* are presented in Table 3.7, Panel B. Column 2 differs from column 1 in that it includes a set of controls.

Compared to the case of firms that change from a male to a female executive, firms that switch back to male record a reversal in the effect of executive gender on insider trading profitability,

as captured by the significantly positive coefficient of *Post*. This result is consistent with the idea that the gender of the executives influences the documented change in the trading behavior of insiders following an executive switch.

3.5.7 Alternative channels

Table 3.8 presents the results regarding how the documented relation between insider trading profitability and executive gender may be explained by two potential alternative channels: financial reporting quality (results presented in the first two columns of the table) and insider trading restrictions (results presented in columns 3 and 4).

[Insert Table 3.8 about here]

Columns 1 and 3 present the results of estimating the effect of female executives on the discretionary accruals and on the insider trading restriction measure, respectively. Columns 2 and 4 present results of how the change in insider trading profitability following a male-to-female executive switch in a research setting where we include an additional control for each channel separately. The presence of female executives does not seem to significantly affect neither the level of discretionary accruals nor the insider trading restrictions; more importantly, even after controlling for the effect of financial reporting quality and insider trading restrictions, the profitability of insiders' trades decreases following a switch to a female executive. The implication of these findings is that the gender of the executives affects insiders' trading behavior not by improving the financial reporting quality or imposing higher trading restrictions, but by exerting a relatively stronger tone-at-the-top.

3.6 Summary and conclusion

In this paper we document that CEOs' and CFOs' gender affects the trading behavior of insiders. Specifically, we examine whether the profitability of firm wide insider trading changes with the appointment of a female CEO or a female CFO. We find compelling evidence that firm-wide insider trading profitability decreases where a firm appoints a female CEO or CFO. This result is consistent with prior evidence that women set a relatively stronger tone-at-the-top than men, and that the ethical tone set at the top disseminates throughout the firm, mitigating insiders' incentives to trade opportunistically.

We perform a series of additional tests to rule out alternative explanations that are consistent with our findings, and the evidence is suggestive of a tone-at-the-top effect. Regardless of the mechanism driving the results, the empirical findings document key differences between the opportunistic behavior of insiders in firms with male and female executives. These results are relevant for regulators in the context of the discussions regarding mandatory board gender representation quotas, as well for empirical research, given that by explaining firms' heterogeneity solely by firm characteristics one may miss individual attributes, like gender, as important determinants of these differences.

3.6 Appendix A. Variable definitions

Book-to-market: firms book value divided by the market value of common equity at the end of the fiscal year.
Exec_Female: an indicator variable taking the value 1 if a firm has a female and 0 if it has a male executive.
Female: an indicator variable for whether the firm is a male-to-female transition firm. (note: this definition applies for the main sample of our study, i.e., the one comprised of only male-to-male and male-to-female transition firms. For tests using the extended sample consisting of all types of executive switches, Female is an indicator variable taking value 1 when a firm has switched to a female executive (i.e., from male-to-female or female-to-female) and 0 if it has switched to a male executive(i.e., from male-to-male or female-to-male).
Financial reporting quality: as a proxy for financial reporting quality we use discretionary accruals as measured by the Lagged Jones model developed by Dechow et al. (2003). The proxy for discretionary accruals is given by the residuals from the following regression:

$$\frac{TA_{i,t}}{Assets_{i,t}} = \alpha + \beta_0 \frac{1}{Assets_{i,t-1}} + \beta_1 \frac{(1+k)\Delta Sales_{i,t} - \Delta Rec_{i,t}}{Assets_{i,t-1}} + \beta_2 \frac{PPE_{i,t}}{Assets_{i,t-1}} + \beta_3 TA_{i,t-1} + \beta_4 ROA_{i,t-1} + \beta_5 SG_{i,t-1} + \varepsilon_{i,t}$$

where k is the slope coefficient from a regression of ΔRec on $\Delta Sales$ for each two-digit SIC-year grouping and captures the expected change in accounts receivables for a given change in sales.
Market Equity: the share price at the end of the fiscal year times the number of shares outstanding.
Post: an indicator variable for whether the observation is after an executive transition.
ROA: income before extraordinary items scaled by total assets.
Size: the logarithm of market equity.

3.6 Appendix B. Example of the computation of risk-adjusted returns

What follows is an illustrative example of the steps we took for computing the profitability measure of insider trading. Let's assume that (all the) insiders of firm X trade in the following days throughout our sample period:

June 7, 2006: 5 shares bought and 8 shares sold
December 21, 2006: 3 shares bought and 2 shares sold
March 5, 2007: 8 shares bought and 9 shares sold

First, we compute the net number of shares traded by all insiders of firm X: that is, 3 shares sold on June 7, 2006; 1 share purchased on December 21 etc. Next, for each firm-transaction date, we use daily returns over the next 180 days to estimate separately the four-factor Fama and French (1993) and Carhart (1997) model below, and we retain the coefficients.

$$R_i - R_f = \alpha + \beta_1(R_m - R_f) + \beta_2 SMB + \beta_3 HML + \beta_4 UMD + \varepsilon$$

where R_i is firm's i daily return, R_f is the daily risk-free interest rate, R_m is the CRSP value-weighted market return, and *SMB*, *HML* and *UMD* are the Size, Book-to-market and Momentum factors from the four-factor Fama and French (1993) and Carhart (1997) model, obtained from Kenneth R. French's website:
http : *//mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html*. Therefore after this step we will have a database of 3 intercepts (alphas), 3 coefficients for the abnormal market returns factor, 3 coefficients for the SMB factor and so on. The same will happen in the case of all the other firms in our sample. Note that there may be repeated observations across dates (e.g., June 7, 2006 appears more than once because insiders at other firms trade as well in that day) and across firms (e.g., insiders at firm X trade in several dates). Hence, we cluster by firm and by transaction day in order to draw inferences on the average alpha value as reported in Table 3.3.

3.6 Appendix C. Propensity Score Matching

We use the propensity score matching methodology in order to construct a matched-control group of firms that are similar to treatment firms across a set of relevant observable firm characteristics. The steps of the analysis are as follows. We start with the complete dataset (86 treatment firms and 1276 non-treatment firms; we will select the control group out of the latter). We run a probit model within each fiscal year on lagged variables that are shown in the literature to predict the likelihood for a firm to have a female executive:

$$Prob(Treat = 1) = \frac{1}{1+e^{-\beta X}} \text{ where:}$$

$$\beta X = \alpha_0 + \alpha_1 ROA + \alpha_2 Size + \alpha_3 BTM + \alpha_4 CEO + Year + Industry + \varepsilon$$

Treat=1 if a firm is in the treatment group (e.g., if it had a male-to-female CEO or CFO transition) and all explanatory variables are one-year lagged, except for CEO. All variables are described in *Appendix A*.

We base our choice of the variables to include in the probit model on Huang & Kisgen (2013) who examine the characteristics that make it more likely for a firm to change their CEO or CFO from male to female.
We store the fitted values of the probit model; they represent the propensity scores or the probabilities that a firm receives the treatment, given the set of independent variables. A high $R-squared$ of the model shows that it successfully captures the relevant factors determining a firm to have a male-to-female CEO or CFO transition. Significant coefficients of the model show that the independent variables are relevant in a firm's decision to incur such a transition.
For every event-year in the treatment group we select the closest non-treatment firm in terms of propensity score that has a male-to-male CEO or CFO transition in the same year using the "nearest-neighbor" without replacement matching procedure. Our final sample is consisted of 50 pairs of treatment firms and 50 matched controls.

3.6 Appendix D. Insider trading restriction proxy

In order to compute our measure for insider trading restrictions, we use an approach similar to the one proposed by Roulstone (2003). We use earnings announcement dates are taken from Compustat Quarterly. Bettis et al. (2000) finds via surveys that firms allow insiders to trade only in the one-month period following an earnings announcements. Following this guidance, a trade is considered to be made during an allowed trading window if it occurs within the first third (approximately 20 trading days, 30 calendar days) of the period between two consecutive earnings announcements. Therefore the allowed trading window is considered to be the period closely following an earnings announcement (approximately the first third of the interval between two earnings announcements) and the "blackout period" is considered the window before an earnings announcement (approximately the last two thirds of the interval between two earnings announcements). A firm is considered to be more restricted the higher the percentage of trades placed during the period comprised between two earnings announcements take place during the allowed trading window.

For every year, the variable *PercentageSafe* is calculated as the percentage of shares traded during the allowed trading window over the total number of shares traded during the period between two consecutive earnings announcements. For simplicity, we compute *PercentageSafe* only during the last quarter of each fiscal year.

For firms with missing information about earnings announcement dates, we estimate *PercentageSafe* as follows. We regress *PercentageSafe* for firms with complete information on variables shown to be good predictors of firms insider trading restrictions: firm size, book to market and the ratio of number of annual shares bought to total shares trades by insiders of a firm as a measure of the intensity of insider trading activity within the firm (Roulstone (2003)). We then use the obtained fitted values to calculate the level of trades performed during the allowed trading window for firms with missing earnings announcement dates. Our insider trading restrictions proxy (ITR) is given by the values of *PercentageSafe*.

Table 3.1: Descriptive statistics

Panel A: Distribution of executives by gender and transition year

	Transition Year									
Gender	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
FEMALE	7	5	10	11	17	12	11	12	1	86
	8.14%	5.81%	11.63%	12.79%	19.77%	13.95%	12.79%	13.95%	1.16%	
MALE	117	147	157	153	180	182	188	147	5	1276
	9.17%	11.52%	12.30%	11.99%	14.11%	14.26%	14.73%	11.52%	0.39%	

Panel B: Distribution of executives by gender and industry affiliation

	Industry								
Gender	Consumer	Health	Manufacture	Utilities	Technology	Energy	Chemicals	Other	Total
FEMALE	23	14	12	6	5	4	3	19	86
	26.74%	16.28%	13.95%	6.98%	5.81%	4.65%	3.49%	22.09%	
MALE	240	330	188	102	36	58	62	260	1276
	18.81%	25.86%	14.73%	7.99%	2.82%	4.55%	4.86%	20.38%	

This table presents the distribution of the executives in our sample by gender, transition year and industry affiliations. The transition year is the first year that the executive shows up on the annual report. The industry affiliation is defined following Fama & French classification, available at: *http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.*

Table 3.2: Insider trading profitability, size, book-to-market, and profitability around executive transitions

Male-to-Male			*Before transition*			
	N	Mean	SD	Median	Min	Max
Annual Avg. Trading Profit	2383	0.0006	0.0082	0.0004	-0.0203	0.0200
Size	2382	7.7540	1.5334	7.6530	3.8379	11.3555
BTM	2382	0.4540	0.2998	0.3972	-0.0732	2.7895
ROA	2382	0.0467	0.0870	0.0532	-0.5457	0.1996
Male-to-Male			*After transition*			
	N	Mean	SD	Median	Min	Max
Annual Avg. Trading Profit	2256	-0.0001	0.0069	0.0000	-0.0203	0.0200
Size	2256	7.6962	1.5421	7.6087	3.8379	11.3555
BTM	2256	0.5210	0.3553	0.4675	-0.0732	2.7895
ROA	2256	0.0415	0.0931	0.0508	-0.5457	0.1996
Male-to-Female			*Before transition*			
	N	Mean	SD	Median	Min	Max
Annual Avg. Trading Profit	165	0.0024	0.0075	0.0016	-0.0192	0.0200
Size	165	7.9191	1.6334	7.6485	3.9811	11.3555
BTM	165	0.4583	0.3475	0.3912	-0.0732	2.7895
ROA	165	0.0596	0.0868	0.0653	-0.5457	0.1941
Male-to-Female			*After transition*			
	N	Mean	SD	Median	Min	Max
Annual Avg. Trading Profit	155	0.0000	0.0057	0.0000	-0.0186	0.0197
Size	155	7.8907	1.6933	7.8318	3.8379	11.3555
BTM	155	0.5433	0.3475	0.5134	-0.0097	2.6771
ROA	155	0.0506	0.0902	0.0541	-0.5260	0.1951

This table presents the descriptive statistics of insider trading, size, book-to-market and firm profitability by executive gender before and after the transition years. See *Appendix A* for the defitions of the variables. All variables are winsorised yearly at 2.5% level.

Table 3.3: Insider trading profits

	All trades	Purchase Trades	Sales Trades
$TradingProfit_{i,t}$	0.0007***	-0.0066***	0.0074***
	(4.4)	(-41.25)	(41.12)
α	-0.0072***	-0.0066***	-0.0074***
	(-44.68)	(-41.25)	(-41.12)
$(R_{mkt} - R_f)$	0.0144***	0.0105***	0.0104***
	(134.67)	(108.46)	(119.24)
SMB	0.0056*	0.0060***	0.0055***
	(33.17)	(28.82)	(29.37)
HML	0.0005***	0.0019***	0.0000
	(-2.82)	(10.75)	(0.15)
UMD	-0.0002**	-0.0012***	0.0001
	(-2.25)	(-10.2)	(1.03)
$Avg.AdjustedR^2$	36.53	36.63	36.49
N	163785	44765	119020

This table presents estimates of trade-specific profits $TradingProfit_{i,t}$ and coefficients from estimating transaction-day specific regressions of daily returns on common factors over the 180 days following each transaction: $(R_i - R_f) = \alpha + \beta_1(R_{mkt} - R_f) + \beta_2 SMB + \beta_3 HML + \beta_4 UMD + e$. R_i is the daily return to firm i's equity; R_f is the daily risk-free interest rate; R_{mkt} is the CRSP value-weighted market return; and SMB, HML, and UMD are the size, book-to-market, and momentum factors (Fama and French [1993], Carhart [1997]). $Avg.AdjustedR^2$ is presented in percentages. $TradingProfit_{i,t}$ is equal to α(-α) for purchases (sales).

Table 3.4: Female Executives and Daily Average Insider Trading Profitability

	CEO & CFO		*CEO*		*CFO*	
	(1)	(2)	(3)	(4)	(5)	(6)
Exec_Female	-	-	-	-	-0.0001	-0.0000
	0.0008***	0.0007***	0.0027***	0.0027***		
	(-2.96)	(-2.74)	(-5.46)	(-5.30)	(-0.34)	(-0.06)
Size		-		-0.0000		-
		0.0001***				0.0003***
		(-3.96)		(-0.26)		(-5.61)
BTM		-		-		-
		0.0023***		0.0010***		0.0042***
		(-16.20)		(-5.33)		(-17.87)
ROA		0.0032***		0.0061***		-0.0003
		(7.16)		(9.51)		(-0.41)
Constant	0.0021***	0.0042***	0.0021***	0.0023***	0.0023***	0.0065***
	(39.22)	(13.12)	(28.74)	(5.23)	(26.80)	(14.02)
N	40441	40432	23297	23288	17144	17144
$AdjustedR^2$	0.02	0.68	0.12	0.66	0.00	1.37

This table presents the regressions results of having a female executive on the daily average insider trading profitability measure. The test is based on the full panel of firms for the mixed CEO and CFO, only CEO, and only CFO samples respectively. $AdjustedR^2$ is presented in percentages. The numbers in parentheses are *t*-Statistics based on White standard errors. All variables are winsorised yearly at 2.5% level.

* Denote statistical significance at 10% level

** Denote statistical significance at 5% level

*** Denote statistical significance at 1% level.

Table 3.5: Female Executives and the Annual Average Trading Profitability of Insider Trading

	(1)	(2)	(3)
Post	-0.0020***	-0.0019**	-0.0029*
	(-2.62)	(-2.42)	(-1.75)
Size		-0.0003	-0.0002
		(-1.39)	(-0.27)
ROA		0.0033	0.0016
		(1.00)	(0.35)
BTM		-0.0013	-0.0013
		(-1.56)	(-0.86)
Constant	0.0019***	0.0050**	
	(13.08)	(2.29)	(-0.63)
Year effect	No	No	Yes
Industry effect	No	No	Yes
N	282	282	282
R^2	0.0246	0.0345	0.3709

This table presents regression results on how transition from male to female executives affects firm's insider trading profitability. Our sample for these tests consists of 282 firm-year observations from 86 male-to-female transitions between 2003 and 2011. The table reports how the male-to-female transitions affect the annual trading profitability of insider trading. See *Appendix A* for the definition of all the variables. The numbers in parentheses are *t*-Statistics based on White standard errors. All variables are winsorized yearly at 2.5% level.

* Denote statistical significance at 10% level

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*** Denote statistical significance at 1% level.

Table 3.6: Female Executives and Insider Trading Profitability

Panel A: Difference-in-difference regressions

	(1)	(2)
Post	-0.0006**	-0.0007**
	(-1.99)	(-2.26)
Female x Post	-0.0007	-0.0012**
	(-1.64)	(-2.04)
Size	-0.0001	-0.0008**
	(-1.29)	(-2.41)
ROA	0.0037***	0.0004
	(2.74)	(0.24)
BTM	0.0000	-0.0006
	(0.01)	(-0.99)
Constant	0.0025	0.0060**
	(0.78)	(2.17)
Year Effect	Yes	Yes
Industry Effect	Yes	No
Firm Fixed Effect	No	Yes
R^2	0.1502	0.4422
N	4347	4347
Panel B: Propensity Score Matching		
Female	-0.0021**	
	(-1.97)	
Size	-0.0007**	
	(-2.06)	
ROA	-0.0022*	
	(-1.93)	
BTM	0.0003	
	(0.08)	
Constant	0.0080**	
	(2.08)	
Year Effect	Yes	
Industry Effect	Yes	
R^2	0.3591	
N	501	

This table reports results on insider trading profitability using two specifications. Panel A presents difference-in-difference results from *Eq. (3.4)*, based on a sample of 86 male-to-female(treatment) and 1276 male-to-male (control) switches. Panel B reports results based on a propensity score matching approach, for which we used a sample of male-to-female and male-to-male matched control firms. The numbers in parentheses are *t-Statistics* based on White standard errors. All variables are winsorized yearly at 2.5% level

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*** Denote statistical significance at 1% level.

Table 3.7: Instrumental variable approach and Reversal firms

Panel A: Instrumental variable approach

	First stage	Second stage
Size	0.0003	-0.0001
	(0.09)	(-0.75)
ROA	0.1258***	0.0083***
	(3.18)	(5.32)
BTM	-0.0074	-0.0009**
	(-0.60)	(-2.47)
Gender Equality Index	0.2542***	
	(3.73)	
FemaleIV		-0.0137*
		(-1.65)
Constant	0.1057	0.0028
	(1.26)	(0.94)
Year Effect	Yes	Yes
Industry Effect	Yes	Yes
F-stat	13.92	
(p-value)	(0.0002)	
Anderson underident. test (χ^2)	16.01	
(p-value)	(0.0001)	
N	6676	6676

Panel B: Reversal firms

	(1)	(2)
Post	0.0034**	0.0031*
	(2.04)	(1.89)
Size		0.0001
		(0.36)
ROA		-0.0031
		(-0.33)
BTM		0.0014
		(1.11)
Constant	-0.0007	-0.0019
	(-1.05)	(-0.65)
Year Effect	Yes	Yes
R^2	0.0533	0.0600
N	124	124

This table reports results on insider trading profitability using two specifications. Panel A presents results of a 2SLS instrumental variable approach. Panel B reports results based on a subsample of 24 firms that switch back to a male executive following. The numbers in parentheses are *t-Statistics* based on White standard errors. All variables are winsorized yearly at 2.5% level

* Denote statistical significance at 10% level

** Denote statistical significance at 5% level

*** Denote statistical significance at 1% level.

Table 3.8: Alternative channels of the Gender-Insider trading relation: Earnings management and Insider trading restrictions

	Earnings management		*Insider trading restrictions*	
	(1)	(2)	(3)	(4)
Post	-0.0002	-0.0029*	0.0263	-0.0028*
	(-0.01)	(-1.92)	(0.44)	(-1.72)
Size	0.0044	-0.0003	0.0365	-0.0000
	(0.64)	(-0.59)	(1.36)	(-0.06)
ROA	0.2377**	0.0032	-0.3168	0.0020
	(1.99)	(0.67)	(-1.29)	(0.42)
BTM	-0.0349	-0.0013	0.0547	-0.0007
	(-1.35)	(-0.86)	(0.83)	(-0.46)
EM		0.0009		
		(0.14)		
ITR				-0.0039**
				(-2.10)
Constant	-0.1613**	0.0027	0.2492	0.0031
	(-2.16)	(0.60)	(0.83)	(0.64)
Year Effect	Yes	Yes	Yes	Yes
Industry Effect	Yes	Yes	Yes	Yes
R^2	0.4676	0.4008	0.3462	0.3860
N	214	271	219	281

This table presents results of two channels that may explain the documented relation between executive gender and insider trading. Columns (1) and (2) present how female executive influence earnings management, and what is the effect of switching to a female executive on insider trading profitability when including an additional control for financial reporting quality. Columns (3) and (4) present how female executive influence the adoption of insider trading restrictions, and what is the effect of switching to a female executive on insider trading profitability when including an additional control for insider trading restrictions. The numbers in parentheses are *t-Statistics* based on White standard errors. All variables are winsorized yearly at 2.5% level

* Denote statistical significance at 10% level

** Denote statistical significance at 5% level

*** Denote statistical significance at 1% level.

4

Insider Trading Restrictions and Earnings Management

4.1 Introduction

This study provides evidence that firm self-adopted insider trading restrictions are associated with a decrease in the level of earnings management. Because we cannot directly observe the extent to which a firm adopts such insider trading restrictions, we operationalize it by developing a measure based on the timing of trades by insiders for each firm with respect to two consecutive quarterly earnings announcements. We find that firms that are identified as adopters of insider trading restrictions (also referred to as blackout-periods) have a lower level of earnings manipulation in the subsequent quarters. Our findings are robust to different specifications that include controls for firm characteristics that are known to be associated with earnings management.

We predict that earnings management is negatively associated with a firm being an insider trading restrictions adopter. The basis for our prediction is the vast empirical literature that examines managerial incentives to manipulate earnings, and in particular, the association between characteristics of the firm's financial reporting environment and the extent to which managers extract rents from insider trading. This literature suggests, on the one hand, that insiders benefit from more opaque environments (Tang et al. (2012)), and on the other hand that such benefits may actually incentivize insiders to further manipulate earnings (Beneish and Vargus (2002)).

As investors gain access to relevant and reliable information about a company's prospects, this information asymmetry decreases, allowing investors to make informed decisions. Financial reporting represents one important source of information about the firm to investors: the higher the quality of financial reporting, the smaller the gap between insiders' and outsiders' level of information about the firm. The dimension of financial reporting quality that we focus on in this paper is accruals-based and real earnings management. We expect that insiders may manipulate earnings in order to enhance information asymmetries between themselves and outsiders. Therefore, if the firm adopts blackout periods that restrict insiders from trading, the incentives to manipulate earnings stemming from the potential to gain profits from trading with their own company's shares should be reduced after such restrictions become effective.

Previous studies have largely focused on the consequences of mandatory regulation intended to improve earnings management, and they document an unwanted substitution effect between reduced accruals management and increased real transaction management following such measures. We take a different approach from these studies and study a self-imposed, internal corporate governance mechanism of the firm, and show that it effectively reduces managerial incentives to manipulate earnings. We conceptualize that the decision to adopt insider trading restrictions represents a shock to insiders' incentives to trade. Moreover, in the case of those managers who also have discretionary power over financial reporting, we expect that such restrictions translate

into a shock to their incentives to manage earnings as well. Most importantly, we find that not only does accruals-based earnings management decrease following the adoption of insider trading restrictions, but the same happens with real transactions management, and as a result, with the overall level of earnings management.

Because the exact date when a firm has adopted blackout periods is hard to observe by the researcher, we compute our insider trading restrictions proxy based on observable trading patterns: the timing and the number of trades performed by insiders of the company. We categorize each trade performed during two consecutive earnings announcement dates either into the allowed trading window (i.e., the first third of the period between earnings announcements), or into the restricted trading window (i.e., the remaining two thirds of the same period). We identify the quarter when a firm imposed blackout periods as the quarter with the highest increase in the percentage of trades taking place in the allowed trading window, conditional on the firm consistently maintaining a high percentage of trades in the same window during all the following quarters.

We test the predicted relation between earnings management and insider trading restrictions using several approaches. We begin the analysis with a validity test for our identification procedure of the event-quarter when insider trading restriction became effective, and find that the volume of insider trading significantly decreases following these measures being adopted. In the first test, we focus on the full sample of insider trading restrictions adopters. After controlling for a series of firm characteristics that are shown in the literature to be associated with earnings management, we document a significant decrease in our measures of earnings management in the period following the adoption of blackout periods. For our second test, we use seemingly unrelated regressions, which permit for regression errors to be correlated across the accruals-based and the real earnings management equations. The results confirm our main finding.

In the third specification, we use propensity score matching to build a matched sample of adopters and non-adopters of blackout periods that are similar across a series of variables likely to predict the adoption of trading restrictions. Using a difference-in-differences approach, we find that trading windows adopters document a higher decrease in both accruals and real transaction management relative to their non-adopter peers. Overall, our results are consistent with firms enjoying lower levels of earnings manipulation following the adoption of blackout periods across all specifications.

Finally, we provide evidence that in the period following the trading windows adoption, firms enjoy lower cost of equity capital. This result provides insights about the dynamics of the complete process for companies that restrict trading windows: following the adoption of such measures, firms enjoy less noisy earnings information (via lower overall earnings manipulation), which translate into lower cost of capital for the firm.

We are aware of some potential limitations of this work. While it is the firm-imposed nature of the restrictions we study that allows us to identify a mechanism that successfully reduces earnings management, it is precisely the endogenous nature of this setting that leaves us with the endogeneity caveat. We control for a battery of corporate governance measures and use a difference-in differences approach in order to alleviate this concern, but despite these efforts we can't rule out the possibility that unobserved internal corporate governance mechanisms of the firm are (partly) responsible for our result.

This paper contributes to several strands of literature. First, we contribute to the earnings management research by identifying a mechanism that allows firms to enjoy lower levels of earnings manipulations: restricting insiders from trading outside an allowed trading window between two consecutive earnings announcement dates. Studies focusing on mandatory financial

reporting regulations systematically document that such measures come with increased overall measures of earnings management. Relative to these papers, the setting we study allows us to isolate a firm-imposed corporate governance mechanism that effectively reduces managerial incentives to manipulate total earnings.

Second, we contribute to the strand of insider trading literature that analyzes reasons for firms to impose their own trading restrictions. If informed trading is undesirable by shareholders or illegal, firms' interest in implementing insider trading restrictions would be justified. Prior work has extensively analyzed the opportunistic behavior of insiders, and most of these efforts have been concerned with the efficiency of mandatory regulation in place in preventing it. Despite the large number of firms imposing blackout periods, little is known about the benefits motivating firms to undertake such measures. Some economists argue that restrictions on insider trading impose costs on insiders and on the firms that contract with them (Manne (1966)). Others argue that restricting insider trading reduces the adverse selection problem in a firm's securities (Fishman and Hagerty (1992)), which manifests itself into cost of capital benefits for the firm. And finally, some others find that such restrictions are adopted for "window-dressing" rather than economical reasons, given that they are not effective unless supported by other corporate governance mechanisms (Jagolinzer et al. (2011)).

In order for firms to decide to impose restricted trading windows, the benefits must outweigh the costs of these measures. This study is among the first to document one reason that may explain firms' decision to restrict informed trades: we find that restrictions on corporate insiders' trades are associated with an improvement in the financial reporting quality as measured by the extent of earnings manipulations. This evidence is consistent with the idea that not only does restricting insider trading reduce the extent to which insiders can extract private benefits at the expense of less informed investors, but it also improves the ability of outside investors to make informed decisions about the firm by providing them with better financial information.

Finally, our paper contributes to the literature on the relation between insider trading and financial reporting quality. Extant studies do not reach an agreement regarding the causality direction between these two concepts. We examine this relation in the context of a firm-level shock to insiders' trading incentives. We document an increase in earnings quality after the restrictions become effective, consistent with the idea that one of the reasons for insiders to manipulate earnings is to extract higher rents from their trades.

The remaining of the paper is organized as follows. Section 2 sets the basis for our predictions and provides a literature review of relevant papers in the field. Section 3 presents the data and the proxies for our variables of interest. Section 4 explains our research design, Section 5 presents the results, and Section 6 concludes.

4.2 Basis for prediction and related research

We predict that earnings management decreases after the adoption of firm-level insider trading restrictions. There is an extensive literature showing that insider trading is more profitable the larger the asymmetry of information between insiders and outsiders. The asymmetry of information increases as accruals quality improves. Therefore, we expect that earnings management is negatively associated with the adoption of insider trading restrictions based on the following reasoning.

4.2.1 Insider trading incentives and earnings management

In order to allow financial reports to convey managers' information about their firm's performance, standards allow managers, who also fall under SEC's definition of a firm's insiders, a certain level of discretion in exercising judgment over financial reporting. Executives have the ability to choose the reporting measures, estimates and disclosures that provide the most informative image of the firm's underlying economics (Healy and Wahlen (1999)). However, it is precisely this managerial discretion that also creates opportunities for earnings manipulations, reducing the quality of the financial information available to outside investors.

Motives for earnings management have been largely studied in the accounting literature. For example, managers with higher stock and option-based compensation are more sensitive to stock prices changes, and therefore managers' choices of accounting practices may be influenced by their compensation incentives. Cheng and Warfield (2005) finds that managers with high equity incentives are more likely to engage in earnings management to increase the value of the shares to be sold; in this sense, managers with high equity incentives report earnings that meet or just beat analysts' forecasts. Teoh et al. (1998) provides evidence that issuers with unusually high accruals in the IPO year experience poor stock returns in the three years following the IPO, suggesting that earnings management may be used for window-dressing before public securities offerings.

Insiders face an agency problem. On the one hand, they are responsible for making decisions that maximize firm value and for designing disclosure policies that maximize the information available to outside investors. On the other hand, their private information creates an incentive to obtain profits via insider trading, and these profits increase with the extent of their information advantage.

Extant studies suggest that higher informativeness of insider trading is associated with lower financial reporting quality. Most papers consider firm's disclosures as exogenous and point towards insiders taking advantage of the quality and timing of these disclosures and of their access to private information to trade opportunistically (Aboody et al. (2005); Maffett (2012); Gu and Li (2012)). However, it is important to note that some insiders (i.e., managers) also have the power to affect the disclosure policy of their firm. This approach is proposed by papers like Beneish and Vargus (2002), Cheng and Lo (2006), Rogers (2008). Given that insider trading yields higher returns in firms with more information asymmetries and lower reporting quality (Aboody et al. (2005); Frankel and Li (2004); Huddart and Ke (2007)), insider trading opportunities may incentivize insiders to supply low quality information to outsiders with the purpose of increasing their own informational advantage over outsiders and extracting greater trading profits. Therefore, in addition to crowding out investors by limiting their gains from information acquisition, insider trading may incentivize insiders to adversely affect the quality of the information supplied to outside investors (Zhang and Zhang (2012)).

One paper that follows a similar reasoning pattern is Beneish and Vargus (2002), who finds evidence consistent with some managers inflating earnings in order to sell their firms' stocks at higher prices. Although the evidence they present only covers the abnormal insider selling subsample, they encourage future research to investigate whether it is particularly insider trading opportunities that provide an incentive for earnings management. Similarly, Cheng and Warfield (2005) finds that equity incentives lead to incentives for earnings management. Specifically, the study documents that managers with high equity incentives are motivated to engage in earnings management to increase the value of the shares to be sold in the future.

While most of the extant literature to date has focused on federal regulation of insider trading, few papers have focused on the efforts made by firms themselves make to prevent insiders from trading opportunistically. Bettis et al. (2000) finds that 92% of the companies in their sample allow their insiders to trade only during a short window following earnings announcements. Below is an excerpt from the document regulating trading by insiders from Netflix, INC:

The Company has determined that all officers, directors, and [those who fall under the description of an insider of the company[1]], shall be prohibited from buying, selling or otherwise effecting transactions in any stock or other securities of the Company or derivative securities thereof EXCEPT during the following trading window: Beginning at the open of market on the trading day following the date of public disclosure of the Company's financial results for a preceding calendar quarter or year and ending at the close of market on the 10th day of the second calendar month of the current calendar quarter (the "Open Window").

(Netflix, INC. Insider Trading Policy)

Most importantly, extant studies find that insider trading restrictions successfully suppress both purchases and sales performed by insiders (Bettis et al. (2000), Roulstone (2003)).

Based on the above discussion, we predict that the extent of earnings manipulations decreases in the quarters following the adoption of insider trading restrictions. If insiders are able to extract higher personal profits from trading after manipulating earnings, then part of the earnings management performed by the firm may be justified by such incentives. If that is the case, trading restrictions represent a shock to insiders' incentives to manipulate earnings, either via accruals-based or real earnings management. In order to study the causality direction of this relation, we analyze the effect that the event of adopting firm-level blackout periods has on financial reporting quality. Specifically, those managers for whom insider trading profits represent a motive to manipulate earnings would face lower such incentives once firm-level policies restrict them to trade.

Alternatively, it could be the case that insider trading and earnings management are substitutes in determining insiders' gains. That is, when faced with restrictions on trading, insiders may increase the extent of earnings manipulations in order to insure themselves a similar profits level. If that is the case, then which of these potential effects prevails is an econometric exercise. Our findings support the idea that insider trading restrictions reduce insiders' incentives to manipulate earnings.

A closely related paper to our analysis is the work by Zhang and Zhang (2012), that studies that first-time enforcement of insider trading laws in 39 countries on insiders' supply of information. While their finding that insider trading motivates insiders to reduce financial reporting quality is consistent with our hypothesis, our paper differs from Zhang and Zhang (2012) in two critical aspects. First, we analyze firm-level restrictions rather than country-level insider trading law enforcement. Despite the finding by Bettis et al. (2000) that a large number of firms have such restrictions in place, it is not clear what motivates shareholders to incur the costs of imposing blackout periods. We propose that shareholders restrict insider trading in order to reduce managers' incentives to reduce financial reporting quality as measured by the extent of earnings management. Second, by focusing only on a U.S. sample, our inferences are not subject to cross-country consistency issues regarding financial reporting or insider trading.

If insiders profit from their access to private information, and these profits are higher when the information asymmetry between insiders and outsiders is higher, then restricting insider trading

[1] Text in brackets is adapted from the original text for readability.

may diminish managers' incentives to negatively affect the financial reporting quality. Based on these arguments, we hypothesize that firm-level insider trading restrictions lead to improved financial reporting quality as measured by lower levels of earnings management.

4.2.2 Accruals-based versus real transaction earnings management

Earnings management is considered as situations 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 practices (Healy and Wahlen (1999)). Managers may attempt to achieve certain earnings target either via accruals manipulations, with no direct cash flow consequences (like under-provisioning for bad-debt expenses or delaying assets write-offs), or via real transaction management, which affect cash flows (like price discounts or reduction of discretionary expenditures).

Previous studies have generally documented a substitution between reduced accruals management and increased real transaction management following regulation intended to improve earnings quality. For example, the rational expectation equilibrium model developed by Ewert and Wagenhofer (2005) shows that an unwanted consequence of tighter accounting standards is that, by reducing discretionary accruals, they may induce managers to resort other forms of earnings management, like real transaction management. Consistent with this finding, Cohen et al. (2008) finds that following the passage of SOX, accruals management decreases while real earnings management increases. In a similar fashion, Chan et al. (2015) documents a substitution effect between accruals and real earnings management after companies adopt compensation recovery policies (also known as "clawbacks").

While they focus on events that represent external shocks to earnings management instruments, which are ineffective in reducing total EM, we propose that self-adopted insider trading restrictions represent a shock to managerial incentives to trade, and, therefore, to manipulate earnings in order to increase insider trading profits. Hence, we expect that blackout periods represent a conjuncture where both real and accruals-based earnings management are reduced by an internal firm policy. Specifically, we predict that the adoption of firm-level insider trading restrictions lead to a decrease in both real and accruals-based earnings management.

4.3 Data and measurement choice

4.3.1 Sample selection

Our proxy for insider trading restrictions requires the dates of insider trades and quarterly earnings announcement, and the financial reporting quality measure is calculated using commonly used in the literature discretionary accruals models. The data on insider trades are available from Thomson Financial Insider Filings. The quarterly earnings announcement dates, as well as accounting information for computing the discretionary accruals measures are obtained from Compustat Quarterly. Corporate governance measures are obtained from I/B/E/S and RiskMetrics.

In order to avoid bias in our earnings management measure, we start by computing discretionary accruals using the entire universe of firms covered by Compustat Quarterly. We then merge the resulting sample with the other databases, drop financial firms, and require all firms to have minimum one observation before and one observation after the date when trading restrictions become effective. We distinguish between treatment and control firms by defining a treatment firm as one that has incurred a large jump in *PercentageSafe* (the ratio of trades during the safe-to-trade period to the total volume of trades over the entire quarter) as compared to the average value of *PercentageSafe* of the same period of all previous quarters, and has maintained the value of *PercentageSafe* high over all the following quarters[2].

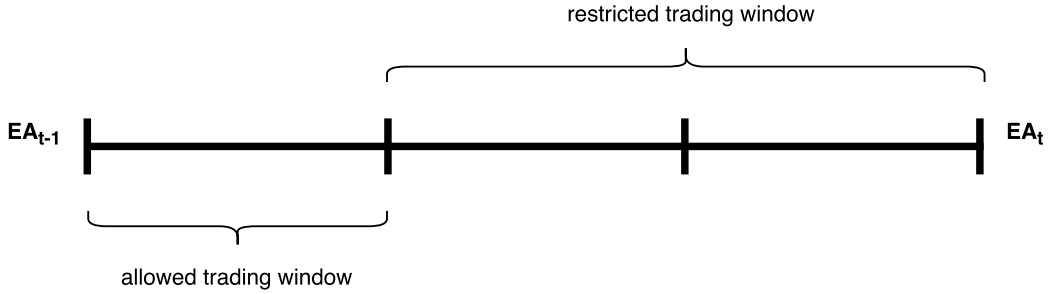
The resulting sample consists of 229 total distinct treatment firms and 1939 total distinct control firms over the period 2001-2013.

4.3.2 Insider trading restrictions proxy

Bettis et al. (2000) finds that the most common restriction firms impose on insider trading is to allow them to trade only during a period closely following earnings announcements.

However, the exact date when blackout periods are imposed by a firm are an internal decision of the company, and therefore hard to observe by the researcher. Our way around this issue is to use an indirect measure of insider trading restrictions, based on observable trading patterns by insiders. We follow Roulstone (2003) in considering the allowed trading window as the first third (approximately one calendar month or 20 trading days) of the period comprised between two consecutive quarterly earnings announcements. Further, we compute *PercentageSafe* as the ratio of the number of trades during the allowed trading window to the total number of trades during the quarter.

Figure 4.1: *Summary of the allowed and restricted insider trading windows*



For each firm in our sample, we define *EventDate* as the quarter when the largest increase in *PercentageSafe* was recorded compared to the average value of the same variable over all previous quarters. *EventDate* is our proxy for the date when the firm has started to have insider trading restrictions in place. In order to consider that a firm restricts insider trading, we follow Lee et al. (2013) and additionally require for *PercentageSafe* to be higher than a benchmark value in all subsequent quarters. Specifically, a firm is considered to fall in the treatment group (that is, a firm that has imposed insider trading restrictions) if at least 70% of all quarterly trades take place in the allowed trading window) during all the quarters following *EventDate*

[2]See the following *Insider trading restrictions proxy* section and *Appendix A* for details about how we calculate *PercentageSafe*and how we identify the quarter when insider trading restrictions became effective.

(i.e., *PercentageSafe* is maintained at a minimum level of 70% in all quarters subsequent to the restrictions adoption).

4.3.3 Accruals-based earnings management proxy

We compute our accruals management proxy by estimating the following model cross-sectionally for industry-quarters with minimum 10 observations, using the entire Compustat quarterly universe:

$$\frac{TA_{i,q}}{Assets_{i,q-1}} = \alpha + \beta_0 \frac{1}{Assets_{i,q-1}} + \beta_1 \frac{\Delta Sales_{i,q} - \Delta Rec_{i,q}}{Assets_{i,q-1}} + \beta_2 \frac{PPE_{i,q}}{Assets_{i,q-1}} + \beta_3 ROA_{i,q-4} + \beta_4 SG_{i,q-4} + \varepsilon_{i,q} \quad (4.1)$$

TA is earnings before extraordinary items and discontinued operations minus the operating cash flow reported in the statement of cash flows[3]. $\Delta Sales$ is the change in sales, ΔRec is the change in accounts receivable, PPE is gross property, plant and equipment. Following Collins et al. (2012), we include as additional regressors the value of ROA in the same quarter of the previous year, $ROA_{i,q-4}$, and $SG_{i,q-4}$, the growth in sales since the same quarter of the previous year. All the variables, including the intercept, are scaled by total assets at the end of the previous quarter, and we also include an unscaled intercept in our regressions. The estimated residuals from Equation (1) are our discretionary accruals.

4.3.4 Real transaction management proxy

Following Roychowdhury (2006), we compute three proxies of real transaction management: *ABExp*, *ABProd* and *ABCash*, which measure abnormal levels of discretionary expenses, production costs and cash flow from operating expenses, respectively. Our measures are given by the residuals from estimating Equations (2) to (4) by quarter and 2-digit SIC code for the entire universe of Compustat quarterly.

$$\frac{Expense_{i,q}}{Assets_{i,q-1}} = \alpha + \beta_0 \frac{1}{Assets_{i,q-1}} + \beta_1 \frac{Sales_{i,q-1}}{Assets_{i,q-1}} + +\varepsilon_{i,q} \quad (4.2)$$

$$\frac{Production_{i,q}}{Assets_{i,q-1}} = \alpha + \beta_0 \frac{1}{Assets_{i,q-1}} + \beta_1 \frac{Sales_{i,q}}{Assets_{i,q-1}} + \beta_2 \frac{\Delta Sales_{i,q}}{Assets_{i,q-1}} + \beta_3 \frac{\Delta Sales_{i,q-1}}{Assets_{i,q-1}} + \varepsilon_{i,q} \quad (4.3)$$

$$\frac{CFO_{i,q}}{Assets_{i,q-1}} = \alpha + \beta_0 \frac{1}{Assets_{i,q-1}} + \beta_1 \frac{Sales_{i,q}}{Assets_{i,q-1}} + \beta_2 \frac{\Delta Sales_{i,q}}{Assets_{i,q-1}} + \varepsilon_{i,q} \quad (4.4)$$

Roychowdhury (2006) states that managers may reduce discretionary expenditures (like R&D expenses or advertising), to boost short-term earnings. Positive values of *ABProd* indicates

[3] We undo the year-to-date values in the statement of cash flows in order to arrive at the quarterly figure.

inventory overproduction to report lower COGS per unit and boost operating income. Finally, offering price discounts or lenient credit terms leads to accelerated sales and inflated sales revenue, although these practices may decrease operating cash flow (negative *ABCash*).

Following Cohen and Zarowin (2010) and Chan et al. (2015), we compute two overall measures of real transactions management: RTM1 is the sum between *(-1) x ABCash* and *(-1) x ABExp*, and RTM2 is the sum of *ABProd* and *(-1) x ABExp*, such that the measures reflect earnings management in a consistent fashion (the more positive the number is, the higher the earnings manipulation).

4.4 Research design

4.4.1 Insider trading restrictions effectiveness in limiting insider trading

Previous work generally agrees on the fact that the type of restrictions analyzed in our paper successfully limit the extent to which corporate insiders use their access to private information to extract rents from outsiders (Bettis et al. (2000), Roulstone (2003)). However, Jagolinzer et al. (2011) finds that restricted trading windows, by themselves, are not effective at restricting insider trading. They find instead that when the general counsel approval is required to execute a trade, insiders' trading profits and the predictive ability of insider trades for future operating performance are significantly lower.

Given this mixed evidence, we begin our analysis by testing whether blackout periods are effective in reducing or suppressing informed trading by corporate insiders. We estimate the following regression for the sample of blackout period adopters:

$$IT_{it} = \beta_0 + \beta_1 Post_{it+1} + \beta_2 Controls_{it-1} + u_i + q_t + \varepsilon_{it} \tag{4.5}$$

where IT_{it} is the net purchase ratio or the net purchase ratio in dollar amount, respectively. $Post_{it+1}$ is an indicator variable that takes the value one if the treatment firm is in the quarters following the period when the blackout period became effective, zero before the event, and a missing value during the event quarter. u_i and q_t are firm fixed effects and quarter fixed effects, respectively. We control for size, book-to-market, ROA, consistent with previous literature.

A negative and significant coefficient of $Post_{it+1}$ would suggest that restricted trading are indeed effective in reducing insiders' ability to trade on private information.

4.4.2 Insider trading restrictions adopters

For this step in the analysis, we employ only the group of firms that have been identified by the methodology explained in Section 3.2. as adopters of insider trading restrictions. To examine the impact of firm-level blackout periods adoptions on the extent of earnings manipulation, we estimate the following regression models:

$$AM_{it}(orRTM_{it}) = \beta_0 + \beta_1 Post_{it+1} + \beta_2 Controls_{it-1} + u_i + q_t + \varepsilon_{it} \tag{4.6}$$

where $Post_{it+1}$ is an indicator variable that takes the value one if the treatment firm is in the quarters following the period when the blackout period became effective, zero before the event, and a missing value during the event quarter; $AM_{it}(orRTM_{it})$ is our earnings management proxy, as described in Sections 3.3. and 3.4. u_i and q_t are firm fixed effects and quarter fixed effects, respectively. We control for size, book-to-market, ROA. Following Chan et al. (2015), we include NOA_d , $Analyst$ and $BoardIndep$ to acount for the costs related to earnings manipulation. The use of accruals manipulation is constrained by the extent of engaging in such practices in previous quarters, therefore we expect a negative association between NOA_d and the accruals manipulation proxies. Next, we include the decile of Altman's Z-Score to account for the finding in Zang (2012) that firms with better financial health (higher Z-Score) are more likely to engage in real earnings management. The same study suggests that firms with higher $InstOwn$ incur higher costs of engaging in real earnings management. Finally, following previous literature, we include the lagged levels of AM (RTM) in the RTM (AM) regressions.

The coefficient of $Post_{it+1}$ captures the impact that adopting insider trading restrictions has on accruals and real earnings management. Notice that since our earnings manipulation measures are given by the extent to which a firm manipulates earnings, the higher the level of AM (or RTM), the lower the quality of a firm's financial reporting. Therefore, we predict that the coefficient of $Post_{it+1}$ is negative and significant.

4.4.3 Seemingly Unrelated Regressions

Additionally, we use Seemingly Unrelated Regressions (SUR) to jointly estimate the regression equations for accruals and real earnings management. The advantage of this estimation method is that it allows for regression errors to be correlated across equations, which can potentially increase the efficiency of the estimates (Zellner (1962)). Specifically, we estimate both equations below, using a similar equation structure as before:

$$AM_{it} = \beta_0 + \beta_1 Post_{it+1} + \beta_2 Controls_{it-1} + u_i + q_t + \varepsilon_{it} \tag{4.7}$$

$$RTM_{it} = \beta_0 + \beta_1 Post_{it+1} + \beta_2 Controls_{it-1} + u_i + q_t + \varepsilon_{it} \tag{4.8}$$

As before, the coefficient of $Post_{it+1}$ reflects the impact of insider trading restrictions has on accruals and real transaction mangement, and our hypothesis predicts a negative and significant coefficient for this variable.

4.4.4 Adopters versus non-adopters of insider trading restrictions

4.4.4.1 Propensity score matching

At the second step in the analysis we use a propensity score matching approach, which is more robust to misspecification of the functional form of the underlying relation between earnings management and the effective date of the insider trading restrictions than the typical regression approach. Using this type of specification allows us to control for the endogeneity induced by a preference of firms with a particular set of characteristics for adopting blackout periods.

This research design allows us to compare changes in financial reporting quality between firms that adopt insider trading restrictions and firms that are similar to the treated firms across a set of relevant observable characteristics, but do not adopt blackout periods. In order to analyze whether the adoption of insider trading restrictions is more likely in firms with lower ex-ante information rents, we estimate the probability that a firm imposes such blackout periods as a function of a set of corporate governance and information asymmetry variables found by the literature to be relevant in predicting the likelihood for a firm to adopt blackout periods. For each firm-quarter in the treatment group, we estimate the following *probit* model[4]:

$$Prob(Treat = 1) = \frac{1}{1+e^{(-„X)}} \text{ where:}$$

$$\beta X = \alpha_0 + \alpha_1 Size + \alpha_2 BTM + \alpha_3 InsiderTrade + \alpha_4 Analyst + \varepsilon$$

Treat=1 if a firm is in the treatment group (if it maintained a minimum of 70% value for *PercentageSafe* in the periods subsequent to *EventDate*); all explanatory variables are one-year lagged. All variables are described in *Appendix A*.

We base our choice of the variables to include in the *probit* model on the following arguments. Roulstone (2003) suggests that restricted firms are larger than nonrestricted firms, have lower BTM ratios, and are followed by more analysts. Jagolinzer et al. (2011) finds similar evidence, and suggests the dollar-volume of insider trading as another predictor of the likelihood for a firm to adopt trading restrictions.

We store the fitted values of the *probit* model; they represent the propensity scores or the probabilities that a firm receives the treatment, given the set of independent variables.

For every event-quarter in the treatment group we select the closest non-treatment firm in terms of propensity score and from the same year using the nearest-neighbor, no replacement matching procedure. Given that we estimate a *probit* model per each fiscal year, the closest matches will only be selected out of controls from the same fiscal year.[5]

For each firm in the control group, a pseudo-event is generated in the same quarter as its corresponding treatment firm. We require all firm to have at least one observation before and after the pseudo-event. Our final sample consists of 47 pairs of treatment firms and matched controls.

The fitted values of the *probit* model represent the propensity scores. We select the match for a treatment firm as a firm that does not adopt blackout periods, is in the same year as the treatment firm and is the closest to the treatment firm in terms of propensity scores; the set of obtained matches are referred to as the control group.

4.4.4.2 Regression analysis on the matched sample

Once the complete database of treatment and matched controls is created, we resume our sample to the three quarters before and three quarters after the event for each firm. We conduct the difference-in-differences test below:

[4]Because using only firm-quarters that result from the merge between the four databases dramatically reduces our matched control sample, for this step in the analysis we use the sample resulting from the merge between Thomson Financial Insider Filings, Compustat and I/B/E/S.

[5]Note that this implies that the same firm may be selected as a control for several treatment firms in different years.

$$AM_{it}(orRTM_{it}) = \beta_0 + \beta_1 Post_{it+1} + \beta_2 Treat_{it} + \beta_3 Post_{it+1} * Treat_{it} + \beta_4 Controls_{it-1} + v_i + q_t + \varepsilon_{it} \quad (4.9)$$

where $Treat_{it}$ is an indicator variable that equals one if the firm is in the treatment group and 0 otherwise. The rest of the variables are the same as in the previous test and they are described in *Appendix 1.* Our coefficient of interest, β_3, captures the difference-in-differences in financial reporting quality levels of: (Treatment group in post-event period - Treatment group pre-event adoption period) - (Control group in post-event period - Control group in pre-event period). A negative and significant β_3 would indicate a decrease in the level of earnings management of treatment firms after the blackout period adoption as compared to the control group.

4.4.5 Cost of capital for insider trading restrictions adopters

Previous studies have documented that earnings management increases the cost of capital for the company. Aboody et al. (2005), Francis et al. (2005) and Gray et al. (2009) show that firms with higher levels of accruals earnings management have higher cost of capital. Kim and Sohn (2013) extends these findings and shows that the market seems to penalize real transactions management by requiring a higher cost of equity for these manipulations compared to accruals-based earnings management.

The intuition behind these findings comes from the fact that outside investors require a higher cost of equity capital for noisier earnings (that is, in the case of high earnings management) that offer noisy signals regarding the level of expected cash flows. This relation is analytically demonstrated by Lambert et al. (2007). Based on these arguments, we expect that the reduced level of total earnings manipulations following the adoption of restricted windows translates into a lower cost of capital for these firms.

Following Easton (2004), we measure the cost of capital using the following formula:

$$CoC = \sqrt{\frac{EPS_2 - EPS_1}{P_0}}$$

where EPS_2 (EPS_1) is the two(one)-periods ahead earnings-per-share, and P_0 is the current price[6].

Next, we estimate the following regression for the sample of restriction windows adopters:

$$CoC_{it} = \beta_0 + \beta_1 Post_{it+1} + \beta_2 Controls_{it-1} + \varepsilon_{it} \quad (4.10)$$

A negative and significant coefficient of $Post_{it+1}$ would suggest that firms enjoy lower levels of cost of capital in the quarters following the adoption of blackout-periods.

[6]Information regarding earnings and prices is collected from Compustat Quarterly.

4.5 Results

4.5.1 Descriptive statistics

Table 4.1, Panel A presents the descriptive statistics for the initial sample, described in Section 3.1. Panels B and C present the main variables used in this study separately by adopters and non-adopters of insider trading restrictions. It can be seen that adopters tend to be smaller, have lower BTM ratios and slightly lower dollar-values of insider trading. From the descriptives, there are no obvious differences between the levels of earnings manipulations between adopters and non-adopters.

[Insert Tables 4.1 and 4.2 about here]

Table 4.2 presents the levels of our measures of discretionary accruals before and after the event date for the treatment and control groups, respectively. Consistent with our prediction, for the control group there are no differences between the level of earnings management before and after their pseudo-events, while the treatment group has lower mean and median values for discretionary accruals following the quarter when the trading restrictions became effective.

[Insert Table 4.3 about here]

Table 4.3 presents the results on whether restricted windows successfully limit insiders' ability to trade. The dependent variable in the first specification is the net purchase ratio, and in the second one is the dollar-value of net purchase ratio. The negative and significant coefficient of the variable $Post_{it+1}$ in both cases suggests that the extent to which insiders trade significantly decreases following the adoption of blackout periods.

4.5.2 Results of tests on sample of insider trading restrictions adopters

The first test assesses the way blackout periods affect earnings manipulations before and after the event date (i.e., before and after trading restrictions become effective). At this step, we estimate *Eq. (4.5)* on the set of firms that have adopted restricted trading windows.

We predict a negative and significant coefficient of $Post_{it+1}$, in line with our hypothesis that on average there is less earnings management (therefore, improved earnings quality) after the blackout periods become effective within the firm.

[Insert Table 4.4 about here]

Table 4.4 present the effect of the insider trading restrictions adoption event on positive, negative and absolute discretionary accruals, respectively. While in the three models the coefficient of our variable of interest, $Post_{it+1}$, has the predicted sign, it is significant in the absolute values model, suggesting that the extent of accruals manipulation decreases after blackout periods are adopted.

[Insert Table 4.5 about here]

The first two columns of Table 5 present the results when using the two measures of real earnings manipulation as dependent variable. As predicted, the coefficient of $Post_{it+1}$ is negative and significant. However, for the second measure of real transaction management the coefficient of the variable of interest is not significant. In the last column, an overall measure of earnings management is the dependent variables, and the coefficient of interest is negative and significant, suggesting that the total level of earnings manipulation decreases following the adoption of firm-level blackout periods.

4.5.3 Results using *Seemingly Unrelated Regressions*

Table 4.6 shows estimation results using Seemingly Unrelated Regressions where the dependent variables are accruals-based and real earnings management, respectively. The negative and significant coefficient of $Post_{it+1}$ is in line with our expectation, suggesting that both types of earnings manipulations decrease following the adoption of insider trading restrictions.

[Insert Table 4.6 about here]

Overall, the results support the prediction that firms which impose blackout periods are small growth firms, and that analyst following is positively associated with insider trading restrictions.

4.5.4 Results of test on treatment versus control firms

For this test we use both the set of treatment firms and their matched controls in order to compare the effect of insider trading restrictions on earnings management on the treatment group compared to the matched control group, before and after the event. We estimate Eq. (4.8) on the matched sample of firms. We expect a negative and significant β_3, suggesting that after trading restrictions become effective, there is a decrease in the extent to which firms manipulate earnings with respect to their non-adopters of insider trading restriction counterparts.

[Insert Table 4.7 about here]

Table 4.7 presents the results of our test. The first three columns present the effect of the insider trading restrictions adoption event on positive, negative and absolute discretionary accruals, respectively. The coefficient of our variable of interest, *Post* x *Treat*, has the predicted sign in all of these specifications. In particular, there is a significant decrease (increase) in income-increasing (decreasing) accruals management levels in the period following blackout period adoption for treatment firms. The same coefficient has the predicted negative sign for the absolute value of discretionary accruals, but is not statistically significant. Columns (4) and (5) present the results of the estimations having real earnings manipulation as dependent variables. As predicted, the coefficient of *Post x Treat* is negative and significant in the case of *RTM1*, while it is not significant for *RTM2*. In the last column, the dependent variable is given by the overall measure of earnings management and the coefficient of interest is negative and significant, consistent with our prediction.

Taken together, these results are consistent with insider trading adopters enjoying overall lower levels of earnings manipulation, both accruals-based and real earnings management, following the introduction of blackout periods.

4.5.5 Results of test on cost of capital

The results corresponding to the estimation of Eq. (4.10) are presented in Table 4.10. The negative and significant coefficient of $Post_{it+1}$ is in line with our prediction that a positive consequence for firms that successfully restrain their insiders from trading on private information comes as a result of the positive rewards of the market for low levels of earnings manipulations in the form of lower cost of equity capital.

[Insert Table 4.8 about here]

4.6 Conclusions and future research

This study examines whether firms that impose restrictions on insider trading enjoy lower levels of earnings management in subsequent quarters to the adoption of such measures. We develop our measure of the restriction adoption quarter based on the relative increase in the percentage of trades performed by insiders in the allowed window compared to previous quarters.

We find that firms have lower levels of discretionary accruals in the quarters following the adoption of the insider trading restrictions by undertaking a two-steps analysis. First, we find that on average treatment firms have lower levels of discretionary accruals in the period following the restriction adoption quarter. Additionally, as a robustness check, we obtain the same result when we employ a *Seemingly Unrelated Regressions* approach that allows for the regression errors to be correlated between two equations where accruals-based and real earnings management, respectively, are the dependent variables.

Second, to alleviate potential endogeneity issues, we use propensity score matching to create a matched-pair research design that allows us to compare changes in financial reporting quality between firms that adopt restrictions and firms that are similar to the treated firms across a set of relevant observable characteristics, but do not adopt trading restrictions. Results show that firms that adopt restrictions have lower levels of earnings manipulations than their matched controls in the post-event period. Taken together, our findings provide evidence consistent with firms that impose restrictions on insider trading enjoying lower levels of earnings manipulation after such measures are imposed.

Next, we document one consequence of the lower levels of earnings manipulation that result from adopting insider trading restrictions. We provide evidence that firms experience lower cost of capital as a result of the decrease in earnings manipulation following the adoption of firm-level blackout periods. This finding is consistent with Kim and Sohn (2013), that suggest that the cost of capital is positively associated with earnings management.

The results presented in this paper provide insights regarding a question left unanswered by previous studies that documented that a large percentage of the firms in S&P500 voluntarily adopt insider trading restrictions, despite finding no consistent answer as to why would firms

engage in such a (costly) behavior. Our findings are consistent with firms enjoying lower levels of earnings manipulation, both accruals-based and real transaction management, following the adoption of blackout periods. These results are consistent with the hypothesis that insider trading opportunities represent an incentive for insiders to negatively influence the quality of financial statements disclosed by their company.

Nevertheless, we are aware of some potential limitations of this work. Insider trading restrictions are not directly observable, and therefore we employ an indirect proxy of whether a firm has such restrictions in place. Previous research that examined blackout periods imposed by firms have identified that restricted firms allow trading only during a short window following earnings announcements. We develop our proxy for insider trading restrictions based on guidance provided by previous work, showing that the most common restriction is for firms to only allow insiders to trade is one month after earnings announcements. We perform a validity test to check whether insider trading decreases following the quarter that we identify as the one when restricted trading windows have been adopted, and results support the use of our measure. However, a more direct proxy to validate our measure could come from textual analysis of firms' disclosures about the exact date when such measures have been adopted.

Also, despite our efforts to alleviate endogeneity concerns by controlling for a series of corporate governance dimensions or using a difference-in-differences approach on a matched sample, we cannot completely rule out the possibility that other corporate events may be (partly) responsible for our result.

Overall, the results presented in this paper are consistent with the idea that earnings manipulation is partly justified by insider trading incentives. Taken together, our findings provide evidence that when firms restrain their insiders from trading with the shares of their own company, there is a reduction in the overall level of earnings management, which could lead to potential benefits from the company like lower cost of equity capital.

4.6 Appendix A. Variable definitions

AM: abnormal accruals, computed based on the model described in Equation (1).
$|$***AM***$|$: the absolute value of abnormal accruals (AM) computed based on the model described in Equation (1).
ABExp: abnormal discretionary expenses, measured as the deviations from the predicted values from the year-industry models in Equation (2).
ABProd: abnormal production cost, measured as the deviations from the predicted values from the year-industry models in Equation (3).
ABCash: abnormal cash flow from operations, measured as the deviations from the predicted values from the year-industry models in Equation (4).
Analyst: a corporate governance control likely to affect managers' opportunities to engage in earnings management. It is measured as the natural log of the number of analysts following the firm at the end of the previous quarter.
BdIndep: board independence, computed as the number of independent directors divided by the total number of directors on the board.
Book-to-market: firms book value divided by the market value of common equity at the end of the fiscal year.
EM: total earnings management, computed as the sum between accruals-based and real earnings management (AM+$RTM1$).
EventDate is the quarter when the largest increase in *PercentageSafe* was recorded compared to the average values of *PercentageSafe* over the previous quarters. *EventDate* is our proxy for the date when the firm has started to apply blackout periods. A firm is considered to restrict insider trading if during all the quarters following *EventDate*, *PercentageSafe* is maintained at a minimum level of 70% (that is, minimum 70% of all quarterly trades take place in the allowed trading window). Firms that restrict insider trading according to this definition represent our treatment group of firms.
InsiderTrading is the ratio of the dollar value of trades made by insiders (buy and sell) to market equity, at the end of the previous quarter.
Insider trading restrictions: We use the approach of Roulstone (2003) to compute our measure of insider trading restrictions. Earnings announcement dates are collected from Compustat. Only trades performed by officer insiders are considered. Bettis et al. (2000) finds via surveys that firms allow insiders to trade only in the one-month period after earnings announcements. Following this guidance, a trade is considered to be made during an allowed trading window if it occurs within the first third (approximately 20 trading days, 30 calendar days) after a quarterly earnings announcement. For every year, a variable *PercentageSafe* is calculated as the percentage of shares traded during this window over the total number of shares traded during the period between 2 consecutive earnings announcements. In order to identify the quarter when insider trading restrictions became effective in a firm, we compute the difference between *PercentageSafe* and the the average *PercentageSafe* of all previous quarters for that firm. The date when the firm has adopted a blackout period is considered the quarter at which this difference is has the highest value. In order to consider that a firm restricts insider trading, we follow Lee et al. (2013) who additionally require for *PercentageSafe* to be higher than a benchmark value in all subsequent quarters. Therefore, we request for PercentageSafe must maintain a high level of 70% (that is, 70% of the trades made during a quarter are performed in the allowed trading window) in all periods subsequent to the event quarter.
InstOwn: the percentage shares owned by institutional investors.
Market Equity: the share price at the end of the fiscal year times the number of shares outstanding.

Net Purchase Ratio: the net number of shares purchased by all insiders during a quarter (=#Purchased shares- #Sold shares), scaled by total shares traded during the quarter (=#Purchased shares + #Sold shares).
Net Purchase Ratio (dollar): the dollar-value of the net number of shares purchased by all insiders during a quarter (=#Purchased shares x Dollar value of purchased shares- #Sold shares x Dollar value of sold shares), scaled by total dollar-value of the shares traded during the quarter (=#Purchased shares x Dollar value of purchased shares+ #Sold shares x Dollar value of sold shares).
PercentageSafe measures the ratio of the number of trades made by the insiders of a firm in the first third of a quarter to the number of trades made by the insiders of a firm over the entire quarter.
Post: an indicator variable for whether the observation is after an executive transition; it takes the value 1 in the quarters following the event, 0 before the event and a missing value in the event quarter.
ROA: income before extraordinary items scaled by total assets.
RTM1: the first measure of the total amount of real transaction management, computed as (-1)x *ABExp* + (-1) x *ABCash*.
RTM2: the second measure of the total amount of real transaction management, computed as (-1)x *ABExp* + *ABProd*.
Size: the logarithm of market equity.
Z-Score: Altman's Z-Score.
Z-Score_d: decile of Altman's Z-Score.
NOA: net operating assets, computed as shareholders' equity less cash and marketable securities plus total debt.
NOA_d: 1 if the net operating assets at the beginning of the year is above the median of the industry-year, and zero otherwise.

Table 4.1: Descriptive statistics - ITR Adopters and Non-ITR adopters

	N	Mean	SD	P25	Median	P75
AM	9519	0.00	0.03	-0.01	0.00	0.01
|AM|	9519	0.02	0.03	0.01	0.01	0.03
RTM1	9519	-0.22	0.76	-0.17	-0.01	0.05
RTM2	9519	0.01	0.06	-0.02	0.01	0.04
EM1	9519	-0.22	0.76	-0.17	-0.01	0.05
PctSafe	9519	0.61	0.37	0.30	0.67	1.00
Size	9519	8.32	1.52	7.17	8.15	9.36
BTM	9519	0.42	0.26	0.25	0.37	0.55
ROA	9519	0.02	0.02	0.01	0.02	0.03
Analyst	9519	2.44	0.62	2.08	2.48	2.89
Insider Trading	9519	2.31	13.36	0.12	0.51	1.73
NOA	9519	2.89	2.40	1.40	2.32	3.57
InstOwn	9519	2.26	12.28	0.00	0.00	0.00
BoardIndep	9519	0.76	0.13	0.69	0.78	0.88
Z-Score	9519	0.53	15.21	0.00	0.00	0.01

This table presents the descriptive statistics of the main variables used in this paper. See *Appendix A* for the definitions of the variables.

Table 4.2: Descriptive statistics

Panel A: ITR Adopters

	N	Mean	SD	P25	Median	P75
AM	442	0.00	0.03	-0.01	0.00	0.02
|AM|	442	0.02	0.03	0.01	0.01	0.03
RTM1	442	-0.15	0.66	-0.05	-0.00	0.02
RTM2	442	0.02	0.05	-0.02	0.02	0.05
EM1	442	-0.15	0.66	-0.05	-0.00	0.02
PctSafe	442	0.70	0.37	0.44	0.90	1.00
Size	442	7.84	1.35	6.96	7.87	8.59
BTM	442	0.38	0.23	0.25	0.34	0.49
ROA	442	0.02	0.02	0.01	0.02	0.03
Analyst	442	2.26	0.59	1.79	2.30	2.77
Insider Trading	442	2.17	4.72	0.17	0.69	2.53
NOA	442	2.72	2.01	1.36	2.28	3.46
InstOwn	442	2.96	14.13	0.00	0.00	0.00
BoardIndep	442	0.77	0.13	0.67	0.80	0.88
Z-Score	442	5.30	63.44	0.00	0.01	0.01

Panel B. Non-ITR Adopters

	N	Mean	SD	P25	Median	P75
AM	9077	0.00	0.03	-0.01	0.00	0.01
|AM|	9077	0.02	0.03	0.01	0.01	0.03
RTM1	9077	-0.22	0.76	-0.18	-0.01	0.05
RTM2	9077	0.01	0.06	-0.02	0.01	0.04
EM1	9077	-0.22	0.76	-0.18	-0.01	0.05
PctSafe	9077	0.61	0.37	0.30	0.67	1.00
Size	9077	8.34	1.52	7.20	8.18	9.41
BTM	9077	0.43	0.26	0.25	0.37	0.55
ROA	9077	0.02	0.02	0.01	0.02	0.03
Analyst	9077	2.45	0.62	2.08	2.56	2.89
Insider Trading	9077	2.32	13.64	0.11	0.51	1.69
NOA	9077	2.90	2.41	1.40	2.33	3.57
InstOwn	9077	2.23	12.19	0.00	0.00	0.00
BoardIndep	9077	0.76	0.13	0.70	0.78	0.88
Z-Score	9077	0.29	6.78	0.00	0.00	0.01

This table presents the descriptive statistics of the main variables used in this paper. See *Appendix A* for the definitions of the variables.

Table 4.3: ITR effectiveness in limiting insider trading

	Net Purchase Ratio	*Net Purchase Ratio (dollar)*
Post	-0.217**	-0.219**
	(-2.30)	(-2.32)
Size	-0.196***	-0.197***
	(-3.07)	(-3.08)
BTM	-0.121	-0.126*
	(-0.77)	(-0.80)
ROA	-2.071*	-2.102*
	(-1.73)	(-1.76)
Constant	1.181*	1.197*
	(1.72)	(1.74)
Firm indicator	Yes	Yes
Quarter indicator	Yes	Yes
R^2	0.417	0.416
N	1180	1180

This table reports results based on Eq. (4.5). The numbers in parentheses are *t-Statistics* based on White standard errors. All variables are winsorized yearly at 1% level.
*, **, *** denote statistical significance at 10%, 5%, 1% level, respectively.

Table 4.4: ITR Adopters - Accruals earnings management

	$AM > 0$	$AM < 0$	$\|AM\|$
Post	-0.012	0.013	-0.011*
	(-0.95)	(1.27)	(-1.73)
Size	-0.014	0.006	-0.005
	(-1.23)	(0.68)	(-0.88)
BTM	-0.006	-0.006	-0.000
	(-0.25)	(-0.19)	(-0.02)
ROA	0.122	-0.080	0.144**
	(1.02)	(-0.43)	(2.18)
NOA_d	-0.010	0.013*	-0.009**
	(-1.24)	(1.91)	(-2.04)
InstOwn	-0.001	-0.001	-0.000
	(-0.96)	(-0.40)	(-0.98)
BoardIndep	0.003	0.020	0.001
	(0.10)	(0.56)	(0.07)
Analyst	0.006	0.014	-0.005
	(0.51)	(1.61)	(-1.11)
Z-Score_d	-0.003	0.002	-0.003**
	(-1.16)	(1.01)	(-2.43)
RTM1	-0.000	0.000	-0.000
	(-0.94)	(0.66)	(-1.48)
Constant	0.287**	-0.100	0.148**
	(2.08)	(-0.05)	(2.15)
Firm indicator	Yes	Yes	Yes
Quarter indicator	Yes	Yes	Yes
R^2	0.654	0.803	0.595
N	220	199	419

This table presents regression results on how adoption blackout periods affects firm's earnings manipulation, as reflected in Eq. (4.6). See *Appendix A* for the definition of all the variables. The numbers in parentheses are t-Statistics based on White standard errors. All variables are winsorized yearly at 1% level.
*, **, *** denote statistical significance at 10%, 5% and 1% level level

Table 4.5: ITR Adopters - Real transactions management and Total earnings management

	RTM1	*RTM2*	*EM*
Post	-0.192**	-0.000	-0.277**
	(-2.57)	(-0.04)	(-2.55)
Size	-0.016	0.018**	0.001
	(-0.51)	(2.01)	(0.02)
BTM	-0.200**	-0.025	-0.322***
	(-2.12)	(-0.87)	(-2.74)
ROA	-1.393**	-0.288	-0.997
	(-2.12)	(-2.62)	(-1.14)
NOA_d	-0.146***	0.013	-0.179***
	(-3.06)	2.07	(-3.05)
InstOwn	0.002	0.000	0.001
	(1.53)	(0.22)	(0.29)
BoardIndep	-0.260*	0.008	-0.309
	(-1.65)	(0.23)	(-1.44)
Analyst	0.034	0.008	0.040
	(1.01)	(1.10)	(0.88)
Z-Score_d	-0.025**	-0.006***	-0.047**
	(-2.18)	(-3.34)	(-2.31)
$\|AM\|$	0.664	0.111	
	(1.25)	(0.88)	
Constant	0.970***	0.899***	1.005***
	(2.89)	(-1.28)	(2.69)
Firm indicator	Yes	Yes	Yes
Quarter indicator	Yes	Yes	Yes
R^2	0.922	0.776	0.914
N	478	418	418

This table presents regression results on how adoption blackout periods affects firm's earnings manipulation, as reflected in Eq. (4.6). See *Appendix A* for the definition of all the variables. The numbers in parentheses are t-Statistics based on White standard errors. All variables are winsorized yearly at 1% level.
*, **, *** denote statistical significance at 10%, 5% and 1% level level

Table 4.6: Seemingly Unrelated Regressions

	$\|AM\|$	*RTM1*
Post	-0.013***	-0.200***
	(-2.61)	(-3.69)
Size	-0.007	0.019
	(-1.60)	(0.38)
BTM	0.009	-0.279**
	(0.77)	(-2.23)
ROA	0.162**	-1.429*
	(2.32)	(-1.82)
NOA_d	-0.008**	-0.167***
	(-2.24)	(-4.12)
InstOwn	0.000	-0.001
	(0.17)	(-0.10)
BoardIndep	-0.029	-0.211
	(-1.58)	(-1.02)
Analyst	-0.009*	0.023
	(-1.79)	(0.38)
Z-Score_d	-0.002*	-0.045***
	(-1.93)	(-4.40)
RTM1	-0.006	
	(-1.29)	
$\|AM\|$		0.401
		(0.69)
Constant	0.000	-0.058
	(.)	(-0.08)
Firm indicator	Yes	Yes
Quarter indicator	Yes	Yes
R^2	0.509	
N	356	

This table reports results based on SUR estimation. The numbers in parentheses are *t-Statistics* based on White standard errors. All variables are winsorized yearly at 1% level.
*, **, *** denote statistical significance at 10%, 5%, 1% level, respectively.

Table 4.7: ITR Adopters vs. Non-ITR Adopters

	$AM > 0$	$AM < 0$	$\|AM\|$	*RTM1*	*RTM2*	*EM*
Post	0.008***	0.002	-0.003	0.020	-0.004	0.059**
	(3.64)	(0.60)	(-0.98)	(0.92)	(-0.79)	(2.33)
Treat	-0.007**	0.010***	-0.016***	0.038	-0.044***	0.050
	(-2.33)	(3.56)	(-5.77)	(1.47)	(-9.31)	(1.65)
Post x Treat	-0.007*	0.011*	-0.002	-0.168**	0.008	-0.437***
	(-1.83)	(1.95)	(-0.63)	(-2.54)	(0.89)	(-4.35)
Size	-0.005***	0.012***	-0.010***	-0.284***	0.017***	-0.355***
	(-5.14)	(5.78)	(-6.61)	(-17.65)	(10.02)	(-15.68)
ROA	-0.229***	-0.163***	0.024	1.839***	0.572***	2.577***
	(-5.67)	(-2.94)	(0.64)	(5.15)	(5.80)	(6.29)
BTM	-0.014***	0.042***	-0.031***	0.018	0.008	-0.008
	(-4.29)	(6.98)	(-8.83)	(0.46)	(1.15)	(-0.19)
Analyst	-0.010***	-0.004	-0.003	0.231***	-0.023***	0.328***
	(-4.59)	(-0.93)	(-1.06)	(9.63)	(-3.86)	(10.89)
RTM1	-0.010***	0.017***	-0.016***			
	(-5.96)	(5.49)	(-9.34)			
$\|AM\|$				-2.141***	-0.448***	
				(-7.83)	(-3.88)	
Constant	0.075***	-0.153***	0.121***	1.708***	-0.076***	1.904***
	(8.47)	(-6.53)	(14.29)	(10.69)	(-4.52)	(11.98)
Industry indicator	Yes	Yes	Yes	Yes	Yes	Yes
Quarter indicator	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.615	0.366	0.390	0.607	0.351	0.521
N	656	633	1289	1289	1289	1675

This table reports results based on a difference-in-differences approach as reflected in Eq. (4.6), for which we used a sample of matched treatment and controls firms identified using propensity score matching. The numbers in parentheses are *t-Statistics* based on White standard errors. All variables are winsorized yearly at 1% level.

*, **, *** denote statistical significance at 10%, 5%, 1% level, respectively.

Table 4.8: Cost of Capital for ITR Adopters

	(1)	*(2)*
Post	-0.020***	-0.014**
	(-3.33)	(-2.01)
Size		-0.004
		(-0.84)
BTM		-0.060
		(1.51)
ROA		-0.050
		(-0.17)
Constant	0.075***	0.072*
	(20.25)	(1.49)
R^2	0.005	0.053
N	686	406

This table reports results based on Eq. (4.10). The numbers in parentheses are *t-Statistics* based on White standard errors. All variables are winsorized yearly at 1% level.
*, **, *** denote statistical significance at 10%, 5%, 1% level, respectively.

5

Price Discovery for Connected Boards

5.1 Introduction

In this paper, we seek to identify channels of confidential information flows to institutional investors that could have an impact on the dynamics of information arrival in prices. We focus on a setting where the board of a listed firm is connected to an institutional investor through a common board member. A comprehensive database on board social network connections allows us to develop a measure of board connectedness that counts the number of connections that a company has to institutional investors. In order to capture the timeliness of price discovery, we compute a measure of how quickly information is impounded into price around earnings announcements. We provide preliminary evidence the higher the number of connections to institutional investors a company is, the more timely the price discovery over quarterly earnings circles is. This result is consistent with the idea that the more institutional investors are connected to the board of the firm, the more pervasive their insider trading becomes in influencing the speed of price discovery during earnings cycles.

A vast literature in accounting and finance has examined channels through which information is impounded into prices. This literature documents that securities prices incorporate information from different sources, like accounting reports, financial analysts, firm's own disclosures, or insider trading, to name a few.[1] In this paper, we aim to study a type of indirect insider trading that has received considerably less attention both from regulators and from the specialized literature, given that it is considerably more difficult to track back: we present preliminary results consistent with the idea that the more institutional investors connections a firm has, the faster the information related to earnings announcements is impounded into its stock price.

As researchers, we are not able to directly observe the flows of private information to institutional investors. In order to overcome this challenge, we study instances where a listed firm and an institutional investor share a common board member. We posit that this type of connection may facilitate the flow of material private information from a listed firm to entities able to trade on such information, like institutional investors. We interpret a relatively fast price discovery as reflecting an early dissemination of private information to institutional investors, and vice versa. Based on this idea, we predict and provide preliminary evidence that the more board connections a firm shares with institutional investors, the faster the price discovery process is.

We also acknowledge that there are potential alternative causal interpretations of the positive association between board connectedness to institutional investors and the speed of price discovery for the firm. One possibility is that our measures of board connectedness are correlated with some unobserved or omitted firm characteristic that is associated with price discovery. For

[1] Some examples include Ball and Brown (1968), Ball and Kothari (1991), Healy and Palepu (2001).

example, well-connected board members may prefer to sit on the boards of firms with more analyst following.

Our analysis extends and complements a recent body of research that investigates novel, disguised types of insider trading by informed institutions. Cohen et al. (2007) documents that portfolio managers place larger bets on connected firms and perform significantly better on these holdings relative to other holdings. Bushman et al. (2010) finds that insider trading by institutional lenders is sufficiently pervasive to significantly influence the speed of stock price discovery during regular earnings cycles. However, while most of these studies focus on the outcome of having access to private information form the perspective of the receiver of this information, we are interested in studying the consequences of being connected to institutional investors for the firm itself.

This paper also contributes to the research regarding the relation between earnings and returns by providing empirical evidence that stock prices anticipate earnings information the higher the number of connections that the firm shares with institutional investors.

The structure of the paper is as follows. Section 2 provides a summary of the related literature, Section 3 discusses data and measurement choices, Sections 4 and 5 present the research design and results, and Section 6 concludes and presents directions for future research.

5.2 Related literature

Our work connects three main strands of research: a growing literature on the role of board connections in the transfer of relevant corporate information, the body of work analyzing indirect forms of insider trading, and the literature on determinants of timely price discovery.

The strand of the role of board connections literature most connected to our study is the body of work exploring different dimensions of the economic impact of shared board directorates for the firm. These studies propose that networks built by shared board directorates represent channels through which information is communicated and resources are exchanged for the connected organizations. However, there is no clear theoretical prediction of the consequences of being well-connected for the firm. Some potential benefits of well-connected boards could be: (1) better access to information about industry trends or market conditions; (2) a comparative advantage in making strategic decisions; or (3) access to a mechanism of value-enhancing innovations transmission (Larcker et al. (2013)).

Being a well-connected board could also adversely affect the firm. For example, the boardroom networks could promote value-decreasing practices, like options backdating (Bizjak et al. (2009)). Another possibility is that members who hold board positions in multiple companies exert less intensive monitoring on each of the companies (Core et al. (1999)). Larcker et al. (2013) takes a first step in resolving this ambiguity and studies the net economic effect of board's well-connectedness; the main take-away from the study is that well-connectedness is associated with better firm performance. We extend these findings by building a measure of *board well-connectedness with institutional investors*, and analyze the impact of this basic centrality measure on the price discovery process around quarterly earnings announcements.

Insider trading has long received increased attention both from research and regulators in the last decades. Because of the potential to undermine investor confidence in the integrity of the security markets, regulators have enforced insiders to publicly disclose their trades within maximum two days from their trading. Interestingly, regulators have been increasingly concerned with insider

trading violations beyond the typical situation where insiders themselves trade based on private information about the prospects of their company. In the U.S., the SEC's Rule 10b5-2 deals with the misappropriation of information based on non-business relationships; that is, the disclosure of material private information to anybody else who can take advantage of such opportunities also falls under the illegal insider trading umbrella.

In the recent years, the finance literature has increasingly focused on potential channels of information flow that could facilitate such indirect insider trading opportunities. Mehta and Reeb (2014) analyze the so-called "shadow trading", representing situations where insiders of a firm enjoy potential opportunities to profitably trade or disseminate private information about their business partners or competitors (target firms). Their evidence indicates that target firms experience a significant increase in symptoms of informed trading activity prior to the release of private information by a business partner or competitor.

In the loan syndicate literature, Bushman et al. (2010) provides compelling evidence that institutional lenders systematically exploiting confidential syndicate information via trading in the equity market. Similarly, Ivashina and Sun (2011) directly examine the stock trading patterns of specific institutional investors that also hold syndicated loans in their portfolio at the time of loan renegotiations. They document that institutional managers who participate in loan renegotiations trade in the same company's stock after the loan renegotiation and outperform other managers.

As for the price discovery literature, Butler et al. (2007) finds that financial reporting frequency affects the speed with which accounting information is reflected in security prices. Twedt (2016) analyzes the role of dissemination of guidance news in the price discovery process following the announcement of management earnings guidance. Brogaard et al. (2014) documents that high-frequency traders facilitate price efficiency by trading in the direction of permanent changes. Boehmer and Wu (2013) shows that short sellers play an important role in the price discovery process, as prices are more accurate when short sellers are more active.

A closely related paper to ours is Cohen et al. (2010), that documents that mutual funds that are connected to listed firms via educational links place larger bets and obtain larger profits based on trades in these firms. While their main focus is on the way that connected mutual funds trade, our approach is closer to that of Larcker et al. (2013) in studying the effects of being connected *for the firm itself*: when the firm is well-connected, the price is more efficient around earnings announcements. This preliminary result is consistent with the fact that the more institutional investors are connected to the board of the firm, the more pervasive their insider trading becomes in influencing the speed of price discovery during earnings cycles.

5.3 Data and measurement

5.3.1 Data sources and sample selection

We gather data from the following sources. We collect information about boards' networks from BoardEx of Management Diagnostics Limited, a private research company specialized in social network data on company officials of US public and private companies. The data provides relational links between boards of directors based on the board members they share with other associations, as well as the period over which each connection has been shared.

We gather institutional investors from the SEC's EDGAR database by scanning 13-F filers. Under Securities Exchange Act Section 3(a)(9) and Section 13(f)(5)(A), an institutional investor is an entity that either invests in, or buys and sells, securities for its own account; or a natural person or an entity that exercises investment discretion over the account of any other natural person or entity. Currently, only managers with over $100 million under their control are required to file, but others they may also do so voluntarily. EDGAR provides the name and the CIK identifier for all institutional investors in their records; however, BoardEx only reports a CIK identifier for listed companies, therefore for insuring the reliability of our match between the data in EDGAR and BoardEx, we resume our sample to those institutional investors that are public and can be matched by CIK code[2].

We obtain earnings announcement dates, firm characteristics and stock data from Compustat Quarterly and CRSP. We match the observations in BoardEx and EDGAR 13-F filers with Compustat and CRSP, and additionally require each firm to have a minimum number of two connections to institutional investors between 2000-2014. The final sample consists of 227 firm-quarter observations with complete data.

5.3.2 Construction of board centrality measure

Using BoardEx, we construct an undirected and unweighted measure of board centrality that counts shared directorates between a firm and an institutional investor. Shared directorates are defined as two organizations (a public firm and an institutional investor) that share at least one board member.

BoardEx offers information about the composition of the committees of firms, including the role each individual holds within the committees and the starting and end date of their appointment. We compute a *degree centrality* measure of the board to institutional investors as the sum of the number of connections that the board of directors has through all of its members to firms that are identified in EDGAR as being a 13-F filer: ***NConnections***.

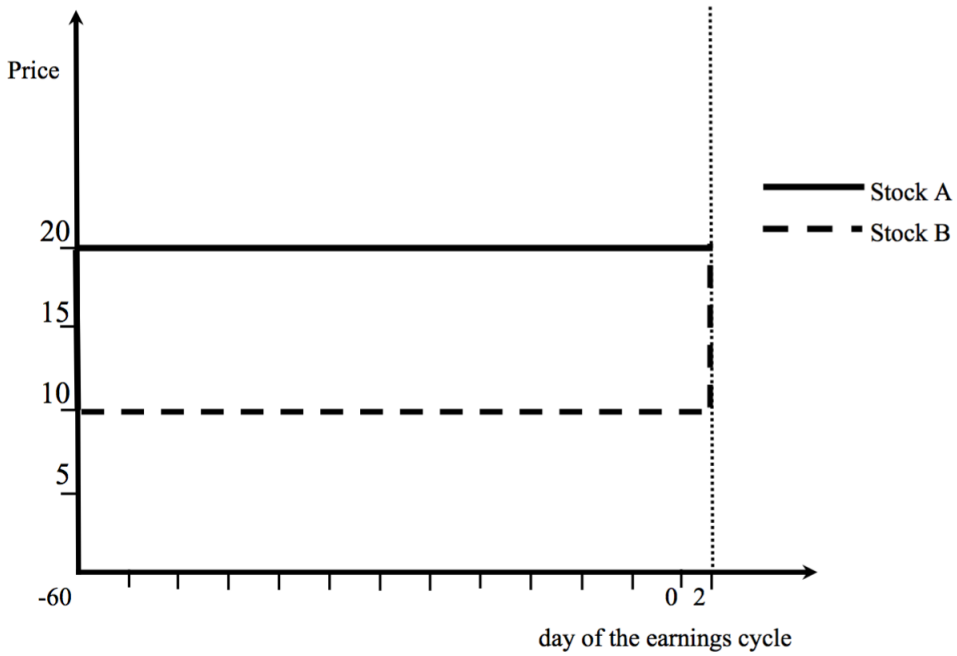
5.3.3 Estimating the timeliness of price discovery

The concept of "timeliness" can be conceptualized in two distinct ways: intraperiod and long-horizon timeliness (Butler et al. (2007)). The first of them, intraperiod timeliness (IPT), reflects the speed with which earnings information is impounded into prices over a given period. This concept is more closely related to the metric of Ball and Brown (1968). The long-horizon timeliness measures how much of the period's earnings explain, or are explained, by contemporaneous returns (Beaver et al. (1980); Beaver et al. (1997)).

Our understanding of the price discovery concept is in line with the first of these two approaches, given that we are interested in the speed of earnings-based price formation over quarterly earnings cycles. Like Ball and Brown (1968), Bushman et al. (2010) and Butler et al. (2007), we focus on the timeliness of price discovery with respect to accounting earnings information. In this sense, we compute an individual intraperiod timeliness metric for each firm-quarter (IPT). This measure captures the speed of earnings-based price formation during the days (-60, +2) around

[2]In order to increase our sample, we intend to manually match the two databases by the institutional investor's name in the following versions of the paper.

Figure 5.1: Example of *IPT* computation



earnings announcements dates. Specifically, we compute a metric similar to Beekes and Brown (2007) and measure timeliness as the average absolute difference between the log of the price in day m=-60 and the log of the price in day m=2 around the earnings announcement date (m=0):

$$IPT = \sum_{m=-60}^{2} \frac{|ln(P_m) - ln(P_2)|}{63} \tag{5.1}$$

As it can be noticed, this measure of firm-level *IPT* does not use information about the individual firm's earnings; instead, earnings information will indirectly affect prices. Following this definition, the lower the value of IPT, the less time it takes to discover price, or the more timely the price discovery process is.

To illustrate the intuition behind our measure of timeliness, assume we have two stocks, A and B[3]. In the case of stock A, assume the price evolves from 10 to 20 by the end of day -60, and it maintains the same value until the last day of our earnings cycle, day 2 (the solid line in *Figure 1*). Therefore, no value-relevant information was disclosed after the first of the 63 days in our earnings cycle.

For stock B, assume the price is 10 throughout the entire earnings cycle, and it reaches the value 20 only in the last day of our cycle, day m=2 (the dashed line in *Figure 5.1*). In this case, all value-relevant information was previously unavailable and is only discovered after the earnings announcement date. Based on the formula (5.1), IPT_A has a lower value than IPT_B, and stock A is more timely than B in its price discovery process.

[3]Example and figure similar to those in Beekes and Brown (2007).

5.3.4 Descriptive statistics

Table 5.1 presents the distribution of the connected firms in our sample by year. As it can be seen, as much as 28 observations are in 2001, when the minimum number of connections was 2 and the maximum 14 with an average of 4.04 connections per firm.

[Insert Table 5.1 about here]

Tables 5.2 and 5.3 show the characteristics of the firm-quarters in our sample. The observations in the below median value of connectedness have a higher mean and median of IPT than those above median; this is consistent with our expectation that the more connections a firm shares with institutional investors, the more timely its price discovery process is. Observations in the above-median group seem to be slightly larger, have lower book-to-market values and lower profitability than those below the median.

[Insert Tables 5.2 and 5.3 about here]

The correlation matrix in Table 5.4 shows that the intraperiod timeliness measure and the centrality measure are negatively correlated, consistent with our prediction. IPT is negatively correlated with size (consistent with Beekes et al. (2007)) and profitability, and positively related with book-to-market.

[Insert Table 5.4 about here]

5.4 Empirical analysis

In order to test our hypothesis, we estimate the following regression:

$$IPT_{it} = \beta_0 + \beta_1 NConnections_{it} + \beta_2 Controls_{it} + \varepsilon \tag{5.2}$$

The coefficient of interest is β_1, which we predict to be negative and significant. Note that price discovery is more timely the lower the *IPT* value is. The controls we include in our specification are size, book-to-market and ROA. All variables are presented in *Appendix A*.

5.5 Results

Table 5.5 reports regression results for the timeliness model estimated by Ordinary Least Squares.

[Insert Table 5.5 about here]

Model (1) presents OLS results without controls, while Models (2)-(4) include controls. In all specifications, industry and quarter indicators are included. White-adjusted standard errors are reported to control for heteroskedasticity. As predicted, the higher the number of connections with institutional investors, the more timely the price discovery process is, as it is reflected by the negative and significant coefficient β_1. Note that when value-relevant information is impounded into shares prices on a more timely manner, the *IPT* metric is closer to zero.

5.6 Conclusion and future developments of the paper

In this paper we provide preliminary evidence of the association between the number of shared directorates between a firm and institutional investors and the speed of price discovery for the firm. Documenting this relation represents the first step in identifying a channel through which confidential information flows from firms to institutional investors.

In order to test our main hypothesis, we use a sample of firms connected to institutional investors and regress the intraperiod timeliness against a measure of board centrality. Our result is robust to the inclusion of industry and quarter indicators, as well as of a series of controls. Results of this analysis are consistent with our main hypothesis, indicating that more central boards have more timely price discovery processes during earnings cycles. However, in order to rule out alternative explanations that could be consistent with our findings, there are few potential developments for this paper.

First, at this point we only include in our analysis firms connected to publicly listed institutional investors, as they are the only ones BoardEx provides a CIK code for. We can obtain a broader sample by manually matching by name institutional investors in BoardEx with institutional investors that are listed as 13-F filers in EDGAR.

Importantly, we see the result presented in this paper as preliminary evidence of a broader, more insightful network study of the effect that information flows has on the speed of price discovery. Specifically, it would be interesting to track information flow that might affect price discovery in the case of business partners or competitors in future versions of this work.

Second, it would be useful to study potential intraperiod timeliness differences between a sample of firms connected to institutional investors (treatment group) and a sample of firms connected to other institutions according to BoardEx. This setting build on the premise that firms well-connected to other organizations (like, for example, charity organizations) do not have similar price discovery levels as those well-connected to institutional investors; this difference would come as a result of institutional investors' higher likelihood to trade on private information than other organizations.

Third, deriving a portfolio-level intraperiod timeliness measure would be extremely insightful. As Bushman et al. (2010) specifies, employing a portfolio-level analysis would average away the random news arrivals that make firm-period measures in regression analysis extremely noisy. For example, similar to Bushman et al. (2010), we can measure IPT for a portfolio of firm-quarter observations as a curve that plots, for each day during the 63-days earnings cycle, the cumulative buy-and-hold abnormal portfolio return up to that day, scaled by the cumulative buy-and-hold abnormal return for the entire cycle. We would compute this measure for the portfolio comprised of the firm-quarter observations corresponding to the firms that are less connected to institutional investors, and for the portfolio of the most connected firm-quarters. Finally, comparing these the IPT measure for the two portfolio would provide compelling evidence supporting our main hypothesis.

Finally, information can flow in predictable ways throughout a network. Up to this point, we employ only a degree centrality measure for the size of connections between firms and institutional investors, where a firm and an institutional investor have a common board member. However, this approach could be extended to other centrality measures that capture the way in which a public firm can be connected to an institutional investor. For example, the closeness centrality represents how easily a board can reach another board through interlocking directorates; or betweenness centrality, capturing the importance of a board in connecting other board with each other (Larcker et al. (2013)).

Overall, the results presented by this paper are consistent with the hypothesis that being better connected to institutional investors allows for faster price discovery process. This finding is in line with the recent interest in the finance and accounting literature regarding the role played by networks as channels of private information transfer; while in order to rule out alternative explanations, additional tests must be performed, this framework provides a rich setting for examining what are the consequences of being well-connected with institutions able to trade on private information about the firm.

5.6 Appendix A. Variable definitions

Book-to-market: firms book value divided by the market value of common equity at the end of the fiscal year.

NConnections: the number of connections of a firm to institutional investors through shared directorates. In order for a firm to be connected to an institutional investor, they have to share minimum a board member.

Market Equity: the share price at the end of the fiscal year times the number of shares outstanding.

ROA: income before extraordinary items scaled by total assets.

Size: the logarithm of market equity.

IPT (intraperiod timeliness): the timeliness of price discovery with respect to accounting earnings information. In we compute a firm-level intraperiod timeliness metric for each firm-quarter (IPT). This measure captures the speed of earnings-based price formation during the days (-60, +2) around earnings announcements dates. Specifically, we compute a metric similar to Beekes and Brown (2007) and measure timeliness as the average absolute difference between the log of the price in day m=-60 and the log of the price in day m=2 around the earnings announcement date (m=0):

$$IPT = \sum_{m=-60}^{2} \frac{|ln(P_m) - ln(P_2)|}{63} \tag{5.3}$$

Following this definition, the lower the value of IPT, the less time it takes to discover price, or the more timely the price discovery process is.

5.6 Tables

Table 5.1: Distribution of connected firms by year

	2000	2001	2002	2003	2004	2005	2006	2007
N	19	28	15	18	15	24	22	14
Mean	4.84	4.04	5.33	3.89	2.93	4.04	3.95	5.93
Min	2	2	2	2	2	2	2	2
Max	30	14	14	11	10	11	9	19
	2008	2009	2010	2011	2012	2013	2014	*Total*
N	10	10	15	14	12	11	1	*228*
Mean	4.10	4.10	4.33	4.93	3.83	3.18	2	
Min	2	2	2	2	2	2	2	
Max	11	13	13	22	8	5	2	

This table presents the distribution of the connected firms in our sample by year. For example, 19 of our observations are distributed in 2000; the minimum number of connections of a firm with an institutional investor was 2, the maximum was 30, and the mean 4.84 connections per firm.

Table 5.2: Descriptives of firm-quarters

	N	Mean	SD	Median	Min	Max
IPT	227	0.13	0.14	0.08	0.00	0.78
NConnections	228	4.23	3.53	3.00	2.00	30
Size	228	6.09	2.31	6.15	0.25	13.51
BTM	227	0.68	1.08	0.49	-3.82	13.73
ROA	228	0.00	0.13	0.00	-0.53	1.70

This table presents the correlation matrix of the variables used in this paper. See *Appendix A* for the definitions of the variables.

Table 5.3: Characteristics of firm-quarters above and below median values of *NConnected*

Panel A. Firm-quarters below median of connectedness measure

	N	Mean	SD	Median	Min	Max
IPT	131	0.14	0.14	0.09	0.01	0.78
NConnections	132	2.33	0.47	2	2	3
Size	132	5.94	2.24	5.89	0.25	13.51
BTM	131	0.73	1.27	0.49	-0.24	13.73
ROA	132	0.01	0.16	0.00	-0.53	1.70

Panel B. Firm-quarters above median of connectedness measure

	N	Mean	SD	Median	Min	Max
IPT	96	0.13	0.13	0.08	0.00	0.72
NConnections	96	6.84	4.19	6.00	4.00	30
Size	96	6.29	2.40	6.36	1.45	13.09
BTM	96	0.61	0.77	0.49	-3.82	4.29
ROA	96	-0.01	0.08	0.00	-0.45	0.09

This table presents the descriptive statistics of the main variables used in this paper. See *Appendix A* for the definitions of the variables.

Table 5.4: Correlation matrix

	IPT	NConnections	Size	BTM	ROA
IPT	1				
NConnections	-0.0681	1			
Size	-0.2972	0.0634	1		
BTM	0.1337	-0.1208	-0.0660	1	
ROA	-0.0381	-0.0607	0.0905	-0.0250	1

This table presents the correlation matrix of the variables used in this paper. See *Appendix A* for the definitions of the variables.

Table 5.5: OLS results. Dependent variable: *IPT (intraperiod timeliness)*

	(1)	(2)	(3)	(4)
NConnections	-0.0065***	-0.0053**	-0.0048*	-0.0049*
	(-2.75)	(-2.08)	(-1.83)	(-1.82)
Size		-0.0131**	-0.0135**	-0.0138**
		(-2.42)	(-2.60)	(-2.60)
BTM			0.0490**	0.0490**
			(2.15)	(2.14)
ROA				0.0324
				(0.54)
Constant	0.2322*	0.2609**	0.2415*	0.2431*
	(1.86)	(1.99)	(1.87)	(1.87)
R^2	0.4115	0.4427	0.4603	0.4608
N	227	221	220	220
Industry indicator	Yes	Yes	Yes	Yes
Quarter indicator	Yes	Yes	Yes	Yes

This table presents regression results based on the following model:
$IPT_{it} = \beta_0 + \beta_1 NConnections_{it} + \beta_2 Controls_{it} + \varepsilon$). See *Appendix A* for the definition of all the variables. The numbers in parentheses are t-Statistics based on White standard errors. All variables are winsorized yearly at 0.5% level.
*,**, *** denote statistical significance at 10%, 5% and 1% level, respectively.

6

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