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# Through the Grapevine: The Effect of CFO Network Centrality on Financial Reporting Quality *

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## Abstract

Being centrally positioned within a network affords easier access to information and resources and also entails a higher reputation cost. However, network centrality can also facilitate the transfer of poor accounting practices and lead to weak governance. We find that firms with CFOs who enjoy higher levels of network centrality have lower discretionary accounting accruals and a lower likelihood of restating their financial statements or engaging in accounting frauds. These firms also have a lower likelihood of internal control weakness and a higher level of accounting conservatism. Further analyses indicate that high-centrality CFOs are better at handling complex accounting issues, such as revenue recognition, and that the positive effect of CFO network centrality on accounting quality is more pronounced for firms with a high litigation risk. Using the propensity score matching technique and change analysis, we also provide evidence that our results are unlikely to be endogenously driven by firm characteristics. Overall, our evidence is consistent with CFOs using their central positions in a network to access information and resources to improve the quality of financial reporting and to protect their personal reputations.

***Keywords*:** CFO Network, Financial Reporting Quality, Earnings Management, Internal Control Quality, Restatement

***JEL classification*:** G30, G41

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# 葡萄藤蔓：首席财务官网络中心度对于财务报告质量的影响


## 摘要

社会网络中的中心位置可以更容易地获取信息和资源，并且同时承担着更大的声誉成本。但是，网络的中心位置也可以帮助不良会计实践的传播，导致更差的公司治理。本文发现，首席财务官的社会网络位置越中心，公司进行应计制的盈余管理的可能性越低，公司进行财务重述或者财务欺诈的可能性也越低。此外，这些公司披露内控缺陷的可能性也更小，并且具有更高的会计稳健性。进一步的研究发现，首席财务官的社会网络位置越中心，越有助于其处理较为复杂的会计业务：如收入确认。在公司面临较高的诉讼风险时，社会网络位置对于财务报告质量的正面作用更加显著。利用倾向性打分匹配法和变化分析法，本文发现，上述结果受到公司特征等因素的内生性干扰的可能性较小。综上，本文发现，首席财务官利用其网络的中心位置，可以更好地获取信息和资源，改善公司的财务质量，以保护自身的声誉。

## I. Introduction

This paper examines the effect of CFO network centrality on financial reporting quality. The major aspect of a CFO's job is to monitor the functioning of the financial reporting system (Graham *et al.*, 2013; Jiang *et al.*, 2010). Networking is also an important aspect of a CFO's job as executives use their networks to obtain the necessary information, ideas, knowledge, and resources to facilitate business decisions (El-Khatib *et al.*, 2015). However, there is little literature examining the relationship between a CFO's network and the organisation's financial reporting quality; this paper aims to provide the initial evidence of this relationship.

A network works as a "pipe" through which information and resources flow (Freeman, 1978; Fernandez and Weinberg, 1997; Borgatti and Halgin, 2011). A network enables a manager to access information promptly, thus facilitating information flow and decision-making (Burt, 1997). In this paper, we use network centrality, which reflects an individual's position in a hierarchical business network, to measure a CFO's ability to efficiently obtain information and resources through the network. Generally, an individual who resides higher in the network's hierarchy has better access to private information and resources (Jackson, 2010; El-Khatib *et al.*, 2015).

Positions of high centrality within their networks can help CFOs improve accounting quality within their firms. First, a more central position in a network leads to better access to trustworthy and credible information and facilitates inter-firm knowledge transfers (Chua and Petty, 1999; Sheng *et al.*, 2011), including accounting-related information such as regulatory changes and accounting practices. Second, network centrality determines an executive's ability to access resources to influence economic decision-making (Banerjee *et al.*, 2012; Larcker *et al.*, 2013); for example, high-centrality CFOs can use their connections and resources to identify and hire high-quality accounting staff. Third, CFOs embedded in networks have incentives to maintain high financial reporting quality to protect their reputations. A more central position in a network makes it more likely that bad behaviours become known, and the ensuing cost to one's reputation can be severe (Burt *et al.*, 2013; Dierickx and Cool, 1989). Thus, well-connected CFOs have incentives to avoid accounting irregularities by maintaining high financial reporting quality.

On the other hand, studies also suggest that having a well-connected CFO may adversely affect a firm's financial reporting quality. First, a central position in a network also facilitates the transfer of knowledge on poor accounting practices. For example, Chiu *et al.* (2013) and Brown and Drake (2014) show that boards with interlocking networks facilitate the transfer of knowledge on accounting irregularities and tax avoidance. Second, executives with high network centrality possess more resources and power, which might protect them from the discipline of the market and internal governance (El-Khatib *et al.*, 2015; Khanna *et al.*, 2015). For example, Khanna *et al.* (2015) show that appointment-based executive connectedness is associated with weak corporate governance and more corporate frauds. Fogel *et al.* (2014)

also suggest that the power associated with residing higher in the hierarchy of a network can make top executives come to believe in their own infallibility, causing value-destroying managerial decisions. Because weak corporate governance is linked to low financial reporting quality (e.g. Klein, 2002), this line of literature suggests that CFO centrality can lead to poor financial reporting quality. Therefore, due to the competing views discussed above, we do not provide a prediction on the association between CFO centrality and financial reporting quality.

Using board data from RiskMetrics, we construct an undirected and unweighted CFO network. Following previous papers (e.g. Jackson and Rogers, 2007; Larcker *et al.*, 2013; El-Khatib *et al.*, 2015), we measure CFO network centrality in four dimensions: degree, closeness, "betweenness", and eigenvector. Degree centrality captures the number of connections and is measured by the number of first-degree links between a CFO and other individuals (nodes). Closeness centrality captures how closely a CFO is tied to other individuals and is measured by the number of steps in the shortest path between a CFO and other individuals. Betweenness centrality captures the importance of a CFO in the network and is measured by the number of times a CFO lies in the path between a pair of other individuals. The fourth measure, eigenvector centrality, captures whether a CFO's connections are also well connected, as measured by the number of times a CFO is directly linked to other well-connected individuals. These four measures have been used extensively in social network theory to capture the fundamentals of social network centrality. Higher rankings in these measures indicate that a CFO is in a better position to access information and resources and is more powerful in influencing decision-making. Finally, we use principal component analysis to combine the four individual centrality measures into one aggregate measure: *Network Score*.

Using a large sample of 12,817 firm-year observations from 1996 to 2011, we comprehensively examine the effect of CFO network centrality on financial reporting quality. Following Hutton *et al.* (2009), Lennox and Pittman (2010), McGuire *et al.* (2012), and Davidson *et al.* (2015), we employ several measures of financial reporting quality: discretionary accruals, accounting restatement, and accounting-related SEC enforcement action. First, we find that CFO centrality is negatively related to the absolute value of discretionary accruals estimated using the modified Jones model (Jones, 1991; DeFond and Jiambalvo, 1994; Dechow *et al.*, 1995). The result is economically significant: Moving from the first quartile to the third quartile of *Network Score* is associated with a 7.46% decrease in the sample mean of the absolute value of discretionary accruals. Second, we also find that CFO centrality is associated with a lower likelihood of making an accounting restatement or being subject to an accounting-related SEC enforcement action.

In additional tests, we also investigate the effect of CFO network centrality on two additional measures of financial reporting quality: internal control weakness and accounting conservatism. First, internal control plays a critical role in ensuring the reliability of reporting

quality (Kim *et al.*, 2011; Costello, *et al.*, 2011). We find that firms with CFOs in more central network positions are less likely to have an internal control weakness under Section 404 of the Sarbanes-Oxley Act (SOX 404). This is consistent with strong internal control leading to higher accounting reporting quality for firms with high CFO centrality. Second, conservative accounting represents an important aspect of financial reporting quality as it requires higher verification standards for recognition of gains than it does for recognition of losses, which leads to a more timely recognition of loss (Watts, 2003a, 2003b). Our results show that CFO centrality is associated with greater accounting conservatism as measured by a firm-year level accounting conservatism score (*C-score*) (Khan and Watts, 2009).

We also conduct two additional analyses to explore the mechanism through which CFO network centrality affects financial reporting quality. First, our analysis indicates that CFO network centrality reduces the likelihood of committing a GAAP violation on revenue recognition. Because revenue recognition involves complex accounting rules and has been subject to numerous rule changes (Peterson, 2012; Aier *et al.*, 2005), this is consistent with more centrally positioned CFOs having better information access to deal with and adapt to complex accounting rules. Second, our results show that the effect of CFO centrality on reducing discretionary accruals and information opacity is more pronounced when the firm is in a litigious industry. This is consistent with the reputation concern of high-centrality CFOs in litigious industries.

Both CFO centrality and financial reporting quality can be affected by some common variables; for example, large, better-performing firms are likely to hire CFOs who are well connected, and these firms are also likely to have higher accounting quality. We employ the propensity score matching method to mitigate this endogeneity issue. In the first-stage regression, we identify the determinants of CFO centrality and compute the propensity of having a high-centrality CFO for each firm-year. We then match firm-years with high CFO centrality with firm-years that have a similar propensity but low CFO centrality. We then repeat our previous tests using this matched sample, and the results are robust. This suggests that our results are not likely to be driven by the common determinants of CFO centrality and financial reporting quality. In addition, our change analysis shows that increases (decreases) in CFO centrality lead to increases (decreases) in financial reporting quality. This change analysis suggests that changes in financial reporting quality are at least partially driven by the changes in CFO centrality, helping to further alleviate the endogeneity concern.

Our paper makes at least two major contributions to the literature. First, financial reporting quality can be influenced by many factors, including board characteristics (Klein, 2002), firm characteristics, auditor quality (Becker *et al.*, 1998), ownership structure (Ramalingegowda and Yu, 2012), and regulations (Cohen *et al.*, 2008). Recent studies have started to recognise CFO characteristics as a major determinant of financial reporting quality (e.g. Aier *et al.*, 2005; Ge *et al.*, 2011; Schrand and Zechman, 2012; Graham *et al.*, 2013).

Network centrality captures individuals' ability to access information and resources through their networks (Borgatti and Halgin, 2011; Larcker *et al.*, 2013; El-Khatib *et al.*, 2015) and thus is a very important CFO characteristic. We empirically show that CFO centrality is significantly and positively associated with financial reporting quality, as demonstrated by multiple measures, including the level of discretionary accruals, accounting restatement, accounting-related SEC enforcement action, internal control weakness, and accounting conservatism.

Second, we contribute to the developing literature on network centrality. Larcker *et al.* (2013) show that high network centrality leads to information advantage and better firm performance. El-Khatib *et al.* (2015) show that CEOs centrally positioned in their networks are more resourceful, powerful, and influential, leading to value-decreasing merger and acquisition (M&A) deals consistent with private gain and an entrenchment effect. We extend this network centrality literature to financial reporting quality. Our results suggest that CFOs in more central positions are concerned about their reputation costs, and they use their information and resource advantages to promote a stronger internal control environment and higher financial reporting quality. Our results indicate that CFO network centrality is beneficial to a firm's financial reporting practice.

The remainder of the paper proceeds as follows. Section II summarises prior research and develops the hypothesis. Section III describes the sample selection process, variables measurement, and research design. Section IV reports our descriptive statistics and regression results, and section V presents the results of additional analyses. Section VI discusses the robustness tests. Section VII concludes the study.

## II. Literature Review and Hypothesis Development

Traditional network theory views the network as a pipe through which information and resources flow (Freeman 1978; Fernandez and Weinberg 1997; Borgatti and Halgin, 2011). Burt (1997) argues that a network enables managers to access information promptly, thus facilitating information flow. Specifically, managers are embedded in a social network which provides a corresponding context for managers' decisions. For example, using data on Fortune 500 companies, Davis (1991) finds that networks of interlocked board members facilitated the spread of the poison pill in the 1980s. Similarly, Chua and Petty (1999) find that director interlocks are positively correlated with the spread of ISO quality accreditation. In addition, Bizjak, Lemmon, and Whitby (2009) find that interlocked directors are associated with a higher likelihood of stock option backdating. Regarding network centrality, the better position of executives in a network provides firms with better access to trustworthy and credible information in an inexpensive way, thus facilitating knowledge transfer among firms (Sheng *et al.*, 2011). El-Khatib *et al.* (2015) argue that a better centrality position enables CEOs to collect information more efficiently, and they find that CEOs leverage their information

advantage to execute more M&A deals. Larcker *et al.* (2013) argue that market, industry, and firm-level information can flow through interlocked directors in a boardroom network and consequently benefit firms whose directors are at the central position of the network; they find these firms have abnormal market returns and higher future return-on-assets growth and are more likely to beat analyst forecasts.

Well-connected CFOs can help improve accounting quality. First, high-centrality CFOs have an information advantage and can learn valuable accounting practice from their peers through the network (Chua and Petty, 1999; Sheng *et al.*, 2011); for example, well-connected CFOs may obtain information on how to comply with complicated accounting regulations in an efficient manner. Omer, Shelley, and Tice (2018) argue that boards with high centrality have an information advantage and thus their firms have higher earnings quality. Godigbe, Chui, and Liu (2018) show that director networks facilitate the transmission of poor accounting practice, especially for firms with poor financial performance and when directors are motivated by equity compensation. While both of the above papers focus on the centrality of the board of directors, our paper focuses on the CFO, the central figure in a firm's financial reporting.[3] A CFO is in charge of the firm's daily financial reporting activities and is ultimately responsible for the truthfulness of the financial statements as a co-signee (Jiang *et al.* 2010). Thus, a CFO's executive role differs from the monitoring role of directors, and our paper presents evidence to supplement that based on director networks.

Second, CFOs in central positions have more resources and are more powerful and influential in decision-making (Banerjee *et al.*, 2012; Larcker *et al.*, 2013). These CFOs can use their resources, power, and influence to improve accounting practices; for example, they can use their connections and resources to identify and hire high-quality treasurers and other accounting staff.

Third, CFOs in central network positions have higher reputation concerns. The emerging network literature posits that networks could fertilise social capital and enhance the reputation mechanism. Burt *et al.* (2013) point out that if an individual is deeply embedded in a network, it is very likely that his/her bad behaviour will be promptly discovered by other individuals in the network; this creates a reputation cost for undesirable behaviour, thus facilitating trust and collaboration. Because higher centrality in a network indicates that the CFO is embedded in the network more deeply, bad behaviour (e.g. accounting irregularities) will be more easily detected and the consequences of such behaviour could be more severe. As reputation and social capital are costly to build and rebuild (Dierickx and Cool 1989), CFOs in central network positions have the incentive to maintain higher financial quality to protect their reputations. For example, Cao *et al.* (2012) investigate the effects of reputation and financial reporting quality and find that firms with a higher reputation have higher financial reporting

[3] In our robustness test, we find robust results after controlling for director centrality.

quality.[4]

On the other hand, studies also suggest that having a well-connected CFO may adversely affect a firm's accounting quality. First, a central position in a network also facilitates knowledge transfer of poor accounting practice. This argument is supported by current evidence on the "contagion effects" in peer firms (Gleason *et al.*, 2008) and interlock in the board room (Chiu *et al.*, 2013; Brown and Drake, 2014). For example, Chiu *et al.* (2013) and Brown and Drake (2014) show that a board interlock network facilitates the transfer of knowledge on accounting irregularity and tax avoidance. In particular, Brown and Drake (2014) posit that a network facilitates tax-related sharing among interlocked board members. Second, the power associated with residing higher in a network's hierarchy might also entrench the top executives, leading to undesirable behaviours (Fogel *et al.*, 2014; El-Khatib *et al.*, 2015; Khanna *et al.*, 2015). Specifically, El-Khatib *et al.* (2015) argue that the resources and power provided by occupying high central positions can protect CEOs from the discipline of the market and internal governance. They show that in M&A deals, high-centrality CEOs are associated with greater value losses to both the acquirer and the combined firms, and these CEOs can avoid the discipline of the market and internal governance even if they make poor decisions. Khanna *et al.* (2015) demonstrate that appointment-based executive connections with board members increase the likelihood of committing corporate fraud. The above literature suggests that CFO centrality weakens governance monitoring. Because weak corporate governance is linked to low financial reporting quality (e.g. Klein, 2002), this in turns suggests that higher CFO centrality can lead to lower financial reporting quality.

On the basis of the above competing views regarding the association between CFO centrality and financial reporting quality, we propose the following hypothesis in null form:

**H1: CFO network centrality is not correlated with financial reporting quality.**

## III. Research Design

### 3.1 CFO Network Centrality

We obtain the names and prior employment information of executives and directors of US public companies from the RiskMetrics database for the years 1996 to 2011. Because the business network is more relevant to corporate policy making (Chidambaran *et al.*, 2012;

[4] Furthermore, trust and collaboration improve financial reporting quality. Burt *et al.* (2013) points out that network centrality creates reputation cost, which in turn generates trust and collaboration. Garrett *et al.* (2014) examine the relationship between intra-organisational trust and financial reporting quality. They find that trust is positively correlated with accruals quality and negatively related to restatement and material internal control weakness since trust improves information sharing and information production. This suggests that the trust and collaboration stemming from high CFO centrality (e.g. trust and collaboration between CEO, directors, and internal and external auditors) can improve financial reporting quality.

Fogel *et al.*, 2014), when measuring CFO network, we use the network built from overlaps in employment instead of from non-business connections such as alumni, country clubs, or other social activities. Following El-Khatib *et al.* (2015), we assume that once formed, the business connection will last until one of the parties dies. Using the RiskMetrics database, we construct an undirected and unweighted CFO network.

Following Larcker *et al.* (2013) and El-Khatib *et al.* (2015), we measure CFO network centrality in four dimensions: degree, closeness, betweenness, and eigenvector. Degree centrality is measured by the number of first-degree links between node (i) and node (j).

$$Degree_i = \sum_{i \neq j} x_{i,j} \ ,$$

where $x_{i,j}$ denotes, for a given node i in this network, an indicator that node (i) and node (j) are linked through interlocked employment (Borgatti and Halgin, 2011).

Closeness centrality is measured by the number of steps in the shortest path between node (i) and node (j). N refers to the size of the network.

$$Closeness_i = \frac{n-1}{\sum_{i \neq j} s(i,j)} \ ,$$

where $s(i,j)$ denotes the number of steps in the shortest path between node (i) and node (j) for a given CFO i in this network (Borgatti and Halgin, 2011).

Betweenness centrality is measured by the average proportion of paths between node (k) and node (j) through node (i).

$$Betweenness_i = \sum_{i \neq j : i \notin \{k,j\}} \frac{g_{kj(i)}/g_{kj}}{(n-1)(n-2)/2} \ ,$$

where $g_{kj}$ equals the number of shortest paths between nodes k and j, and $g_{kj(i)}$ equals the number of shortest paths through which k and j are linked via i (Borgatti and Halgin, 2011).

The fourth measure of centrality is eigenvector, which captures how connected a well-connected node is to other well-connected nodes. Eigenvector centrality is solved by satisfying the following equation:

$$\lambda E' E = E' A E,$$

where E is an eigenvector of the matrix of connection A, and $\lambda$ is its eigenvalue (Borgatti and Halgin, 2011). These four measures have been used extensively in social network theory to capture the fundamentals of social network centrality. Following prior literature (Larcker *et al.*, 2013), we standardise the centrality measures by converting them to their quartile ranks: *Degree_quartile*, *Closeness_quartile*, *Betweenness_quartile*, and *Eigenvector_quartile.* Since each of these measures captures different characteristics of centrality, we employ a principal component analysis to collapse these four percentile-rank-based individual measures into an aggregate network measure: *Network Score.* A higher *Network Score* indicates higher network centrality.

## 3.2 Financial Reporting Quality

Following Hutton *et al.* (2009), Lennox and Pittman (2010), McGuire *et al.* (2012), and Davidson *et al.* (2015), we employ the following measures to capture financial reporting quality: discretionary accruals, information opacity, accounting restatement, and accounting-related SEC enforcement action.

First, following prior literature (Jones, 1991; DeFond and Jiambalvo, 1994; Dechow *et al.*, 1995), we use the absolute value of discretionary accruals (*DA*) estimated from the modified Jones model as a measure of financial reporting quality. *DA* also captures the accruals-based earnings management.

Second, following McGuire *et al.* (2012), we use whether a firm makes an accounting restatement (*Restatement*) to infer its financial reporting quality. To ensure that the restatements in our sample are substantial restatements, we further require a restatement to be followed by a security lawsuit for it be included in our sample. Lastly, similar to Lennox and Pittman (2010) and Davidson *et al.* (2015), we use whether a firm is subject to an accounting-related SEC enforcement action as disclosed by the SEC's Accounting and Auditing Enforcement Releases (AAERs) to measure its financial reporting quality.

## 3.3 Sample Selection

We report the sample selection in Panel A of Table 1. Our initial sample consists of 19,310 firm-year observations in the RiskMetrics database from the years 1996 to 2011. We exclude 2,860 observations in the financial services and utility industries and exclude 750 and 2,883 observations with insufficient data to calculate accounting quality measures and control variables, respectively. This yields a final sample of 12, 817 firm-year observations.

We obtain corporate governance measures from RiskMetrics, financial data from Compustat, stock return data from CRSP, and auditor information from Audit Analytics.

Panel B of Table 1 shows the sample distribution by year. The sample size is relatively stable over time, ranging from a low of 578 observations in 1998 to a high of 1,046 observations in 2010. Regarding percentage distribution, the yearly sample distribution ranges from 4.51% to 8.16%.

**Table 1 Sample Selection, Sample Distribution, and Descriptive Statistics**

**Panel A: Sample Selection**

The sample consists of 12,817 firm-year observations from 1998 to 2011. Variable definitions are provided in the Appendix.

| | Number of firm-years |
|---|---|
| Total firm-year observations with director data available on the RiskMetrics database from 1998 to 2011 | 19,310 |
| *Less:* | |
| financial services and utility industries | (2,860) |
| insufficient data to calculate accounting quality variables | (750) |
| insufficient data to calculate control variables | (2,883) |
| Final sample | 12,817 |

**Panel B: Distribution by Year**

| Year | Freq. | Per cent | Cum. |
|---|---|---|---|
| 1998 | 578 | 4.510 | 4.51 |
| 1999 | 827 | 6.450 | 10.96 |
| 2000 | 854 | 6.660 | 17.63 |
| 2001 | 929 | 7.250 | 24.88 |
| 2002 | 897 | 6.990 | 31.87 |
| 2003 | 966 | 7.540 | 39.40 |
| 2004 | 1,019 | 7.950 | 47.35 |
| 2005 | 1,024 | 7.990 | 55.34 |
| 2006 | 984 | 7.680 | 63.02 |
| 2007 | 813 | 6.340 | 69.37 |
| 2008 | 868 | 6.770 | 76.14 |
| 2009 | 1,020 | 7.960 | 84.10 |
| 2010 | 1,046 | 8.160 | 92.26 |
| 2011 | 992 | 7.740 | 100 |
| Total | 12,817 | 100 | |

## 3.4 Regression Model

We examine the effect of CFO network centrality on the financial reporting quality using the following equation:

$$\begin{aligned} \textit{Financial Reporting Quality} = {} & \beta_0 + \beta_1 \textit{Centrality} + \beta_2 \textit{CFO Age} + \beta_3 \textit{CFO Female} \\ & + \beta_4 \textit{Busy Board} + \beta_5 \textit{Independent Ratio} \\ & + \beta_6 \textit{Independent Ownership} + \beta_7 \textit{SIZE} + \beta_8 \textit{ROA} \\ & + \beta_9 \textit{BIG4} + \beta_{10} \textit{LEV} + \beta_{11} \textit{CR} + \textit{Industry} + \textit{Year} + \varepsilon, \end{aligned} \quad (1)$$

where *Financial Reporting Quality* separately refers to one of the different proxies for financial reporting quality described previously (e.g. *DA*, *Restatement*, and *AAER*). *Centrality* refers to one of our five CFO centrality measures: *Degree_quartile*, *Closeness_quartile*, *Betweenness_quartile*, *Eigenvector_quartile*, and *Network Score*.

Prior studies (Anderson *et al.*, 2004; Agrawal and Chadha, 2005; Aier *et al.*, 2005; Jiang *et al.*, 2010; Ge *et al.*, 2011; Huang *et al.* 2012; Falato *et al.* 2014) show that CFO characteristics and corporate governance are important determinants of financial reporting quality. We control for CFO age (*CFO Age*), CFO gender (*CFO Female*), directors' busyness (*Busy Board*), percentage of independent board directors (*Independent Ratio*), and independent directors' equity incentive (*Independent Ownership*). Following prior literature (Cohen *et al.* 2008; Hutton *et al.* 2009; McGuire *et al.* 2012, and Lawrence *et al.* 2011), we control for several firm characteristics related to financial reporting quality: the natural logarithm of market value of equity (*SIZE*) to control for firm size, return-on-assets (*ROA*) to control for financial performance, whether the auditor is from a Big 4 firm (*BIG4*) to control for auditor quality, leverage ratio (*LEV*) to control for financial risk, and current ratio (*CR*) to control for operating risk. Detailed variable definitions are provided in the Appendix.

## IV. Descriptive Statistics and Empirical Results

### 4.1 Descriptive Statistics

Table 2 presents the descriptive statistics for the research sample. The mean (median) of *DA* is 0.042 (0.031). These statistics are consistent with those in prior studies (e.g. McGuire *et al.*, 2012). Respectively, 0.8% and 1.4 % of the observations involve accounting restatements and SEC enforcement action, and 4.2% of the observations report at least one material internal control weakness in our sample. The descriptive statistics of the network measures are similar to those in El-Khatib *et al.* (2015) and Larcker *et al.* (2013). Specifically, the means of *Degree*, *Closeness*, *Betweenness*, and *Eigenvector* are 47.960, 0.241, 0.011, and 0.009, respectively.

**Table 2 Descriptive Statistics**

| *Variables* | N | Mean | Std. | P25 | Median | P75 |
|---|---|---|---|---|---|---|
| **Financial Reporting Quality** | | | | | | |
| *DA* | 12,817 | 0.042 | 0.040 | 0.014 | 0.031 | 0.057 |
| *Restatement* | 12,817 | 0.008 | 0.088 | 0.000 | 0.000 | 0.000 |
| *AAER* | 9,759 | 0.014 | 0.117 | 0.000 | 0.000 | 0.000 |
| *ICW* | 7,336 | 0.042 | 0.201 | 0.000 | 0.000 | 0.000 |
| *Number of ICW* | 7,336 | 0.073 | 0.599 | 0.000 | 0.000 | 0.000 |
| *C_score* | 12,817 | 0.084 | 0.081 | 0.031 | 0.078 | 0.131 |
| **Network Centrality** | | | | | | |
| *Degree* | 12,817 | 47.960 | 385.100 | 7.000 | 12.000 | 21.000 |
| *Closeness* | 12,817 | 0.241 | 0.096 | 0.193 | 0.241 | 0.281 |
| *Betweenness* | 12,817 | 0.011 | 0.129 | 0.000 | 0.000 | 0.001 |
| *Eigenvector* | 12,817 | 0.009 | 0.053 | 0.000 | 0.001 | 0.006 |
| *Degree_quartile* | 12,817 | 2.439 | 1.128 | 1.000 | 2.000 | 3.000 |
| *Closeness_quartile* | 12,817 | 2.509 | 1.119 | 2.000 | 3.000 | 4.000 |
| *Betweenness_quartile* | 12,817 | 2.164 | 1.308 | 1.000 | 1.000 | 3.000 |
| *Eigenvector_quartile* | 12,817 | 2.498 | 1.117 | 2.000 | 2.000 | 3.000 |
| *Network Score* | 12,817 | 4.763 | 1.836 | 3.295 | 4.856 | 6.428 |
| **Corporate Governance** | | | | | | |
| *CFO Age* | 12,817 | 53.500 | 6.961 | 49.000 | 53.000 | 58.000 |
| *CFO Female* | 12,817 | 0.067 | 0.251 | 0.000 | 0.000 | 0.000 |
| *Busy Board* | 12,817 | 0.136 | 0.343 | 0.000 | 0.000 | 0.000 |
| *Independent Ratio* | 12,817 | 0.719 | 0.155 | 0.625 | 0.750 | 0.846 |
| *Independent Ownership* | 12,817 | 0.013 | 0.068 | 0.001 | 0.003 | 0.008 |
| **Firm characteristics** | | | | | | |
| *SIZE* | 12,817 | 7.655 | 1.544 | 6.558 | 7.508 | 8.638 |
| *ROA* | 12,817 | 0.053 | 0.084 | 0.024 | 0.055 | 0.094 |
| *BIG4* | 12,817 | 0.962 | 0.191 | 1.000 | 1.000 | 1.000 |
| *LEV* | 12,817 | 0.255 | 0.214 | 0.078 | 0.238 | 0.373 |
| *CR* | 12,817 | 2.281 | 1.695 | 1.232 | 1.819 | 2.701 |

Regarding CFO characteristics and corporate governance measures, we find that the average CFO age is 53.50, 6.7% of firm-years have female CFOs, and the average percentage of independent directors on the boards is 71.9%. On average, independent directors hold 0.013% of common shares outstanding. As for firm characteristics, the average firm has a *SIZE* of $1,763.562 million, an *ROA* of 5.3 percent, leverage of 25.5%, and a current ratio of 2.281, and 96.2% of the firm-years are audited by Big 4 audit firms.

## 4.2 Main Results

### 4.2.1 CFO Network Centrality and Accruals Earnings Management

Table 3 presents the regression results relating CFO network centrality to the absolute value of discretionary accruals (*DA*) estimated from the modified Jones model (Jones, 1991; DeFond and Jiambalvo, 1994; Dechow *et al.*, 1995). In column (1), the coefficient of *Degree_quartile* is negative and significant ($\beta_1$ = -0.003, t value = -4.94), indicating a negative association between CFO's degree centrality and the level of accruals earnings management. The results in columns (2) to (4) are consistent with the result in column (1), showing negative correlations between other measures of CFO centrality (i.e. closeness, betweenness, and eigenvector) and accruals earnings management. As shown in column (5), using the comprehensive measure of CFO network centrality, *Network Score*, we also find that CFO network centrality is associated with less accruals earnings management ($\beta_1$= -0.001, t-value= -4.38). As for economic significance, moving from the first quartile (3.295) to the third quartile (6.428) of *Network Score* is associated with a decrease of 0.31% in discretionary accruals (*DA*), equivalent to 7.46 % of the sample mean of *DA*. Regarding the control variables, we find *CFO Age* and *Size* to be negatively associated with the discretionary accruals.

**Table 3 CFO Network Centrality and Accruals Earnings Management**

This table presents the OLS estimation results relating CFO network centrality to accruals earnings management. All regressions include the industry and year fixed effects. To conserve space, we do not report the coefficient estimates for these dummy variables. The t-statistics reported in parentheses are based on standard errors that are clustered by firm. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. All variables are defined in the Appendix.

| | (1) *DA* | (2) *DA* | (3) *DA* | (4) *DA* | (5) *DA* |
|---|---|---|---|---|---|
| *Degree_quartile* | -0.003*** | | | | |
| | (-4.94) | | | | |
| *Closeness_quartile* | | -0.003*** | | | |
| | | (-3.83) | | | |
| *Betweenness_quartile* | | | -0.001*** | | |
| | | | (-2.74) | | |
| *Eigenvector_quartile* | | | | -0.002*** | |
| | | | | (-3.37) | |
| *Network Score* | | | | | -0.001*** |
| | | | | | (-4.38) |

| | | | | | |
|---|---|---|---|---|---|
| *CFO Age* | -0.000*** | -0.000*** | -0.000*** | -0.000*** | -0.000*** |
| | (-3.78) | (-4.04) | (-3.88) | (-4.04) | (-3.80) |
| *CFO Female* | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 |
| | (0.44) | (0.21) | (0.20) | (0.26) | (0.43) |
| *Busy Board* | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 |
| | (0.48) | (0.44) | (0.28) | (0.56) | (0.65) |
| *Independent Ratio* | 0.001 | 0.001 | -0.001 | 0.001 | 0.001 |
| | (0.25) | (0.20) | (-0.18) | (0.19) | (0.31) |
| *Independent Ownership* | -0.004 | -0.004 | -0.004 | -0.004 | -0.004 |
| | (-1.36) | (-1.39) | (-1.31) | (-1.45) | (-1.39) |
| *SIZE* | -0.001** | -0.001*** | -0.002*** | -0.001*** | -0.001*** |
| | (-2.43) | (-3.13) | (-3.71) | (-3.18) | (-2.66) |
| *ROA* | 0.003 | 0.003 | 0.005 | 0.004 | 0.003 |
| | (0.38) | (0.47) | (0.71) | (0.58) | (0.43) |
| *BIG4* | 0.003 | 0.003 | 0.002 | 0.002 | 0.002 |
| | (1.09) | (1.11) | (0.91) | (0.85) | (1.00) |
| *LEV* | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| | (0.40) | (0.31) | (0.36) | (0.36) | (0.37) |
| *CR* | 0.001 | 0.001* | 0.001** | 0.001* | 0.001 |
| | (1.54) | (1.79) | (1.97) | (1.82) | (1.64) |
| *Intercept* | 0.071*** | 0.074*** | 0.075*** | 0.076*** | 0.073*** |
| | (3.91) | (4.31) | (4.28) | (4.41) | (4.14) |
| *INDUSTRY & YEAR* | YES | YES | YES | YES | YES |
| No. of observations | 12,817 | 12,817 | 12,817 | 12,817 | 12,817 |
| Adjusted $R^2$ | 0.066 | 0.064 | 0.063 | 0.064 | 0.065 |

### 4.2.2 CFO Network Centrality and Accounting Restatement

To avoid potential measurement errors in accruals earnings management (DeFond and Zhang, 2014), we employ accounting restatement as another measure of financial reporting quality. *Restatement* is an indicator variable that takes the value of one if the firm made an accounting restatement during that year which is followed by a securities class action lawsuit, and zero otherwise.[5]

Table 4 presents the results relating CFO network centrality to accounting restatement in a logit regression. In four out of the five columns, we find negative relations between CFO network centrality and *Restatement* (p-value <0.1). Moving from the first quartile (3.295) to the third quartile (6.428) of *Network Score* is associated with a decrease of 0.6% in the incidence of restatement, equivalent to 75% of the sample mean of *Restatement*.[6]

**Table 4 CFO Network Centrality and Accounting Restatement**

This table presents the logistic estimation results relating CFO network centrality to accounting restatement (*Restatement*). All regressions include the industry and year fixed effects. To conserve space, we do not report the coefficient estimates for these dummy variables. The z-statistics reported in parentheses are based on standard errors that are clustered by firm. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. All variables are defined in the Appendix.

[5] Some restatements are technical and do not reflect accounting irregularity, while the restatements that are followed by a securities class action are more likely to be caused by managerial misbehavior (Palmrose and Scholz, 2004).

[6] $1 - e^{-0.006264} = 0.6\%$, where -0.006264 = (6.428-3.295)*(-0.001).

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | *Restatement* | *Restatement* | *Restatement* | *Restatement* | *Restatement* |
| *Degree_quartile* | -0.002** | | | | |
| | (-2.45) | | | | |
| *Closeness_quartile* | | -0.002** | | | |
| | | (-1.98) | | | |
| *Betweenness_quartile* | | | -0.000 | | |
| | | | (-0.64) | | |
| *Eigenvector_quartile* | | | | -0.003*** | |
| | | | | (-3.00) | |
| *Network Score* | | | | | -0.001** |
| | | | | | (-2.32) |
| *CFO Age* | -0.000** | -0.000** | -0.000** | -0.000** | -0.000** |
| | (-2.05) | (-2.18) | (-2.16) | (-2.15) | (-2.04) |
| *CFO Female* | -0.005 | -0.005* | -0.006* | -0.005 | -0.005 |
| | (-1.62) | (-1.71) | (-1.75) | (-1.60) | (-1.61) |
| *Busy Board* | 0.004 | 0.004 | 0.004 | 0.005* | 0.004 |
| | (1.46) | (1.45) | (1.31) | (1.69) | (1.55) |
| *Independent Ratio* | 0.008 | 0.008 | 0.006 | 0.009 | 0.008 |
| | (1.33) | (1.32) | (1.07) | (1.54) | (1.38) |
| *Independent Ownership* | -0.010 | -0.011 | -0.010 | -0.0110 | -0.0100 |
| | (-0.91) | (-0.92) | (-0.91) | (-0.95) | (-0.92) |
| *SIZE* | 0.003*** | 0.003*** | 0.002*** | 0.003*** | 0.003*** |
| | (4.67) | (4.46) | (4.09) | (4.81) | (4.62) |
| *ROA* | -0.005 | -0.004 | -0.002 | -0.005 | -0.004 |
| | (-0.45) | (-0.40) | (-0.21) | (-0.47) | (-0.44) |
| *BIG4* | 0.004 | 0.004 | 0.003 | 0.003 | 0.004 |
| | (0.87) | (0.87) | (0.78) | (0.73) | (0.82) |
| *LEV* | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 |
| | (1.49) | (1.44) | (1.46) | (1.47) | (1.47) |
| *CR* | 0.001** | 0.001** | 0.001*** | 0.001** | 0.001** |
| | (2.31) | (2.45) | (2.61) | (2.33) | (2.35) |
| *Intercept* | -0.014 | -0.012 | -0.011 | -0.011 | -0.013 |
| | (-0.74) | (-0.62) | (-0.55) | (-0.55) | (-0.66) |
| *INDUSTRY & YEAR* | YES | YES | YES | YES | YES |
| No. of observations | 12,817 | 12,817 | 12,817 | 12,817 | 12,817 |
| Pseudo $R^2$ | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |

### 4.2.3 CFO Network Centrality and SEC Enforcement Action

When the SEC brings investigative and prosecutorial actions against a firm for violations of SEC and federal rules, these actions are summarised in the AAERs. From the AAERs, we collect actions that are related to accounting issues for the sample period 1998 to 2011. Such actions are generally considered as an indication of accounting frauds committed by firms (Lennox and Pittman, 2010; Davidson *et al.*, 2015).

Table 5 presents the logit estimation between CFO network centrality and SEC enforcement action. All network centrality measures except *Betweenness_quartile* are significantly negatively related to the likelihood of the firm being subject to an SEC

enforcement action. Moving from the first quartile (3.295) to the third quartile (6.428) of *Network Score* is associated with a decrease of 0.6% in the incidence of SEC enforcement action, equivalent to 42.86% of the sample mean of *AAER*.[7]

**Table 5 CFO Network Centrality and Accounting Fraud**

This table presents the logistic estimation results relating CFO network centrality to SEC enforcement action as disclosed by SEC Accounting and Auditing Enforcement Releases (AAERs). All regressions include the industry and year fixed effects. To conserve space, we do not report the coefficient estimates for these dummy variables. The z-statistics reported in parentheses are based on standard errors that are clustered by firm. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. All variables are defined in the Appendix.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | *AAER* | *AAER* | *AAER* | *AAER* | *AAER* |
| *Degree_quartile* | -0.003** | | | | |
| | (-2.28) | | | | |
| *Closeness_quartile* | | -0.007*** | | | |
| | | (-4.83) | | | |
| *Betweenness_quartile* | | | -0.000 | | |
| | | | (-0.16) | | |
| *Eigenvector_quartile* | | | | -0.004*** | |
| | | | | (-2.67) | |
| *Network Score* | | | | | -0.002*** |
| | | | | | (-2.83) |
| *CFO Age* | -0.001*** | -0.001*** | -0.001*** | -0.001*** | -0.001*** |
| | (-3.34) | (-3.07) | (-3.53) | (-3.50) | (-3.31) |
| *CFO Female* | -0.015*** | -0.015*** | -0.016*** | -0.015*** | -0.014*** |
| | (-3.86) | (-4.02) | (-4.08) | (-3.91) | (-3.81) |
| *Busy Board* | 0.002 | -0.003 | 0.002 | 0.003 | 0.002 |
| | (0.46) | (-0.68) | (0.58) | (0.82) | (0.60) |
| *Independent Ratio* | -0.016*** | -0.012** | -0.017*** | -0.015*** | -0.015*** |
| | (-3.22) | (-2.44) | (-3.44) | (-3.11) | (-3.09) |
| *Independent Ownership* | -0.005 | -0.005 | -0.005 | -0.006 | -0.005 |
| | (-0.49) | (-0.47) | (-0.49) | (-0.52) | (-0.49) |
| *SIZE* | 0.010*** | 0.011*** | 0.009*** | 0.011*** | 0.011*** |
| | (7.11) | (7.70) | (6.92) | (7.17) | (7.20) |
| *ROA* | -0.031 | -0.029 | -0.029 | -0.031 | -0.031 |
| | (-1.56) | (-1.47) | (-1.47) | (-1.57) | (-1.58) |
| *BIG4* | -0.018* | -0.020** | -0.018* | -0.018* | -0.018* |
| | (-1.88) | (-2.04) | (-1.90) | (-1.91) | (-1.89) |
| *LEV* | 0.006 | 0.003 | 0.007 | 0.006 | 0.005 |
| | (0.76) | (0.41) | (0.94) | (0.77) | (0.71) |
| *CR* | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| | (1.21) | (1.32) | (1.39) | (1.18) | (1.16) |
| *Intercept* | -0.007 | -0.005 | -0.002 | -0.003 | -0.006 |
| | (-0.45) | (-0.32) | (-0.13) | (-0.18) | (-0.37) |
| *INDUSTRY & YEAR* | YES | YES | YES | YES | YES |
| No. of observations | 9,759 | 9,759 | 9,759 | 9,759 | 9,759 |
| Pseudo $R^2$ | 0.024 | 0.026 | 0.024 | 0.024 | 0.024 |

[7] $1 - e^{-0.006266} = 0.6\%$, where -0.006266 = (6.428-3.295)*(-0.002).

Overall, the results in tables 3 to 6 show that firms led by higher centrality CFOs have lower accruals-based earnings management, lower information opacity, and a lower likelihood of accounting restatements or facing an SEC enforcement action.

## V. Additional Tests

In this section, first we test the association between CFO centrality and two other additional measures of financial reporting quality: internal control weakness and accounting conservatism.

### 5.1 CFO Network Centrality and Internal Control Weakness

Internal control "provides reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes" (PCAOB, 2007[8]) and thus is critical to financial reporting quality. The existence of a material internal control weakness can indicate that the internal control is ineffective (PCAOB, 2007). Starting from the year 2002, the Sarbanes-Oxley Act (SOX) mandates public firms to disclose their material internal control weaknesses. The accounting and auditing literature has extensively examined the economic consequences of material internal control weaknesses, including financial reporting quality (Ashbaugh-Skaife *et al.* 2008), market reaction (Zhang, 2007), management forecast (Feng *et al.*, 2009), and cost of capital (Kim *et al.*, 2011; Costello *et al.*, 2011). In our paper, we examine the relation between CFO network centrality and internal control quality by constructing the following equation:

$$\begin{aligned} ICW \text{ or } Number\ of\ ICW = {} & \beta_0 + \beta_1 Network\ Score + \beta_2 CFO\ Age \\ & + \beta_3 CFO\ Female + \beta_4 Busy\ Board \\ & + \beta_5 Independent\ Ratio + \beta_6 Independent\ Ownership \\ & + \beta_7 SIZE + \beta_8 Firm\ Age + \beta_9 M\&A \\ & + \beta_{10} Sale\ Growth + \beta_{11} Inventory\ Ratio \\ & + \beta_{12} Foreign + \beta_{13} Number\ of\ Segments \\ & + Industry + Year + \varepsilon, \end{aligned} \quad (2)[9]$$

where *ICW* is an indicator variable that equals one if the auditor attests that a firm's internal control is ineffective under SOX 404 and zero otherwise. *Number of ICW* refers to the number of *ICW*. Following previous studies (Doyle *et al.*, 2007; Ashbaugh-Skaife *et al.*, 2008), we include several determinants of internal control weakness in the regression: firm size (*SIZE*), firm age (*Firm Age*), M&A activities (*M&A*), firm growth (*Sale Growth*), the inventory of total assets (*Inventory Ratio),* foreign transaction (*Foreign*), and the number of business

[8] PCAOB Auditing Standard No. 5—An Audit of Internal Control Over Financial Reporting That Is Integrated with An Audit of Financial Statements.

[9] Except for testing *ICW* or *Number of ICW*, all other regressions use the same set of control variables as used in Equation (1).

segments (*Number of Segments*).

Table 6 reports the results of CFO network centrality and internal control quality with *ICW* and *Number of ICW* as the dependent variables in columns (1) and (2), respectively. We find that the coefficients on *Network Score* are negative and significant ($\beta_1$=-0.003 and -0.098, t-value=2.29 and -3.43, respectively, under columns (1) and (2)). The results indicate that firms with a high-centrality CFO are less likely to have a material internal control weakness.

**Table 6 CFO Network Centrality and Internal Control Weakness**

This table presents the logistic / OLS estimation results relating CFO network centrality to internal control weakness. All regressions include the industry and year fixed effects. To conserve space, we do not report the coefficient estimates for these dummy variables. The t- or z-statistics reported in parentheses are based on standard errors that are clustered by firm. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. All variables are defined in the Appendix.

| | (1) | (2) |
|---|---|---|
| | *ICW* | *Number of ICW* |
| *Network Score* | -0.003** | -0.098*** |
| | (-2.29) | (-3.43) |
| *CFO Age* | 0.000 | 0.008 |
| | (0.13) | (1.29) |
| *CFO Female* | 0.005 | -0.216 |
| | (0.50) | (-1.10) |
| *Busy Board* | -0.040** | -1.526*** |
| | (-2.42) | (-3.00) |
| *Independent Ratio* | -0.005 | 0.051 |
| | (-0.27) | (0.14) |
| *Independent Ownership* | -0.027 | -1.935 |
| | (-0.53) | (-1.35) |
| *SIZE* | -0.008 | 0.368*** |
| | (-1.22) | (2.79) |
| *Firm Age* | -0.000 | 0.166* |
| | (-0.02) | (1.91) |
| *M&A* | -0.001 | 0.374*** |
| | (-0.17) | (3.85) |
| *Sale Growth* | -0.009 | -0.471** |
| | (-0.92) | (-2.02) |
| *Inventory Ratio* | 0.051* | 1.887*** |
| | (1.84) | (3.52) |
| *Foreign* | 0.021*** | 0.607*** |
| | (4.35) | (6.32) |
| *Number of Segments* | 0.002* | 0.072*** |
| | (1.81) | (3.06) |
| *Intercept* | 0.119** | -2.924*** |
| | (2.40) | (-2.66) |
| *INDUSTRY & YEAR* | YES | YES |
| No. of observations | 7,336 | 7,336 |
| Adjusted/Pseudo $R^2$ | 0.046 | 0.184 |

## 5.2 CFO Network Centrality and Accounting Conservatism

Accounting conservatism is an important measure of financial reporting quality. Specifically, accounting conservatism demands a higher verification requirement for recognition of gains than for recognition of losses (Watts 2003a, 2003b). This timely recognition of losses can mitigate agency conflicts by reducing the information asymmetry between managers and monitors (Ball and Shivakumar, 2005).

Following Khan and Watts (2009), we estimate firm-year level *C-score* as a measure of accounting conservatism. Table 7 presents the results relating CFO network centrality to accounting conservatism. The coefficient on *Network Score* is positive and significant ($\beta_1$=0.001, t-value=3.91), suggesting firms with high-centrality CFOs employ more conservatism in their financial reporting. In other words, these firms tend to report their losses in a timelier manner.

**Table 7 CFO Network Centrality and Accounting Conservatism**

This table presents the OLS estimation results relating CFO network centrality to accounting conservatism. The dependent variable is conservatism score (*C-score*). All regressions include the industry and year fixed effects. To conserve space, we do not report the coefficient estimates for these dummy variables. The t-statistics reported in parentheses are based on standard errors that are clustered by firm. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. All variables are defined in the Appendix.

| | *C-score* |
|---|---|
| *Network Score* | 0.001*** |
| | (3.91) |
| *CFO Age* | 0.000 |
| | (1.17) |
| *CFO Female* | -0.000 |
| | (-0.20) |
| *Busy Board* | 0.002 |
| | (1.02) |
| *Independent Ratio* | 0.005 |
| | (1.30) |
| *Independent Ownership* | -0.032*** |
| | (-6.46) |
| *SIZE* | -0.029*** |
| | (-53.88) |
| *ROA* | -0.035*** |
| | (-4.97) |
| *BIG4* | 0.009** |
| | (2.29) |
| *LEV* | 0.063*** |
| | (16.04) |
| *CR* | -0.001*** |
| | (-3.09) |
| *Intercept* | 0.212*** |
| | (13.30) |
| *INDUSTRY & YEAR* | YES |
| No. of observations | 12,817 |
| Adjusted $R^2$ | 0.724 |

Next, in the second part of this section, we examine the mechanisms through which CFO network centrality leads to higher accounting quality. First, we examine whether better access to information and resources for high-centrality CFOs allows them to better handle complicated accounting issues such as revenue recognition. Second, we examine whether the reputation concern for high-centrality CFOs propels them to further improve accounting quality in litigious industries.

## 5.3 CFO Network Centrality and Misstatement of Revenue Recognition

Complex accounting issues can contribute to accounting misstatements because the complexity can cause accounting preparers to err (Dechow and Dichev, 2002; Cox, 2005; Peterson, 2012). Revenue recognition is considered to be one of the most complicated accounting issues, and there is a lack of comprehensive guidelines and much uncertainty about both the transactions and accounting standards (Palmrose *et al.*, 2004; Peterson, 2012).

**Table 8 CFO Network Centrality and Restatement relating to Revenue Recognition**

This table presents the logistic estimation results relating CFO network centrality to misstatement of revenue recognition. All regressions include the industry and year fixed effects. To conserve space, we do not report the coefficient estimates for these dummy variables. The z-statistics reported in parentheses are based on standard errors that are clustered by firm. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. All variables are defined in the Appendix.

| | *Restatement_RR* |
|---|---|
| *Network Score* | -0.151*** |
| | (-2.84) |
| *CFO Age* | 0.001 |
| | (0.06) |
| *CFO Female* | -0.234 |
| | (-0.62) |
| *Busy Board* | 0.235 |
| | (0.99) |
| *Independent Ratio* | 0.097 |
| | (0.16) |
| *Independent Ownership* | -0.942 |
| | (-0.38) |
| *SIZE* | 0.042 |
| | (0.58) |
| *ROA* | -1.184 |
| | (-1.36) |
| *BIG4* | 0.510 |
| | (0.86) |
| *LEV* | 0.577 |
| | (1.39) |
| *CR* | -0.017 |
| | (-0.28) |
| *Intercept* | -5.251*** |
| | (-4.46) |
| *INDUSTRY & YEAR* | YES |
| No. of observations | 9,759 |
| Pseudo $R^2$ | 0.019 |

Consequently, whether a firm errs in revenue recognition can reflect its CFO's ability to handle complex accounting issues. Because CFOs with high network centrality are likely to have better information and resources in handling complex accounting issues, we expect these firms are less likely to misstate their revenue.

Table 8 presents the results estimating the relation between CFO network centrality and misstatement of revenue recognition. The dependent variable is *Restatement_RR*, which equals one if a firm misstates its revenue recognition (as indicated by a restatement involving revenue recognition during that firm year) and zero otherwise. We find *Network Score* to be significantly negatively related to the likelihood of committing an accounting restatement for revenue recognition. We also conduct test for these restatements that are not related to revenue recognition, and the untabulated results indicate that the effect of CFO network centrality is not significant on these restatements. This suggests that high-centrality CFOs are better at handling complex accounting standards such as revenue recognition, probably due to their better access to information and resources; for example, when revenue recognition rules change, these CFOs are more likely to adjust to the new rules better.

## 5.4 CFO Network Centrality and Accounting Quality Conditional on Litigation Risk

As discussed previously, high-centrality CFOs are more concerned about their reputations (Dierickx and Cool, 1989; Burt *et al.*, 2013). When a firm becomes a defendant in a securities litigation, the CFO is often named as a defendant and his/her personal reputation will be negatively affected. In other words, CFOs with high network centrality stand to lose more by becoming a defendant given their high reputation cost. Because litigious industries are associated with a higher likelihood of lawsuit incidents, we expect that high-centrality CFOs in these industries would be more motivated to monitor their firms' financial reporting practices in order to avoid any potential lawsuit.

**Table 9 CFO Network Centrality and Accounting Quality: Litigation Risk**

This table presents the OLS estimation results relating CFO network centrality to accounting quality conditional on litigation risk. The dependent variable is conservatism score (*C-score*). All regressions include the industry and year fixed effects. To conserve space, we do not report the coefficient estimates for these dummy variables. The t-statistics reported in parentheses are based on standard errors that are clustered by firm. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. All variables are defined in the Appendix.

| | *DA* |
|---|---|
| *Network Score* | -0.001*** |
| | (-3.20) |
| *Litigation Risk* | 0.014*** |
| | (4.66) |
| *Network Score*Litigation Risk* | -0.001** |
| | (-2.04) |
| *CFO Age* | -0.000*** |
| | (-2.60) |

| | |
|---|---|
| *CFO Female* | -0.000 |
| | (-0.06) |
| *Busy Board* | 0.001 |
| | (0.82) |
| *Independent Ratio* | -0.003 |
| | (-0.91) |
| *Independent Ownership* | 0.005 |
| | (0.30) |
| *SIZE* | -0.001** |
| | (-2.21) |
| *ROA* | 0.009* |
| | (1.74) |
| *BIG4* | 0.001 |
| | (0.49) |
| *LEV* | 0.004** |
| | (2.03) |
| *CR* | 0.001*** |
| | (3.55) |
| *Intercept* | 0.064*** |
| | (11.50) |
| *INDUSTRY & YEAR* | YES |
| No. of observations | 7882 |
| Adjusted $R^2$ | 0.037 |

Table 9 presents the results of testing the impact of CFO centrality on financial accounting quality conditional on the litigation risk. We define *Litigation Risk* as an indicator variable that equals one for high litigation risk industries and zero otherwise (Francis *et al.*, 1994). We use *Litigation Risk* as the dependent variable in Equation (1). We continue to find significantly negative coefficients on *Network Score*. When we interact *Network Score* with *Litigation Risk*, we find this interaction term carries significantly negative coefficients. This indicates that high-centrality CFOs in litigious industries are associated with higher financial accounting quality, consistent with their reputation concern.

## VI. Robustness Tests

In this section, we use a few tests to alleviate the endogeneity concern that the determinants of having a high-centrality CFO also simultaneously determine the firm's financial reporting quality. These tests include propensity score matching method, change analysis, and controlling for firm fixed effects.

### 6.1 Propensity Score Matching Method

We use the propensity score matching technique to control for the difference in firm characteristics between firms with and without high-centrality CFOs. In the first stage, we set an indicator variable, *High_Network*, which equals one if the firm-year *Network Score* is larger than the sample median and zero otherwise. Then, we regress *High_Network* on all

control variables including industry and year fixed effects in Equation (1). Panel A of Table 10 presents the results of this first-stage analysis. We find that *CFO Age*, *CFO Female*, *Busy Board*, *Independent Ratio*, and *Size* (*ROA*, *CR*) are positively (negatively) associated with high CFO network centrality.

**Table 10 CFO Network Centrality and Accounting Quality: Propensity Score Matching**

This table presents the OLS estimation results relating CFO network centrality to accounting quality by using the propensity score matching method. Panel A presents the first-stage Probit model estimation results. Specifically, the dependent variable in the first stage is *High Network Score*, an indicator variable that equals one if *Network Score* is above the sample median and zero otherwise. We regress *High Network Score* on firm characteristics and use the estimated coefficients from this first-stage model to compute the propensity score for each observation in our sample. We then match each firm-year in the high *Network Score* group with a firm-year in the low *Network Score* group, with the closest propensity score. Panel B reports the OLS results of examining the relation between CFO network centrality and accounting quality using the propensity score matched sample. All regressions include the industry and year fixed effects. To conserve space, we do not report the coefficient estimates for these dummy variables. The t- and z-statistics reported in parentheses are based on standard errors that are clustered by firm *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. All variables are defined in the Appendix.

**Panel A: First Stage Propensity Score Matching**

| | *High Network Score* |
|---|---|
| *CFO Age* | 0.023*** |
| | (7.71) |
| *CFO Female* | 0.672*** |
| | (7.84) |
| *Busy Board* | 0.687*** |
| | (9.50) |
| *Independent Ratio* | 2.023*** |
| | (12.96) |
| *Independent ownership* | -0.056 |
| | (-0.22) |
| *SIZE* | 0.481*** |
| | (29.67) |
| *ROA* | -2.126*** |
| | (-7.91) |
| *BIG4* | 0.158 |
| | (1.32) |
| *LEV* | 0.111 |
| | (1.05) |
| *CR* | -0.167*** |
| | (-9.85) |
| *Intercept* | -7.641*** |
| | (-16.31) |
| *INDUSTRY & YEAR* | YES |
| No. of observations | 12817 |
| Pseudo $R^2$ | 0.170 |

**Panel B: CFO Network Centrality and Accounting Quality: Propensity Score Matched Sample**

| | *DA* |
|---|---|
| *Network Score* | -0.004*** |
| | (-3.38) |
| *CFO Age* | -0.000*** |
| | (-3.99) |
| *CFO Female* | 0.001 |
| | (0.35) |
| *Busy Board* | 0.001 |
| | (0.61) |
| *Independent Ratio* | 0.002 |
| | (0.44) |
| *Independent ownership* | -0.005 |
| | (-0.49) |
| *SIZE* | -0.001* |
| | (-1.93) |
| *ROA* | 0.005 |
| | (0.54) |
| *BIG4* | 0.006* |
| | (1.88) |
| *LEV* | 0.001 |
| | (0.38) |
| *CR* | 0.002*** |
| | (3.24) |
| *Intercept* | 0.077*** |
| | (4.08) |
| *INDUSTRY & YEAR* | YES |
| No. of observations | 7,882 |
| Adjusted $R^2$ | 0.0657 |

In the next step, we calculate the propensity score for each firm-year on the basis of the coefficients from the first-stage regression. Without replacement, we then match each firm-year with a *Network Score* higher than the median with a firm-year with a *Network Score* lower than the median with the closest propensity score. Following Lawrence *et al.* (2011) and Minutti-Meza (2013), we choose 0.03 as our matching caliper. We rerun our previous regressions in the matched sample and find (in Panel B of Table 10) that our main results are still robust. Specifically, after controlling for the propensity of becoming high-centrality CFOs, we still find high CFO centrality to be associated with lower accruals earnings management.

## 6.2 Change Analysis

To further address the endogeneity issue, we explore the causality between CFO centrality and financial reporting quality using change analysis. If CFO centrality indeed influences financial reporting quality, we expect that changes in CFO centrality lead to significant changes in financial reporting quality.

We compute the annual differences in *Network Score*, financial reporting quality measures (i.e. *DA*), and control variables in Equation (1). We then regress the changes in financial reporting quality measures, respectively, on changes in the CFO centrality measures and control variables. Table 11 reports the results. We find that increases (decreases) in CFO centrality increase (decrease) financial reporting quality, as evidenced by the significantly negative coefficients on Δ*Network Score*.

**Table 11 CFO Network Centrality and Accounting Quality: Change Analysis**

This table presents the OLS estimation results relating CFO network centrality to accounting quality using change analysis. The t-statistics reported in parentheses are based on standard errors that are clustered by firm *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. #indicates statistical significance at the 10% level (one-tailed). All variables are defined in the Appendix.

| | Δ*DA* |
|---|---|
| Δ*Network Score* | -0.001# |
| | (-1.43) |
| Δ*CFO Age* | 0.002 |
| | (0.67) |
| Δ*CFO Female* | -0.004 |
| | (-0.60) |
| Δ*Busy Board* | 0.007 |
| | (0.21) |
| Δ*Independent Ratio* | 0.000 |
| | (0.01) |
| Δ*Independent Ownership* | -0.001 |
| | (-0.38) |
| Δ*SIZE* | 0.004 |
| | (1.40) |
| Δ*ROA* | 0.030* |
| | (1.87) |
| Δ*BIG4* | -0.006 |
| | (-0.57) |
| Δ*LEV* | 0.045*** |
| | (5.81) |
| Δ*CR* | 0.003** |
| | (2.28) |
| *Intercept* | -0.007 |
| | (-0.57) |
| *INDUSTRY & YEAR* | YES |
| *Firm Fixed Effect* | YES |
| No. of observations | 11,025 |
| Adjusted $R^2$ | 0.005 |

## 6.3 Firm Fixed Effects

Firm fixed effects purge time-invariant firm characteristics and thus can help alleviate the concern that firm characteristics affect both CFO centrality and accounting reporting quality. Table 12 presents the results after including firm fixed effect in the baseline regression.

We find that *Network Score* continues to be significantly and negatively related to *DA*.[10]

**Table 12 CFO Network Centrality and Accounting Quality: Firm Fixed Effects**

This table presents the OLS estimation results relating CFO network centrality to accounting quality with controlling for firm fixed effects. The t- and z-statistics reported in parentheses are based on standard errors that are clustered by firm. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively. All variables are defined in the Appendix.

| | *DA* |
|---|---|
| *Network Score* | -0.001*** |
| | (-4.38) |
| *CFO Age* | -0.000** |
| | (-2.09) |
| *CFO Female* | 0.000 |
| | (0.19) |
| *Busy Board* | 0.003** |
| | (2.28) |
| *Independent Ratio* | -0.011*** |
| | (-3.16) |
| *Independent Ownership* | -0.005 |
| | (-0.71) |
| *SIZE* | 0.000 |
| | (0.28) |
| *ROA* | 0.018*** |
| | (3.34) |
| *BIG4* | 0.001 |
| | (0.36) |
| *LEV* | 0.015*** |
| | (5.83) |
| *CR* | 0.000 |
| | (0.44) |
| *Intercept* | 0.056*** |
| | (7.67) |
| *INDUSTRY & YEAR* | YES |
| *Firm Fixed Effect* | YES |
| No. of observations | 12,817 |

## 6.4 Control for Audit Committee Network Centrality

We control for the effects of audit committee network centrality. Untabulated results show that our previous results are still robust, indicating that CFO network centrality has incremental effects on financial reporting quality.

## 6.5 Control for CEO and Directors Network Centrality

We control for CEO and director network centrality by including in the main regressions

[10] A few coefficients are shown as zero due to rounding. It is expected that some control variables will carry small coefficients due to the addition of the firm fixed effects.

the first primary component of CEO network centrality and director network centrality scores. We find (in untabulated results) that the main results are still robust, indicating that after controlling for CEO and director network centrality, the effects of CFO network centrality on accounting quality are still significant.

### 6.6 Performance-Adjusted Measure of Discretionary Accruals

Following Kothari *et al.* (2005), we include ROA in the modified Jones model (Dechow *et al.* 1995) and estimate the residuals from this model. We continue to find that our main results are robust.

## VII. Conclusion

While the importance of network centrality and the quality of financial reporting have been widely recognised, to the best of our knowledge, we are the first to examine the association between these two important aspects of a CFO's job. On the basis of a large sample covering the period 1996 to 2010, we find that high CFO network centrality is strongly associated with lower discretionary accruals and a lower likelihood of financial restatement or accounting fraud. We also find that high CFO network centrality is associated with a lower incidence of material internal control weakness. Furthermore, firms with high-centrality CFOs tend to employ more accounting conservatism by being timelier in loss recognition. Additional analyses indicate that high-centrality CFOs are better at handling complex accounting issues such as revenue recognition, and the effect of these CFOs on improving accounting reporting quality is more pronounced in litigious industries. Overall, our evidence is consistent with high-centrality CFOs using their access to information and resources to enhance financial reporting quality to protect their personal reputations.



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## Appendix: Variable Definitions

| | |
|---|---|
| **CFO Network Centrality Characteristics** | |
| *Degree* | Degree centrality is measured by the number of first-degree links between node (i) and node (j). Source: RiskMetrics |
| *Closeness* | Closeness centrality is measured by the number of steps in the shortest path between node (i) and node (j). Source: RiskMetrics |
| *Betweenness* | Betweenness centrality is measured by the average proportion of paths between node (k) and node (j). Source: RiskMetrics |
| *Eigenvector* | Eigenvector centrality is solved by satisfying the following equation: $\lambda E' E = E' AE$ where E is an eigenvector of the matrix of connection A, and λ is its eigenvalue (Borgatti and Halgin, 2011). Source: RiskMetrics |
| *Degree_quartile* | The quartile ranks in *Degree*. Source: RiskMetrics |
| *Closeness_quartile* | The quartile ranks in *Closeness*. Source: RiskMetrics |
| *Betweenness_quartile* | The quartile ranks in *Betweenness*. Source: RiskMetrics |
| *Eigenvector_quartile* | The quartile ranks in *Eigenvector*. Source: RiskMetrics |
| *Network Score* | First principle component of four measures: *Degree_quartile*, *Closeness_quartile*, *Betweenness_quartile*, and *Eigenvector_quartile.* |
| *High Network* | Indicator variable that equals one if the firm-year *Network Score* is larger than the sample median and zero otherwise. |
| **Financial Reporting Quality Measures** | |
| *Discretionary Accruals (DA)* | Absolute value of abnormal accruals estimated using a cross-sectional modified Jones model (DeFond and Jiambalvo, 1994; Dechow *et al.*, 1995). $\frac{Total\_Accrual_t}{TA_{t-1}} = \lambda_1(1/TA_{t-1}) + \lambda_2(\Delta REV_t - \Delta REC_t)/TA_{t-1} + \lambda_3(PPE_t/TA_{t-1}) + \varepsilon_t$ Following Dechow *et al.* (1995), the estimates of $\lambda_1, \lambda_2$ *and* $\lambda_3$ are those obtained from the original Jones model. Total accrual is earnings before extraordinary items and discontinued operations minus the operating cash flows. $\Delta REV_t$ is the change in total revenue from year t-1 to year t. $\Delta REC_t$ is the change in net receivables from year t-1 to year t, and PPE is the gross property, plant, and equipment. |
| *Restatement* | Indicator variable that equals one if the firm made an accounting restatement during that year which is followed by a securities class action lawsuit, and zero otherwise. |

| | |
|---|---|
| *AAER* | Indicator variable that equals one if the firm engaged in AAER fraud, and zero otherwise. |
| *Restatement_RR* | Indicator variable that equals one if the firm made an accounting restatement relating to revenue recognition during that year, and zero otherwise. |
| *ICW* | Indicator variable that equals one if the auditor considers a firm's internal control as not effective under Section 404 of SOX, and zero otherwise. |
| *Number of ICW* | Number of internal control weaknesses under Section 404 of SOX. |
| *C_score* | Following Khan and Watts (2009), we estimate the following model to get firm-year-specific coefficients: $$X_{jt} = \beta_{1t} + \beta_{2t}D_{jt} + \beta_{3t}\left(\mu_{1t} + \mu_2 MV_{jt} + \mu_3 MB_{jt} + \mu_{4t}LEV_{jt}\right) + D_{jt} * R_{jt}\left(\lambda_{1t} + \lambda_{2t}MV_{jt} + \lambda_{3t}MB_{jt} + \lambda_{4t}LEV_{jt}\right) + \left(\sigma_{1t}MV_{jt} + \sigma_{2t}MB_{jt} + \sigma_{3t}LEV_{jt} + \sigma_{4t}D_{jt}MV_{jt} + \sigma_{5t}D_{jt}MB_{jt} + \sigma_{4t}D_{jt}LEV_{jt}\right) + \varepsilon_{jt}$$ More specifically, we calculate C-score as follows: $$\text{C\_score} = \lambda_{1t} + \lambda_{2t}MV_{jt} + \lambda_{3t}MB_{jt} + \lambda_{4t}LEV_{jt}$$ |
| **Corporate Governance** | |
| *CFO Age* | Age of CFO. Source: RiskMetrics |
| *CFO Female* | Indicator variable that equals one if the CFO is female, and zero otherwise. Source: RiskMetrics |
| *Independent Ratio* | Percentage of independent directors on the board. Source: RiskMetrics |
| *Independent Ownership* | Percentage of common shares outstanding held by the independent directors at year-end, including stock options. Source: RiskMetrics |
| *Busy Board* | Indicator variable that equals 1 if the majority of independent directors hold three or more directorships, and zero otherwise. Source: RiskMetrics |
| **Firm-Level Control Variables** | |
| *SIZE* | Natural logarithm of the market value of equity at the end of the year. Source: Compustat |
| *ROA* | Lagged income before extraordinary items (IB) scaled by average lagged total assets (AT). Source: Compustat |
| *BIG4* | Indicator variable that equals one when the client's auditor is a member of the Big 5 (or Big 4 after the exit of Arthur Andersen), and zero otherwise. Source: Compustat |
| *LEV* | Sum of short-term debt (DLC) and long-term debt (DLTT) scaled by lagged total assets (AT). Source: Compustat |
| *CR* | Current assets (ACT) scaled by current liabilities (LCT). Source: Compustat |

| | |
|---|---|
| *M&A* | An indicator variable that equals 1 if the client is involved in mergers or acquisitions (AQC), and 0 otherwise. Source: Compustat |
| *Sale Growth* | Growth in sales (SALES). Source: Compustat |
| *Inventory Ratio* | Inventory divided by lagged assets. Source: Compustat |
| *Foreign* | Indicator variable that equals 1 if the client is involved in foreign exchange income (FCA), and 0 otherwise. Source: Compustat |
| *Number of Segments* | The number of business segments. Source: Compustat |
| *Litigation Risk* | Indicator variable that equals one for high litigation risk industries (SIC 2833-2836; 3570-3577; 7370-7374; 3600-3674; 5200-5961; 8731-8734), and zero otherwise, as defined in Francis *et al.* (1994). Source: Compustat |