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Regulations and Corporate Financial and Investment Policy

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Guest editorial

Regulations and corporate financial and investment policy

The special issue has its primary focus on topics involving regulatory, financial and investment content. The rich mix of empirical papers exploring regulations, practices, models, etc., from the world of business explains how those impact mood and decisions in corporate finance across major markets. The research studies establish several factors that can affect finance in practice and as a discipline ranging from social media to legislations and financial reporting to modeling. These studies contribute to the growing literature on the impact of policy on corporate activities.

The paper by Mishra *et al.* (2019) seeks to understand any possible connection between the appointment of chief financial officer (CFO) and debt-equity choice of a firm. During their research, it was unraveled that an internal candidate, primarily in "value firms," in the CFO position can substantially decrease information asymmetry (IA) leading to lesser risk in market and thereby reduced cost of equity financing. However, in firms with high IA, even internally chosen CFO was found to prefer debt financing due to its "disciplining role."

The relevance of information is further emphasized by Amin *et al.* (2019) in their article that examines the potential role played by social media in the "information dissemination and information generation" when it comes to corporate performance forecasts by analysts. The study reveals that there is no positive responsiveness between the two; in fact a negative relationship has been observed. However, the research confirms that social media's part, as a source of fresh information that can potentially enhance an analyst's accuracy, is increasing.

On the other hand, Guo *et al.* (2019) aim to test "if relative asset purchase values differ" amid single and dual-class purchasers. The results are positive for dual-class purchasers, only for family-controlled firms. The other factors that can impact the gap happen to be dual-class structures, extent of family ownerships and board composition.

On the contrary, in another research, potential impacts due to regulatory changes were studied. Bhabra and Rooney (2019) explore the post Sarbanes-Oxley (SOX) era for possible "changes in the market's assessed value of capital expenditures" and its potential impact(s) on corporate governance in firms. It finds that the market reacted to the regulatory changes by shifting to value assessment which holds consistent with the agency theory. However, although inferences from the study suggest that agency conflicts have decreased after SOX implementation, evidence exists that there are firms that had to shoulder heavy compliance costs and/or witness managers become too disinclined at risk-taking.

The role of legislation has been further studied by Bhabra *et al.* (2019) in their work, covering the history and journey of Canadian Sarbanes-Oxley (popularly referred to as C-SOX or Bill-198) regulation. In their work, they have discussed the causalities that paved the way, among skepticism, for the regulation in Canada. Different aspects regarding the regulation were also studied and compared, where possible, with the US equivalent, i.e. US SOX. The review found that although there were a lot of positive aspects to the regulation, it has its critics as well.

Trends in reporting has been given priority by Karim and Sarkar (2019), and using a large sample of financial statement footnotes for their analysis, they find that firms audited by Big 4 auditors have fewer footnotes than firms audited by non-Big 4 auditors and conclude that firms that use non-Big 4 auditors tend to obfuscate annual reports by using more footnotes and in turn reduce earnings persistence.

Finally, from an internal operations perspective, the case study by Lelkes and Krueger (2019) is aimed at explaining the benefits of recent models, "Duration-Based Costing (DBC)

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and its affiliate Modified Duration-Based Costing" which is time based, against traditional cost allocation method followed at companies. The suitability and/or viability of either of the two new methods, however, remain dependent on the organizational capacity and requirement to "separate fixed and variable costs."

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CFO appointment and debt-equity choice

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Abstract

Purpose – There is some evidence that firms appoint internal candidates to exploit their unique firm specific knowledge and that the type of appointments may have signaling value to the market. However, these studies are limited to chief executive officer appointments whereas other top executives could also play an important role in corporate decision making. The purpose of this paper is to focus on the chief financial officer (CFO) appointments and firm's debt-equity choice.

Design/methodology/approach – The authors employ a multiple regression framework. To control for potential endogeneity, the authors use an instrumental variable approach with both two-stage least squares and generalized method of moments estimators.

Findings – The authors find that firms with internal CFO hires issue more equity than firms that hire from the external labor market. The authors also find that internal CFOs significantly reduce information asymmetry (IA), which may lower market risk and the cost of financing through equity issues. Furthermore, consistent with the value maximizing role of reduced IA the authors find that this effect is concentrated in value firms. In firms with higher IA this preference for equity by the internal CFO may be weaker as even internal CFOs will prefer debt financing for its disciplining role and to reduce IA. A subsample analysis with growth firms shows this diminishing impact on the financing choice of an internal CFO.

Originality/value – This study provides important information about the influence the CFO has on a firm's capital structure decisions.

Keywords Governance, Information asymmetry, CFO, Debt-equity choice

Paper type Research paper

1. Introduction

Research has shown that the characteristics of top executives such as age, tenure, incentives and their professional background impact corporate policies (see Chava and Purnanandam, 2010 Barua *et al.*, 2010; Aier *et al.*, 2005; Geiger and North, 2006; Francis *et al.*, 2008). Yet most studies focus on the (chief executive officer) CEOs only, while our understanding of how other top executives such as the chief financial officer (CFO) could impact financing policy choices is limited[1]. CFOs play an important role in the financial information production process. The role of CFOs has gained even more prominence after SOX (2002), which makes CEOs and CFOs personally responsible for ensuring the accuracy of financial and accounting information provided by publicly listed firms in the USA. Also noteworthy is the SEC regulation in 2006 on compensation disclosure of the principal financial officer (i.e. the CFO in most cases[2]). In this paper, we focus on CFO appointments to see if internal CFOs are different from external ones in making a firm's capital structure decisions.

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Our research question is also inspired by the signaling value of employment decisions that has been shown in earlier papers such as Spence (1973).

The search for CFOs from the external labor market is costly and time consuming. Firms want to avoid the searching costs for a CFO if they can find a capable individual inside the organization. A recent study sponsored by Chicago Booth Executive Education, University of Chicago, reports that four out of five times, firms promote internals as CEOs[3]. Cremers and Grinstein (2008) find that 68 percent of the CEOs were former employees of the same firm and 86 percent belonged to the same industry. The same logic can be extended to the case of CFOs. Compared to internally promoted CFOs, external CFOs who have less familiarity with the internal dynamics of the firm need time to learn the culture of the organization, as well as its financing, investment and other policies.

Conversely, internal hires have an edge over external hires in terms of understanding the firm's policies, maintaining the firm's commitment to its investors and furnishing timely information. Therefore, unless the market expects the firm to hire from the external labor pool, firms will promote incumbents as CFOs[4].

Murphy and Zábojník (2003, 2004) document that external hires cost 15.30 percent more than internally promoted CEOs. The cost of hiring from the external labor market has increased over time. Taylor (2010) shows that replacing a CEO (who was fired) can cost at least $200m to shareholders, and shareholder value is increased by 3 percent if these (perceived) costs can be eliminated. The perceived costs associated with a new hire are due to entrenchment (or poor governance). The extant literature[5] shows that when there is a forced turnover, firms usually hire from the external labor market.

Because CFOs are the firm's principal financial decision-makers, the firm's capital structure could be differentially impacted by the choice of an internal vs external candidate. Myers and Majluf (1984) show that due to information asymmetry (IA) (insiders and managers having better information than external investors) managers avoid issuing equity and could forgo valuable opportunities due to the negative stock market reaction of a secondary offering. The less adverse selection or lower IA motivates managers to issue equity rather than debt. Dittmar and Thakor (2007) show managers issue equity when investors' views and managers' views are aligned in terms of project payoffs. Firms can reduce IA either by external certification, such as employing high quality auditors, or by internal mechanisms such as policies to share timely information with the investors. The ultimate responsibility lies with the management of firms on how much information they want to share with investors. Both the management leadership choice and the policies of the firm affect the extent of IA and ultimately affect the financing decision of the firm.

An internal CFO, assuming that she/he has been with the firm at least for a year, knows the firm's reporting policies better than an external CFO. Chung *et al.* (2010) establish a relationship between a firm's governance and IA. They show that good governed firms have less IA whereas poorly governed firms have more IA. If an internally promoted CFO is shown to improve a firm's governance or equivalently reduce IA, then the firm will have greater incentive to issue equity. The relation between issuing equity and firm asymmetry is negative. In the absence of IA, firms no longer refuse to issue stock, and therefore, do not pass up valuable investment opportunities (Myers and Majluf, 1984).

We find that internally promoted CFOs issue significantly more equity relative to an externally hired CFO. We attempt to analyze various firm characteristics to provide intuition on the CFO appointment type and firm's debt-equity choices. In this context, we find that relatively younger growth and low-levered firms promote incumbents as CFOs. Although younger firms are more likely to promote within, the internally promoted CFO is more likely to raise equity in value firms than in growth firms. Subsample analyses suggest that this may be due to the higher level of IA associated with growth firms. On the whole, an internal CFO seems to utilize the more informationally efficient environment in value firms

and takes advantage of a relatively lower cost of equity. Our results suggest that all else equal, internal CFOs prefer to raise more equity over external CFOs, but in the case of high IA, internal CFOs prefer debt due to its disciplinary nature. The disciplinary effect of debt has been well-established in the literature (see Ross, 1977; Myers and Majluf, 1984).

Potential endogeneity may be present because there are some unobserved firm characteristics or random shocks that may affect both a firm's choice of issuing equity and its internal appointment of the CFO. We control for potential endogeneity by using instrumental variable (IV) analysis. In addition to the most common IV estimator, two-stage least squares (2SLS), we also use maximum likelihood estimation and generalized method of moments (GMM) estimators. Following Balsam *et al.* (2016), we use the industry CFO ratio as an instrument and find that internal CFO appointments significantly affect the firm's equity issue. We also test for the validity or the strength of the chosen instrument, which results in a partial *F*-value of 45.66 in the first-stage regression, ensuring that the chosen instrument is valid and strong. Employing all the known factors found in earlier research that affect the capital structure decision of a firm, we show our findings are robust to all these specifications.

Our study contributes to the relatively limited research on CFOs. Specifically, we explore the relation between CFOs and a firm's financing choice and thus help increase our understanding of the dynamics between the two. We find that younger and smaller firms promote incumbents as the CFO. Frank and Goyal (2009) note that since 1990, more small firms pursue equity financing. Thus, our finding shows that internal CFOs are more likely to raise equity complements Frank and Goyal (2009). We also find that profitable firms employ internal CFOs, and firms with negative ROA employ external CFOs. This is consistent with Mian (2001) who finds a strong association between a firm's negative operating performance and external CFO appointments. Finally, we find that firms with higher stock returns promote internals as CFOs. This result is consistent with Hovakimian *et al.* (2004) who show that firms with high stock returns have a higher probability of issuing equity.

The remainder of this paper is organized as follows: Section 2 describes the background of the study. Section 3 presents hypotheses development with some relevant background literature. Section 4 describes the data and sample selection. Section 5 describes the methodology and Section 6 presents our findings. At last Section 7 concludes.

2. Background on CFO appointment

The CFO, as the overseer of the firm's financial disclosures can significantly contribute to reducing the information gap between the firm and investors. Lo and Fu (2016) show that CEOs along with senior executives (including the CFO) develop the key strategies for firms and affect firm performance. Among other managers of the firm, CFOs carry an important role in determining corporate financial decisions after the CEO. Geiger and North (2006) find that discretionary accruals significantly decreased surrounding new CFO appointments, and their finding is not driven by the concurrent CEO appointments. Thus, CFOs largely operate independently when making financial decisions. In addition, the labor pool that the CFO is hired from matters in corporate investment and financing decisions. The most likely incumbents for CFOs are treasurers, controllers and principal accounting officers. Firms promote incumbents when there are no expectations from the stock market to hire from the external labor market. If firms are meeting the expectations of investors by providing adequate and timely information and reducing IA, they tend to promote an incumbent as the CFO. Internal managers play a significant role in reducing IA, as noted by Myers and Majluf (1984), "They [managers] have an insider's view of their organization and what it can and cannot do. This organizational knowledge is part of managers' human capital; they acquire it as they work, by conscious effort as well as by trial and error (p. 196)." In the case of CEOs, J.-H. Park *et al.* (2014) argue that CEOs obtain power from internal sources such as management expertise and stock ownership.

Internal CFOs have stronger incentives to approach investors for financing within a year to take advantage of the news of her/his promotion to the CFO position. As internal CFOs' interests are presumably better aligned with that of investors, incumbent CFOs are more likely to utilize equity financing rather than debt financing. Equity financing is preferable when firms have a clear idea of the expected payoffs of the potential projects. Shareholders are the owners of the firms; they do not pose a threat of bankruptcy like debt holders do in case of the firm's inability to pay the reward for capital provided. Debt holders need detailed information about potential projects before making the issue decision. Sharing detailed information of potential profitable projects with a third party is strategically disadvantageous to firms. When internal CFOs with a good understanding of the project payoffs approach the owner-investors of the firm, she/he can expect to receive the funds without the fear of leaking the information to the firm's competitors. In addition, contrary to the "pecking-order" theory, firms frequently issue equity. Fama and French (2005) note 86 percent of their sample firms issue equity of some form during their sample period, 1993–2003.

3. Testable hypotheses

Frank and Goyal (2009) test the pecking-order theory with respect to American firms and find that external financing is much more prevalent than previously thought, and equity is a significant component of external financing. We hypothesize that a CFO who is recently promoted within the firm with an expectation to add value to the company's operation will reduce the information gap and can facilitate external financing by equity. The appointment of a qualified CFO who has worked for the firm knows the firm's operations in detail, and has good relations with investors is more likely to take advantage of equity financing. Since she/he knows that she/he is implementing the investment or growth plans that have been scrutinized by the current board, his or her primary job is to make sure that information conveyed to investors regarding project payoffs is transparent, timely and complete. All else equal, firms that experience relatively less IA between managers and investors will prefer to issue equity (consistent with what the pecking-order theory[6] predicts). Therefore, we posit the following hypothesis:

H1. The type of CFO (internally or externally appointed) has no impact on a firm's debt or equity choice nor does it have any impact on the relative quantity of debt and equity (Null form).

Firms that are new and early in their life cycle have not yet been able to lay out a transparent information pathway to investors. For younger firms, IA is higher. Due to high disclosure requirements in the USA, issuing equity is more expensive for younger firms and these firms will seek debt financing over equity financing. On the contrary, value firms are well-established and thus have less information opacity. Value firms with their longer track record are less likely to suffer from IA and are thus in a better position to issue equity without negative signaling. We test the following hypothesis in terms of growth firms issuing equity *vis-à-vis* issuing debt:

H2. Internal CFOs' debt-equity choice does not differ between value and growth firms (Null form).

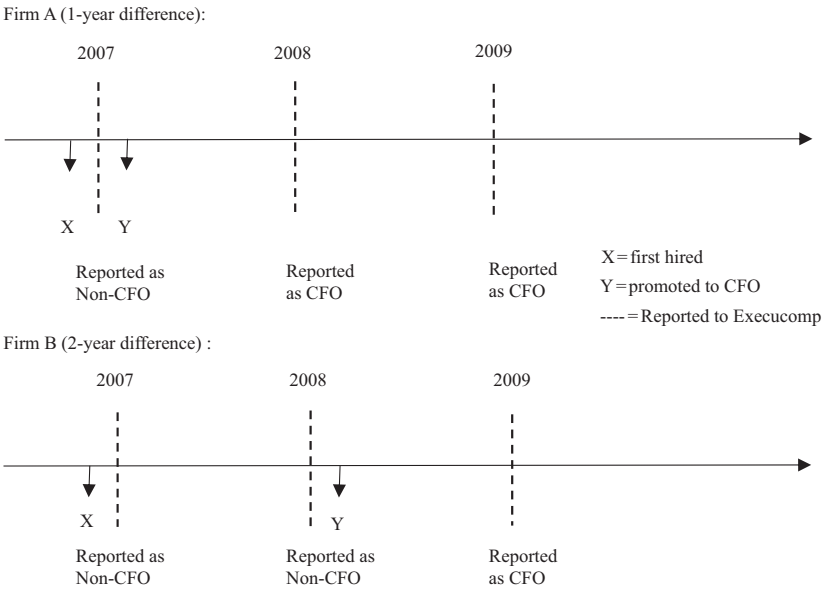
4. Data and sample selection

We collect firm-level data from Compustat. Return data and number of analysts are obtained from Center for Research in Security Prices (CRSP) and Institutional Brokers' Estimate System (I/B/E/S), respectively. Companies that are not covered by I/B/E/S are assumed not to be followed by any analyst (Chang *et al.*, 2009). Following the extant literature (see Ferris *et al.*, 2014), we define external and internal CFOs as follows: CFOs who have been with the company

for at least one year are labeled as an internal CFO and CFOs that are newly hired and with the company for less than a year are defined as external. We take all the firms in the Execucomp database over the period of 1992–2014. We measure the tenure before becoming the CFO as the difference between the year in which she/he is hired by the firm and the year she/he is appointed as the CFO. For example, if a CFO is hired in 2007 (appears in the database as CFO) and the year in which his or her name appears for the first time is 2005, then she/he will be an internal CFO. The difference in this case is two years. However, if the same CFO's name appears for the first time in 2007 and thus, the difference is 0, the CFO would be defined as external. In defining internal CFOs, when the year difference (tenure) is 1, then the case might be confounding. For example, assume an employee is hired right before the reporting date, then right after the reporting date, she/he is promoted as the CFO and another employee in another firm is hired as a non-CFO employee and promoted to CFO right before the next year reporting. In both cases, the CFO will be labeled as "internal." However, the CFO in the first example is not a true internal CFO. As there is no available data source for us to verify this type of scenario without a specific appointment date, we exclude internal CFOs that have a year difference of one. By including all the internals that have a year difference of two or more, we make sure that a CFO who has promoted internally has served the company for at least one year. The previous work experience of a CFO with the same company is defined as the difference when his or her EXECID (executive ID) appears in the Execucomp data set working for a firm and his or her appointment as a CFO. For new external hires, the year in which the ID first appears, and appointment year will be same, hence, the difference will be zero. In order to ensure that the internal CFO has worked for the appointing firm for at least a year, we define internal CFOs when year difference is greater than or equal to 2 (refer to Figure 1 for a graphical explanation). Title "CFO" includes, "chief financial officer," "CFO," "chief finance officer," "sr. exec.-finance," "vice president of finance," "principal financial officer," "chf. fin. Offr.," "V-P-finance," "VP-finance," "VP-strategy & finance," "V-P-fin," "exec. fin. offr.," "sr. exec.-finance" and excludes "interim chief financial officer" "acting chief finance officer" "former chief finance officer" in the Annual Title column of the Execucomp data set. Our sample covers 1994–2014[7]. We have included firm-years in which there is a CFO change and firms issued either debt or equity (according to the definition given earlier). Following Chang *et al.* (2009), we assume companies that are not covered by I/B/E/S have zero analysts' coverage. Smaller companies are usually not followed by analysts. To exclude the effect of concurrent CEO turnover on equity issues, we dropped all the firm-years in which there were both CEO and CFO turnovers. Finally, we have 1,045 firm-years, which meet all our sample selection criteria. The number of observations across models is different due to: using more variables in some models than others, and not all variables having sufficient data for the same years.

5. Methodology

Taylor (2010) estimates CEO firings using the structural equation model. He shows that CEOs are rarely fired by the board because of the personal costs associated with it. The CEO firing puts the personal reputation of the board members at risk to be appointed for other boards. To minimize the risk, the board of a weakly governed firm would not fire a bad CEO. He shows that reduction of entrenchment (equivalently improving governance) can significantly increase the returns to shareholders. Along the same lines, we conjecture that an internal CFO improves a firm's overall governance by reducing entrenchment. However, it is plausible that well governed firms appoint an internal as CFO. We use Bebchuk *et al.*'s (2009) E-index which is a parsimonious form of governance index developed by Gompers *et al.* (2003) and show that only six provisions (out of 24 IRRC provisions[8]) matter for firm value. If a firm practices good governance, then the appointment of CFOs will enhance the value of the shareholders by reducing any form of entrenchment. We proxy a firm's governance by Bebchuk *et al.*'s E-index (or entrenchment index), which should potentially



Notes: The figure shows that in order to be labeled as "internal," a CFO has to serve at least one year in the company. To ensure that CFO has completed one year of service, we have to take the year-difference (year becoming the CFO-year joining the company) of at least 2. The top part of the figure shows that taking year-difference equal to 1 does not guarantee one year of service as a CFO

Figure 1.
Definition of internal CFO

have a strong negative correlation with the internal appointment. The lower entrenchment means better governance of the firms which suggests that the board has more control over management. We posit that internal appointments are a result of better governance due to the fact that the promoted CFO is a known entity. If the incumbent was not the optimal choice, then the board would not promote him/her as the CFO but would look for an external hire instead (Taylor, 2010). To find the likelihood or determinants of an internal CFO appointment, we employ the following model:

$$\begin{aligned}\text{InternalCFO}_{i,t} = {} & \text{PoorGovernance}_{i,t} + \text{InformationAsymm.}_{i,t} + \text{Tangibility}_{i,t} + \text{Levratio}_{i,t} \\ & + \text{ROA}_{i,t} + \text{Sharetrunover}_{i,t} + \text{Fin.size}_{i,t} + \text{Debtrating}_{i,t} + \text{No. of analysts}_{i,t} \\ & + \text{Earn.volatility}_{i,t} + \text{Returnvolatility}_{i,t} + \text{FirmSize}_{i,t} + \text{MtoBratio}_{i,t} \\ & + \text{Compounded stock return}_{i,t} + \text{Firm age}_{i,t} + u_{i,t}. \end{aligned} \quad (1)$$

Poor governance is proxied by the E-index computed using the methodology of Bebchuk *et al.* (2009). IA is represented by Bid-Ask Spread and is calculated for each stock for each year as follows:

$$\text{Bid} - \text{Ask Spread} = \frac{\sum_{i=1}^{T} \text{Closing Ask}_d - \text{Closing Bid}_d}{T}, \quad (2)$$

where the closing bid price and ask price is computed daily, and T represents the number of trading days in a year.

An internal CFO who has a better understanding of the company and its stakeholders will presumably improve the governance of the firm. Because the firm has maintained a good rapport with its shareholders and the newly appointed CFO is carrying out the board's investment plan, we hypothesize that there will be no need for debt financing which inherently increases a firm's bankruptcy risk and often comes with stringent covenants or conditions.

The CFO influences firm governance with fair and timely financial disclosure. We use the following regression incorporating the bid-ask spread as a conduit to improve firm governance by a CFO. Ideally, the CFO will reduce IA and positively impact the firm's equity issue.

To examine the type of CFO appointment (internal/external) in relation to the equity issue we use the following model:

$$\begin{aligned}\text{Equity}_{i,t} = {} & \text{InternalCFO}_{i,t} + \text{Tangibility}_{i,t} + \text{Levratio}_{i,t} + \text{ROA}_{i,t} + \text{Sharetrunover}_{i,t} \\ & + \text{Fin. size}_{i,t} + \text{Debtrating}_{i,t} + \text{No. of analysts}_{i,t} + \text{Earn.volatility}_{i,t} \\ & + \text{Returnvolatility}_{i,t} + \text{FirmSize}_{i,t} + \text{MtoBratio}_{i,t} \\ & + \text{Compounded stock return}_{i,t} + \text{Firm age}_{i,t} + u_{i,t}. \end{aligned} \tag{3}$$

Equity is defined as net equity issue[9] scaled by beginning year book value of total assets by company i in fiscal year t. As in Chang *et al.* (2009), firm-years in which the net equity issue or net debt issue[10] exceeds 5 percent of the beginning balance of the firm's total assets are included in the sample; years in which both are 5 percent or neither is above the 5 percent cutoff are not included in the model. Internal CFO is an indicator variable assuming a value of 1 if the appointed CFO is promoted and 0, if the appointed CFO is hired from the external labor market. The definition of the variables is provided in the Appendix. As discussed earlier, the internal CFO potentially improves firm governance (or equivalently governance is a function of internal CFO). When we have both internal and poor governance (E-index) as independent variables to determine the effect on the firm's equity issue, we essentially get a biased coefficient for internal. Thus, we cannot use both of them as independent variables. When we use INTERNAL as the only independent variable, the coefficient includes both the direct and the indirect (governance) effect on the firm's equity choice.

In order to account for endogeneity, we use IV regression and estimate the model by 2SLS and GMM with robust standard errors. We use the industry CFO ratio as the instrument along with all other variables from the determinant model in Equation (1) above in the first-stage regressions. A similar instrument is used in Balsam *et al.* (2016). We have included all potential variables that can affect a firm's choice of equity issue. These variables are chosen consulting the extant literature.

The notion that the CFO improves firm governance by providing timely and accurate information can be captured by incorporating IA. If the internally promoted CFO has a better knowledge of the firm's reporting policies and knows the investor clientele, she/he should have an influence on the information environment and the firm's equity issue. Therefore, we incorporate IA and assess the impact of INTERNAL CFO on firm equity choice via reduction in IA. Hence, we incorporate an interaction term in the model as follows:

$$\begin{aligned}\text{Equity}_{i,t} = {} & \text{InternalCFO}_{i,t} + \text{IA}_{i,t} + \text{InternalCFO}_{i,t} \times \text{IA}_{i,t} + \text{Tangibility}_{i,t} \\ & + \text{Levratio}_{i,t} + \text{ROA}_{i,t} + \text{Sharetrunover}_{i,t} + \text{Fin.size}_{i,t} \\ & + \text{Debtrating}_{i,t} + \text{No. of analysts}_{i,t} + \text{Earn. volatility}_{i,t} \\ & + \text{Returnvolatility}_{i,t} + \text{FirmSize}_{i,t} + \text{MtoBratio}_{i,t} \\ & + \text{Compounded stock return}_{i,t} + \text{Firm age}_{i,t} + u_{i,t}. \end{aligned} \tag{4}$$

In the presence of IA, if the internal CFO significantly affects firm equity choice, then our earlier argument that CFOs reduce IA, improve governance and issue equity holds.

6. Empirical findings

Descriptive statistics

Table I reports the descriptive statistics. It includes mean, standard deviation and minimum and maximum values of the variables we use in the study. On an average, the sample firms issue larger sized debt than equity. The mean value for a debt issue is 11.90 percent (based on beginning book value of total assets) with a minimum and maximum of −24.60 and 82.30 percent, respectively. In contrast, the mean value of an equity issue is 2.80 percent with minimum and maximum values of −41.00 and 76.30 percent. The negative minimum values indicate repurchase of shares or repayments of debt. The average firm age is 14.89 years with the oldest firm being 62 years. About half of the firms have a rating history by Standard and Poor's. The mean industry leverage ratio is 33.80 percent, which suggests that firms have the ability to issue more equity if necessary. Smaller companies are usually not followed by analysts. Following Chang *et al.* (2009), we assume that companies that are not covered by I/B/E/S have zero analysts' coverage.

Table II includes comparisons between two categories of CFO appointments: the data on CFOs promoted from within the firms and CFOs hired from the external labor market provide univariate tests of *H1* (i.e. whether the type of CFO (internal or external) has any impact on a firm's debt or equity choice or any impact on the relative quantity of debt and equity). We also want to examine how different the two groups are in their other important variables. The two groups differ from each other in almost all variables except in volatility of earnings, volatility of returns, the industry leverage ratio and the total debt to total assets ratio. The mean value for governance under external CFO is more than 1 (i.e. 1.21), which means on average external CFO appointed firms have at least one of the six entrenchment provisions present. On the other hand, internally appointed CFO firms have an entrenchment value less than 1 (i.e. 0.54), which means most of the internally appointed CFO firms have better governance than their counterparts. These two groups of firms significantly differ in terms of governance; *t*-statistic

Variable	NOBS	Mean	SD	Min.	Max.
Debt percent	1,045	0.119	0.177	−0.246	0.823
Equity percent	1,045	0.028	0.160	−0.410	0.763
Internal CFO	1,045	0.495	0.500	0.000	1.000
Firm size	1,045	6.996	1.532	3.543	11.127
Tangibility	1,043	0.306	0.236	0.013	0.902
Leverage ratio	1,043	0.359	0.210	0.017	0.905
ROA	1,045	0.016	0.153	−0.907	0.276
Market-to-book ratio	1,044	2.129	1.481	0.788	8.961
Finance size	1,045	0.098	0.107	−0.195	0.408
Share turnover	966	1.986	1.559	0.192	8.142
Firm age	1,040	2.701	0.830	0.000	4.127
Debt rating	1,045	0.464	0.499	0.000	1.000
Number of analyst	1,045	10.283	9.740	0.000	41.000
Earnings volatility	734	0.068	0.074	0.010	0.466
Return volatility	966	0.030	0.015	0.010	0.085
Compound stock return	964	0.238	0.888	−0.846	5.545
Industry leverage ratio	1,045	0.338	0.143	0.074	0.715
Industry Internal CFO ratio	1,045	0.025	0.024	0.000	0.121
Cashflow	1,045	329.857	982.683	−490.500	7,997.000
Debt-to-asset	728	0.267	0.179	0.000	0.783

Notes: This table reports the descriptive statistics of the variables used in the study. All the variables are winsorized at 1 and 99 percent levels, respectively (except indicator or dummy variables). Variable definitions are provided in the Appendix

Table I.
Descriptive statistics

Variable	External CFO (1) Mean	Median	Internal CFO (2) Mean	Median	Mean Diff. (1−2)	*t*-value	Med. Diff. (1−2)	*Z*-value
Equity issue	0.006	0.001	0.051	0.004	−0.046	4.68***	−0.003	−4.54***
Debt issue	0.126	0.094	0.112	0.087	0.014	1.30	0.008	2.70**
E-index	1.208	0.000	0.542	0.000	0.667	7.91***	0.000	8.08***
Firm size	7.268	7.238	6.719	6.569	0.55	5.90***	0.669	5.10***
Tangibility	0.291	0.222	0.321	0.258	−0.03	−2.05**	−0.037	−2.27**
Leverage ratio	0.384	0.356	0.334	0.312	0.05	3.86***	0.044	3.87***
ROA	−0.001	0.039	0.034	0.053	−0.035	−3.70***	−0.014	−4.00***
Market-to-book ratio	1.965	1.599	2.296	1.753	−0.331	−3.62***	−0.154	−2.95***
Finance size	0.092	0.080	0.105	0.086	−0.012	−1.85*	−0.006	−1.75*
Share turnover	2.214	1.794	1.748	1.231	0.466	4.69***	0.563	6.70***
Firm age	2.858	2.833	2.543	2.565	0.314	6.21***	0.268	5.73***
Debt rating	0.511	1.000	0.416	0.000	0.096	3.11***	1.000	3.09***
Number of analyst	11.197	9.000	9.35	7.000	1.847	3.08***	2.000	3.03***
Volatility of earnings	0.071	0.044	0.064	0.047	0.007	1.31	−0.003	−1.19
Volatility of return	0.03	0.026	0.031	0.028	−0.001	−1.32	−0.003	−2.60***
Compound return	0.148	0.056	0.332	0.111	−0.183	−3.21***	−0.055	−3.26***
Industry leverage ratio	0.339	0.324	0.336	0.332	0.003	0.31	−0.008	0.39
Cashflow	422.05	81.603	235.70	61.100	186.35	3.08***	20.503	2.04**
Total debt/total assets	0.271	0.259	0.259	0.252	0.012	0.88	0.007	0.80

Notes: This table reports the variables that we use in the study dividing into two groups: external and internal CFOs. 6th (8th) column is the mean (median) difference between the two groups of CFOs. Column 7 (9) is a *t*-statistic (*Z*-statistic) from *t*-tests (Wilcoxon–Mann–Whitney test), where the null hypothesis is the mean or median difference between the two groups is 0. ***,**,*Significant at 10, 5 and 1 percent levels, respectively

Table II.
External CFO and internal CFO comparison

is 7.91, which rejects the null hypothesis of same governance between two groups at 1 percent or less. The same conclusion follows from WMW test.

The leverage ratio between two groups of firms significantly differs. On an average, external CFO appointed firms have 38 percent leverage, whereas internally promoted CFOs have a 33 percent leverage ratio. Controlling for other factors that influence the firm's debt level, the lower leverage ratio for an internal firm allows them more room to increase the debt in the future. Internal CFO appointing firms are younger than the external appointing firms; the average age of the internal CFO appointing firms is 12.72 years (= EXP(2.543)), whereas the mean age of the firms appointing external CFOs is approximately 17.43 years (= EXP(2.858)). The older firms have more analysts following them, and more of them are rated by S&P as seen in the debt rating.

Determinants of internal CFOs

Table III reports the likelihood of appointing an internal CFO. We use both a logit and probit model, and the results are similar. Poor governance negatively affects the appointment of internal CFOs. For example, the coefficient for poor governance is −0.196 under both probit and logit models. Companies with high IA positively affect the appointment of internal CFOs. Usually, growth companies have more IA in their early lives as the market is still learning about the firm and is trying to assess its plans for growth. Good performance also affects the appointment of internal CFOs positively. The coefficient for return of assets is 2.735 in logit model and 1.676 in probit model. Other significant determinants of internal CFO appointments are the number of analysts following the firm and the size of the firm. While analyst following positively affects internal CFO appointments, firm size negatively affects it. From the firm size results one potential insight is that growth firms or relatively

Variable	Logit model	Probit model
Poor governance	−0.196*** (0.06)	−0.119*** (0.04)
Information asymmetry (IA)	4.668*** (0.61)	2.532*** (0.32)
Tangibility	0.445 (0.41)	0.313 (0.24)
Leverage ratio	0.438 (0.68)	0.245 (0.40)
ROA	2.735*** (0.85)	1.676*** (0.51)
Finance size	0.866 (0.98)	0.485 (0.58)
Share turnover	−0.116 (0.08)	−0.083* (0.05)
Debt rating	0.136 (0.25)	0.070 (0.15)
Num. of analyst	0.027** (0.01)	0.017** (0.01)
Returns volatility	−0.011 (1.55)	0.039 (0.95)
Earnings volatility	3.998 (8.52)	2.961 (5.08)
Ln of assets	−0.224** (0.11)	−0.137** (0.06)
M-to-B ratio	0.058 (0.10)	0.03 (0.06)
Compound stock return	0.015 (0.13)	0.001 (0.08)
Firm age	−0.29 (0.19)	−0.162 (0.11)
Growth firm	0.179 (0.21)	0.104 (0.12)
Constant	0.837 (0.93)	0.526 (0.56)
Pseudo R^2	0.203	0.199
Log likelihood	−367.34	−369.37
NOBS	672	672

Notes: The table reports the likelihood of appointment of internal CFOs. Internal CFO is the dependent variable. Poor governance is proxied by E-index (Bebchuk *et al.*, 2009). Standard errors are reported in the parenthesis. Variables definitions are provided in the Appendix. ***,**Significant at 1 and 5 percent levels, respectively

Table III.
Likelihood of internal CFO appointment

smaller firms are more likely to appoint CFOs from inside the firm to avoid the outside labor market search costs. Overall, the model is significant with a log likelihood value of −367.34 (−369.37) under the logit (probit) model. The pseudo R^2 in both models is about 20 percent.

Internal CFOs and risk reduction

Table IV reports the relation between the appointment of an internal CFO and the firm's risk. We use the firm's beta calculated using daily returns from CRSP as the dependent variable in the models. We use three estimation methods: OLS, 2SLS IV and GMM with robust weight matrix. Internal CFO has a negative effect on beta. This result is robust to the 2SLS IV estimation, which potentially controls for endogeneity. The reduction in the firm's beta associated with an internal CFO appointment should the reduce cost of equity. The advantage of using beta rather than a direct measure of the cost of equity to capture risk is due to confounding factors that determine a firm's equity cost beyond market risk. Carlson *et al.* (2010) use the firm's beta to investigate a firm's risk dynamics surrounding a seasoned equity offering. Other variables that positively affect firm risk are equity size, firm size, share turnover and volatility of stock returns. Conversely, the leverage ratio and firm age negatively affect a firm's beta. Younger firms have higher betas than older firms, which is logical as younger firms will have more stock volatility than older firms. If internal CFOs reduce a firm's market risk, all else equal internal CFOs should try to issue more equity than debt to fund the firm's capital needs. Our next models investigate the relation between CFO appointment and the firm's financing choice with and without IA.

Internal CFOs and equity issue

Table V reports outputs from three estimation processes: OLS, 2SLS IV and GMM robust. The variable of interest – internal CFO – has a significant positive effect on a firm's equity choice. However, endogeneity can generate from two sources: internal CFO influences the

	OLS	2SLS IV	GMM robust
Internal CFO	−0.018 (0.04)	−0.480*** (0.19)	−0.480** (0.19)
Information asymmetry	−0.478*** (0.09)	−0.100 (0.18)	−0.100 (0.20)
Cashflow	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)
Equity size	0.000 (0.00)	0.000** (0.00)	0.000*** (0.00)
Firm size	0.091*** (0.02)	0.066** (0.03)	0.066** (0.03)
Leverage ratio	−0.308** (0.13)	−0.266* (0.14)	−0.266* (0.15)
ROA	−0.008 (0.16)	0.233 (0.20)	0.233 (0.23)
M-to-B ratio	−0.023 (0.02)	−0.017 (0.02)	−0.017 (0.02)
Finance size	0.184 (0.19)	0.249 (0.21)	0.249 (0.23)
Share turnover	0.124*** (0.02)	0.107*** (0.02)	0.107*** (0.02)
Firm age	−0.055 (0.04)	−0.082** (0.04)	−0.082** (0.04)
Debt rating	0.004 (0.05)	0.024 (0.05)	0.024 (0.05)
Number of analyst	−0.004* (0.00)	−0.002 (0.00)	−0.002 (0.00)
Returns volatility	0.100 (0.31)	0.149 (0.34)	0.149 (0.34)
Earnings volatility	7.780*** (1.65)	8.506*** (1.83)	8.506*** (2.17)
Compound stock return	−0.009 (0.03)	−0.009 (0.03)	−0.009 (0.03)
Constant	0.362* (0.19)	0.694*** (0.25)	0.694*** (0.25)
R^2	0.332	0.182	0.182
NOBS	657	657	657

Notes: The table reports the relation between internal CFOs and firm risk reduction. The dependent variable is firm beta. Standard errors are reported in the parenthesis. *,**,***Significant at 10, 5 and 1 percent levels, respectively

Table IV.
Internal CFO and risk reduction

	OLS	2SLS IV	GMM robust
Internal CFO	0.022** (0.009)	0.115*** (0.037)	0.115*** (0.040)
Intercept and controls?	Yes	Yes	Yes
R^2	0.369	0.263	0.263
NOBS	672	672	672

Notes: This table reports the relation between internal CFOs and firm equity issue in multiple regression framework using the following model. Dep. variable if firm's equity issue as a proportion of beginning of year total assets. Standard errors are reported in the parenthesis. ***,**Significant at 1 and 5 percent levels, respectively

Table V.
Internal CFO and firm equity choice

choice of equity while firms that want to issue equity promote internals as CFOs; and omitted variables. To address this, we use IV regressions. Following Balsam *et al.* (2016), we use the industry CFO ratio as an instrument as it is likely correlated with a CFO appointment but not necessarily with a firm's financing choice. We defined the proportion of firms (excluding the sample firms) in the industry (two-digit SIC) that employ internal or external candidates as CFOs. We test the validity or strength of the defined instrument. The partial F-statistic 45.66 and the R^2 in the first stage (regressing internal on industry CFO ratio) is 17.60 percent, which indicates the instrument has sufficient power in explaining a firm's internal CFO's choice.

Under 2SLS IV and GMM robust, the effect of internal CFOs on a firm's equity issue is significantly positive. GMM robust assigns higher standard errors than 2SLS IV. The other significant variables associated with a firm's equity size are leverage, ROA, finance size, number of analysts, return volatility and compounded stock returns. Leverage, ROA and number of analysts negatively affect a firm's equity issue. Higher levered firms are less likely to issue equity because it is riskier for new stock holders. Firm with higher returns

usually rely on internal finance or retained earnings. A similar finding is reported by Chang *et al.* (2009) (see Table V, p. 1105). Finance size is the amount of money needed from external sources. This should be positively related with equity financing because equity is a major component of external financing. In the equity issuance process, firms take advantage of timing (Greenwood, 2005). Both return volatility and compounded returns positively affect the equity issue of the firm and therefore justify market timing. Firms may issue equity during good times and repurchase equity during bad times. Therefore, return volatility is positively related with a firms' equity choice.

To further ensure the robustness of our findings, in Table VI we test yet another specification. In this specification we try to control for industry fixed effects and also expand our hypotheses testing to the entire sample of CFO change vs CFO non-change firms. Thus, we want to see if internal CFOs prefer equity to debt when compared to the rest of the sample and alternatively, whether an external CFO has less preference for equity compared to the rest of the sample. Robust standard errors are computed using Huber–White–Sandwich estimator of variance by clustering on firm-level indicators. The coefficient on the internal CFO dummy is 0.005 and significant even after controlling for CEO change, while the coefficient on the external CFO dummy is exactly opposite −0.005 and significant as well. In other specifications, we drop the CEO change variable and the internal CFO dummy retains its significance. This shows internal CFO preference for equity financing even beyond the CEO preference and is not influenced by a specific industry.

Internal CFOs, information asymmetry and equity issue

Table VII shows that the joint effect of IA and internal CFOs on the percent of equity is negative. The coefficient of internal CFO is positive in all three models. However, when we interact internal CFO with IA the coefficient is significantly negative, meaning if firms are operating in an opaque environment the chance the CFO will issue equity is low. We assume higher IA is tantamount to operating in an opaque environment. The coefficients under 2SLS and GMM are −0.227 (SE = 0.082) and −0.227 (SE = 0.084), respectively. In subsample analyses we focus on growth firms and value firms separately. Typically, growth firms have higher IA as those firms have not yet solidified their operation and strategies. We report the results in Table VIII.

Because growth and value firms have differing financial needs we postulate there may be a difference in their choice of capital. Here, we report a triangular relationship among IA, internal CFOs and firm's choice of equity in growth firms. A firm is defined as a growth firm

	Dependent variable: equity size (% of assets)			
	Model No. 1	Model No. 2	Model No. 3	Model No. 4
CFO change	0.001 (0.002)	0.006*** (0.002)		
Internal CFO	0.005** (0.003)		0.008*** (0.002)	
External CFO		−0.005** (0.003)		0.001 (0.002)
CEO change	0.005*** (0.002)	0.005*** (0.002)		
Intercept and controls?	Yes	Yes	Yes	Yes
Fixed Effects	Industry	Industry	Industry	Industry
R-squared	0.418	0.418	0.418	0.418
NOBS	18,013	18,013	18,013	18,013

Notes: This table reports output from OLS with clustering by firm ID (GVKEY), industry fixed effect models. Robust standard errors are computed using Huber–White–Sandwich estimator of variance by clustering on firm-level indicators. Industry is classified following Fama–French 12 industry classification (see http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_12_ind_port.html). ***,**Significant at 1 and 5 percent levels, respectively

Table VI.
CEO–CFO change and firm equity issue

if it earns above average sales in a given year in the industry it operates. The interaction term (= internal CFO×IA) is significantly negative in all three models. The negative relation found earlier in Table VII is driven by the growth firms. We run the same models for the group of value firms. As expected, internal CFOs in value firms do not opt for equity as a financing option. The interaction term is insignificant in all models. The result supports our earlier assertion.

To establish the robustness of our findings, in Table IX we test the opposite question whether internal CFOs in growth firms prefer debt (since they do not prefer equity). As expected, we find growth firms prefer not to issue equity due to their opaque information environment; they prefer debt financing. The interaction term (= internal CFO×IA) is significantly positive in all three models for the growth firms and insignificant in the case of value firms.

7. Conclusion

In this paper, we show that firms with internal CFO appointments take advantage of external equity financing within one year of such appointments. This finding is robust under various specifications. Our findings suggest that internal CFOs improve firm's governance by significantly reducing IA, and firms try to take advantage of CFO appointments by issuing equity. Thus in general, internal CFOs prefer equity issues. However, in firms with higher IA this preference for equity by an internal CFO may be weaker as even internal CFOs will prefer debt financing for its disciplining role and

Dep. variable: equity issue (%)	OLS	2SLS IV	GMM Robust
Internal CFO	0.033*** (0.012)	0.108*** (0.033)	0.108*** (0.035)
Information asymmetry (IA)	0.032 (0.038)	0.110** (0.050)	0.110** (0.051)
Internal CFO × IA	−0.058 (0.044)	−0.227*** (0.082)	−0.227*** (0.084)
Intercept and controls?	Yes	Yes	Yes
R^2	0.370	0.331	0.331
NOBS	672	672	672

Notes: This table reports the relation between internal CFOs with firm information asymmetry and firm equity issue in multiple regression framework. Standard errors are reported in the parenthesis. ***,**Significant at 1 and 5 percent levels, respectively

Table VII. Internal CFO and information asymmetry

	Growth firms			Value firms		
	OLS	2SLS IV	GMM robust	OLS	2SLS IV	GMM robust
Internal CFO	0.041 (0.025)	0.153** (0.074)	0.153** (0.075)	0.021 (0.013)	0.095*** (0.037)	0.095** (0.037)
Information asymmetry (IA)	0.269*** (0.086)	0.382*** (0.111)	0.382** (0.160)	−0.055 (0.041)	0.020 (0.054)	0.020 (0.046)
Internal CFO × IA	−0.284*** (0.096)	−0.524*** (0.177)	−0.524*** (0.199)	0.029 (0.048)	−0.135 (0.090)	−0.135 (0.088)
Intercept and controls?	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.426	0.362	0.362	0.382	0.342	0.342
NOBS	189	189	189	482	482	482

Notes: This table reports the relation between internal CFOs and firm equity issue in two types of firms: growth and value. The dependent variable is firm equity issue. Standard errors are reported in the parenthesis. ***,**Significant at 1 and 5 percent levels, respectively

Table VIII. Internal CFOs and firms' equity issue in growth/value firms

	Growth firms			Value firms		
	OLS	2SLS IV	GMM robust	OLS	2SLS IV	GMM robust
Internal CFO	−0.078** (0.033)	−0.257*** (0.098)	−0.257** (0.100)	−0.021 (0.02)	−0.088** (0.04)	−0.088** (0.04)
Information asymmetry (IA)	−0.301*** (0.111)	−0.482*** (0.147)	−0.482*** (0.177)	0.05 (0.05)	−0.017 (0.06)	−0.017 (0.05)
Internal CFO × IA	0.347*** (0.125)	0.732*** (0.235)	0.732*** (0.249)	−0.012 (0.06)	0.137 (0.11)	0.137 (0.09)
Intercept and controls?	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.469	0.377	0.377	0.389	0.366	0.366
NOBS	189	189	189	482	482	482

Table IX.
Internal CFOs and debt issue

Notes: This table reports the relation between internal CFOs and firm debt issue in two types of firms: growth and value. The dependent variable is firm debt issue. Standard errors are reported in the parenthesis. ***,**Significant at 1 and 5 percent levels, respectively

reduction in IA. We use the entrenchment index created by Bebchuk *et al.* (2009), which has been widely used as a parameter for firm governance. We find that an internal CFO simultaneously reduces IA and solicits funds by selling equity. Firms that promote from their CFO from internal sources are also younger, have relatively low leverage, and have better growth prospects than the firms that hire the CFO from external labor markets.

What do firms do with the funds raised from the stock market? We cannot answer that question explicitly without further analysis. Firms submit S-filings before equity issue and are required to mention the specific reason(s) for the equity issue. The reasons mentioned in the S-filings are to invest, to retire some existing debt or for general corporate purposes. The last reason is a somewhat ambiguous. Walker and Yost (2008) show that the stock market reacts favorably in the scenario where firms use the proceeds from stock repurchase for further investment and provide investors with specific plans of such investment. Without knowing the motive of the equity issue, we cannot say why the stock market reacts favorably to an equity issue by an internal CFO. We leave this intriguing issue for future research.

Notes

1. There is some literature that presents evidence on how CFO's incentives could play a role in debt maturity choice or accruals management (Chava and Purnanandam, 2010).
2. See the proposed and final rules of the SEC in release numbers 33-8732A, 34-54302A and IC-27444A.
3. This study covers 3,719 CEO turnover events globally. For the full report, please refer to www.strategy-business.com/article/10208
4. Situations in which the market expects an external hire are if the firm receive an adverse SOX 404 opinion, if the firm's current CFO consistently fails to meet analysts' expectations or if the firm has been doing poorly for the last few years (Mian, 2001).
5. Parrino (1997) finds that the real costs of firing a CEO are lower when firms can find a replacement in similar (homogeneous) industry. Also, Mian (2001) finds that investors expect an external hire when firms had few years of negative performance.
6. The pecking-order theory is attributed to S.C. Myers (1984). The theory predicts that firms issue debt over equity due to the negative signal associated with equity, but if a firm does not have much problem with asymmetric information, then there is less likely to be a negative signal with a new equity issuance.
7. 1992–1993 is not considered because of the INTERNAL definition. The previous two years are needed to define INTERNAL.

8. The Investor Responsibility Research Center Institute, please refer to http://irrcinstitute.org/
9. Net equity issue = (Sale of common and preferred stock−Purchase of common and preferred stock)/TA_{t-1}.
10. Net debt issue = (Long term debt issuance−Long term debt reduction+ Current debt changes)/TA_{t-1}.

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Appendix. Variable definitions

- Debt percent: Net debt issue/Beginning balance of assets = [Long term debt issuance (DLTIS) −Long term debt reduction (DLTR)+Current debt changes (DLCCH)]/Beginning total assets (AT_{t-1}).
- Equity percent: Net equity issue/Beginning balance of assets = [Sale of common and preferred stock (SSTK)−Purchase of common and preferred stock (PRSTKC)]/Beginning total assets (AT_{t-1}).
- Equity dummy: following Chang *et al.* (2009), firm-years in which the net equity issue or net debt issue exceeds 5 percent of the beginning balance of the firm's total assets are included in the sample; years in which both are 5 percent or neither is above the 5 percent cutoff are not included in the model.
- Internal CFO: an indicator variable taking a value of 1 if the hired CFO is promoted and has worked for the firm at least one year, 0 if the hired CFO worked for the company 0 year.
- Industry CFO ratio: number of internal CFO appointments (excluding the sample firm) in a two-digit SIC divided by the total number of firms in the industry in a year. It is used as an instrument.
- Poor governance: it is proxied by the entrenchment index or E-index which implies the alignment (agreement) between firm's management and investors about the future payoffs of the projects. E-index is computed following Bebchuk *et al.* (2009) (Source: www.law.harvard.edu/faculty/bebchuk/data.shtml).
- Firm Size: natural log of book value of assets (AT).

- Tangibility: Net PPE (PPENT)/Total asset (AT).
- Leverage ratio: Total debt (LT)/[Total assets (AT) + Market value of equity (PRCC_F × CSHO) −Book value of equity (CEQ)].
- Market-to-book ratio: [Total assets (AT)+ Market value of equity (PRCC_F×CSHO)−Book value of equity (CEQ)/Total assets (AT).
- Finance size: Total financing needs/Total assets = [Net debt issued (DLTIS−DLTR + DLCCH) + Net equity issued (SSTK−PRSTKC)]/Total assets (AT).
- Share turnover: median value of monthly shares traded (volume) divided by shares outstanding over a 12-month period.
- Firm age: natural log of year difference between the first year the firm entered into Compustat database and current fiscal year.
- Debt rating: dummy variable if the firm has a debt rating (SPLTICRM) assigned by Standard and Poor's, and 0 otherwise.
- Number of analysts: the maximum number of analysts making annual earnings forecasts at any month over a 12-month period. We assume firms that are not covered by I/B/E/S have zero analyst's coverage (Chang *et al.*, 2009).
- Earnings volatility: historical volatility using previous 10 years of the ratio of EBITDA to total assets (AT).
- Volatility of stock returns: standard deviation of the daily stock return calculated for each firm for each year.
- Compound stock return: cumulative compounded annual stock returns over a 12-month period using monthly return data from CRSP.
- Industry leverage ratio: the median industry leverage ratio is computed as the median of the ratio of total debt to the market value of assets by the 3-digit SIC code and by year.
- ROA: Income before extraordinary items (IB)/Total assets (AT).
- Debt-to-total assets: Total debt (DT)/Total assets (AT).
- Cashflow: Income before extraordinary items (IB) + Depreciation and amortization (DP).
- Growth firms: firms that experience above average sales growth in a given year in an industry (based on two-digit SIC) are defined as growth firms.
- Value firms: firms that experience below average sales growth in a year in an industry (based on two-digit SIC) are defined as value firms.

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Social media information and analyst forecasts

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Abstract

Purpose – The purpose of this paper is to examine whether corporate social media information helps improve analysts' forecast accuracy.
Design/methodology/approach – This study uses hand-collected information on S&P 500 firms' official Facebook pages and uses posts and reactions to such posts to measure corporate Facebook information. Multivariate regression models are estimated to test the relationship between analysts' forecast accuracy and corporate Facebook information.
Findings – The results indicate that analysts forecast accuracy is unresponsive to posts. However, analyst forecast errors are decreasing in reactions to posts. These findings are robust to the inclusion of control variables, firm and time fixed effects, and alternative specifications of forecast errors and different pre-forecast time windows.
Research limitations/implications – This study has some limitations. It focuses only on the S&P 500 firms, which are large and generally provide better information to the market. The sample period coincides with the early period of the corporate Facebook culture. However, more recent data sets are likely to provide stronger results.
Practical implications – The findings of this study provide support for "information generation" role of social media and show that reactions to corporate Facebook posts are the new and unique information generated from corporate social media activities, which help information intermediaries in improving their forecasting accuracy.
Originality/value – This study makes an important contribution to the literature by separating the information dissemination role of social media from information generation role and establishes the first evidence on how corporate social media information affects forecast accuracy of financial analysts.

Keywords Analyst forecasts, Facebook posts, Social media information

Paper type Research paper

1. Introduction

This study focuses on whether and how social media information helps to improve analysts' forecast accuracy. Social media has gradually becomea popular communication channel for companies (Kaplan and Haenlein, 2010). Unlike traditional media outlets, social media offers two-way communication (Cade, 2017), allowing companies to interact with stakeholders in a dynamic information environment. The SEC issued a report and further guidance (in 2013 and 2014) recognizing the importance of social media as a platform for corporate communication[1]. Although existing research examines the effects of opinions expressed by the users of social media on stock markets (Bartov *et al.*, 2017; Das and Chen, 2007; Blankespoor *et al.*, 2014), ours is the first to examine whether social media information affects the forecasting performance of expert information intermediaries, i.e. analysts, who follow these companies.

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Extant literature documents the effects of financial and non-financial information on analyst forecast error. Rogers and Grant (1997) argue that analysts use a substantial amount of non-financial information both within and outside of the annual reports. Vanstraelen *et al.* (2003) show that a higher level of forward-looking nonfinancial disclosure is associated with higher accuracy in analysts' earnings forecasts. Dhaliwal *et al.* (2012) find that the issuance of stand-alone corporate social responsibility reports (a proxy for nonfinancial information) is associated with lower analyst forecast error. However, analysts can gather non-financial information from sources other than financial statements and traditional media outlets. Social media has become an especially important source of information, defying the interest in and resources available through conventional media (Lau and Wydick, 2014). In a high-frequency trading environment where the instant dissemination of information is critical, firms are increasingly relying on social media in order to engage with investors. Traditional media outlets (such as newspapers, news channels, websites, blogs, RSS feeds, etc.) do not have the dynamic platforms offered by social media, which makes the information disclosed via social media timelier and more easily accessible to subscribers. The interactive nature of social media highlights information that others have considered important through sharing, and thus contributes to faster dissemination and quicker impounding of information in the market response. Moreover, disclosures in traditional media are aimed at a broader audience. Investors need to sift through volumes of available information in order to make an informed decision. But social media has made it easier for investors to follow certain companies and to be at the forefront of receiving relevant information in real time, and at almost no cost. Companies are increasingly adopting social media platforms in order to reach relevant audiences who actively seek information about these companies. Disclosure frequency and the content of the message can both play integral roles in terms of shaping market sentiment.

The answers to questions such as "Why would expert information intermediaries, such as analysts, follow corporate social media?" or "What kind of information can they derive from such sources?" are not obvious, because these experts are believed to possess superior information sources compared to unsophisticated investors. The information disclosed on social media may or may not already be available to analysts from other sources. However, sometimes posts that are disseminated on social media can have a huge market moving impact[2]. On the other hand, the reactions on social media (likes, comments and shares) – unavailable in traditional media – can also act as a source of new information, and may have content that is relevant for predicting future expected performance of companies[3]. Thus, it is unlikely that expert information intermediaries will ignore market sentiment related information revealed through reactions on social media.

Current research also shows that social media plays an important role in information dissemination. More importantly, it generates additional information content (though opinions, reactions or sentiment) to supplement firm disclosure. Bartov *et al.* (2017) find that an aggregate opinion from firm-specific Tweets predict corporate earnings and stock price reaction around quarterly earnings announcements. Existing literature has also documented the positive influence of emotional state (such as calm, alert, sure, vital, kind and happy) expressed in Twitter in terms of predicting a change in stock index (Bollen *et al.*, 2011; Mao *et al.*, 2012; Sul *et al.*, 2017). However, there is no evidence of how firm-initiated information that is disseminated through social media affects the behavior or performance of expert information intermediaries. Thus, an investigation of how information disclosed through social media affects the performance of analysts is imperative.

We study social media information that has been disclosed by companies on their corporate Facebook pages. Corporate Facebook pages often serve as an official communication channel, in addition to Twitter. However, we focus on corporate Facebook pages mainly because Facebook has the highest active user base among all

social media platforms, more than 6 times more active users compared to Twitter; there are 2.06bn active Facebook users, while Twitter only has 328m[4]. Given the broader audience base of Facebook, we focus on corporate disclosures on Facebook and hand-collected information on all posts on Facebook pages of S&P 500 firms from 2008 to 2012. In addition to posts, our data also include subscriber sentiments on Facebook ("comments," "shares" and "likes") that are associated with these posts. We aggregate posts and reactions over 15-day window prior to earnings forecast in order to focus more on posts and reactions provided close to earnings forecasts[5]. Analyst forecast error is computed by comparing the actual earnings announcements with analysts' forecast of earnings for the same quarter. Our analyses are done at a firm level, and hence we take the average forecast error across all analysts following the firm in a quarter.

We separately study social media's role in information dissemination through aggregate number of corporate posts and information generation through aggregate market sentiment to corporate posts. Analysts are considered expert information intermediaries with the ability to make precise inferences from a set of information. To the extent that corporate posts disseminate information about the firms, it is expected that information gap between management and other stakeholders will be reduced. Therefore, we expect that analysts can revise their beliefs and improve forecast accuracy following corporate Facebook posts. We conjecture that corporate Facebook posts have a negative association with analysts' forecast error. As prior studies suggest, the aggregate sentiment expressed through social media platform can significantly change the information environment that is critical for analysts' forecast accuracy. As an avid follower of companies with superior interpretation skills, it is plausible that analysts will be able to generate information from market reactions to posts, as revealed through "likes," "comments" and "shares." Average forecast errors among analysts depend on available information, either in the form of wider dissemination (posts on Facebook – information dissemination) and/or in the form of new information (reactions to posts on Facebook – information generation). Such a separation of social media information allows us to gauge whether expert information intermediaries update their beliefs due to information and/or reactions to information.

Our results indicate that analysts' forecast accuracy is unresponsive to posts on corporate Facebook pages. However, we find that market reactions to such posts reduce analysts' forecast errors. Our findings are robust to the inclusion of control variables, firm-fixed effects, time-fixed effects, and firm-specific clustered standard errors and alternative specifications of analysts' forecast errors and different time windows. Our findings suggest that increased dissemination of information through corporate Facebook posts has no impact on the forecast accuracy of financial analysts. We interpret this result in light of RegFD, which mandates timely and simultaneous disclosure of material corporate information to all investors through all maintained channels, eliminating the pre-RegFD information advantage enjoyed by information intermediaries. As long as analysts are getting the same information from other sources, corporate Facebook posts may not provide them with any incremental information. On the other hand, our results show that reactions to corporate Facebook posts help to improve analysts' forecast error. This finding suggests that the reactions information, unique to social media, act as new information for analysts.

We make an important contribution to the nascent literature on social media by separating the information dissemination role from the information generation role. Our results also extend the literature on social media reaction (Bollen *et al.*, 2011; Mao *et al.*, 2012; Sul *et al.*, 2017). Although some studies investigate how social media sentiments affect stock market performance, we contribute to this literature by documenting how expert information intermediaries can improve their forecast accuracy by incorporating market sentiment extracted from social media. Second, we add to the traditional disclosure literature (Rogers and Grant, 1997; Vanstraelen *et al.*, 2003; Dhaliwal *et al.*, 2012)

by highlighting the role of non-financial information. Existing literature suggests the incremental use of non-financial information mostly by looking at financial reports and news from traditional media. But we extend this line of research by showing that market reactions to social media information can be another potential source of non-financial information.

2. Literature review and hypotheses development

2.1 Literature review on analysts' forecast and social media disclosure

Existing literature documents several factors contributing to improvements in analysts' forecast accuracy. It has been shown that analysts' forecast error tends to be lower for large companies (Lys and Soo, 1995; Hope, 2003a, b; Lang *et al.*, 2004) and for companies with stable growth and less variability in earnings (King *et al.*, 1990; Chung and Kim, 1994). On the other hand, forecast error tends to be higher for companies reporting loss, and for companies in financial distress (Brown, 2001; Ciccone, 2001; Hwang *et al.*, 1996). Since larger companies have less information asymmetry, it is likely that analysts following such companies will have a higher forecast accuracy. The quality of financial information can adversely affect forecast accuracy (Behn *et al.*, 2008). Rogers and Grant (1997) argue that analysts use a substantial amount of non-financial information both within and outside of annual reports. Barker and Imam (2008) find that analysts use both accounting-based and non-accounting-based information when they assess earnings. Barron *et al.* (1999) document that forecast accuracy increases with the quality of firms' information through MD&A disclosures. Hope (2003a, b) finds that the level of disclosure about accounting policy is inversely related to forecasting error. Yu (2010) documents that analysts for companies with more comprehensive corporate governance disclosures in annual reports have more accurate earnings forecasts. Vanstraelen *et al.* (2003) show that a higher level of forward-looking non-financial disclosure is associated with a higher accuracy in analysts' earnings forecasts. Dhaliwal *et al.* (2012) find that the issuance of stand-alone corporate social responsibility reports (a proxy for nonfinancial information) is associated with lower analyst forecast error. Tsao *et al.* (2016) show that more disclosures lead to more accurate and less dispersed analyst forecast. Their findings highlight the importance of voluntary disclosure in generating idiosyncratic information by the analysts. Collectively, these studies document that the information environment facilitates analysts' forecasting accuracy. We extend the analyst forecast literature by providing evidence that social media, a unique information generation and dissemination platform, can enrich the information environment for analysts and help reduce their forecast errors.

The information environment for analysts has evolved significantly in the past two decades (Kaplan and Haenlein, 2010) as more and more firms are using social media (either Facebook or Twitter) to disseminate information among capital market participants (Jung *et al.*, 2016). Social media has become an important source of information, challenging conventional media in terms of interest and available resources (Lau and Wydick, 2014). In a high-frequency trading environment where dissemination of information is critical, firms are increasingly relying on social media to engage with investors. Traditional media outlets – such as newspapers, websites, blogs, RSS feed, etc. – do not have the dynamic platform offered by social media platforms. Corporate Facebook pages are open to the public – people who are interested in following certain companies can subscribe to the Facebook pages of those companies, and as soon as new information is made available on Facebook pages, subscribers to these pages are able to see new posts in their newsfeed. Reactions to posts such as "likes," "shares" or "comments" on Facebook pages by the subscribers also make those posts immediately available to their circle of friends. This dynamic connectivity accelerates the dissemination of information and makes Facebook disclosures different from traditional media disclosures. However, literature has not explored how the rapid diffusion of social media

can become an important source of information for information intermediaries. We document this increasing role of social media as a means of information dissemination, and provide evidence of efficient use of information by financial analysts.

Research on social media's impact on the capital market and its' participant is limited. Yang and Liu (2017) argue that social media provides firms with control over the image that they intend to establish. They show that firms minimize disclosures of negative information but employ various patterns and dissemination techniques in order to emphasize positive information. Despite firms' attempts to control their image, social media information can influence stock price and firm value. Luo *et al.* (2013) find that social media-based activities such as web-blogs and consumer ratings are leading indicators of firm equity value, and that they have stronger predictive power than conventional online consumer behavioral metrics. Luo and Zhang (2013) indicate that consumer buzz and traffic in social media explain a substantial portion of the total variance of firms' value. Lee *et al.* (2015) find that social media disclosure related to recall announcements attenuates the negative price reactions. Blankespoor *et al.* (2014) show that social media dissemination is positively associated with liquidity for low-visibility technology firms. However, there is limited evidence of how dissemination on social media affects the beliefs of sophisticated information intermediaries, such as analysts.

Social media channels are also used to provide information and advice by peers (e.g. contributors in Seeking α, or StockTwits) or other investors with or without predictive value, creating variation in opinion across the several available social media platforms (Drake *et al.*, 2016). Studies examining this strand of literature find that opinions expressed by peers in internet message boards do not predict future abnormal returns (Kim and Kim, 2014; Chen *et al.*, 2014). However, these opinions predict abnormal trading volume (Wysocki, 1998; Antweiler and Frank, 2004; Das and Chen, 2007). Correia *et al.* (2014) show the importance of Facebook as an online networking tool for businesses, highlighting the need to examine the implications of corporate social media behavior on market participants. Market participants can also express opinions on firm-specific information using Twitter as a channel. Bartov *et al.* (2017) show that aggregate opinion from firm-specific Tweets predicts corporate earnings and stock price reaction around quarterly earnings announcements. Studies have documented the positive influence of emotional state expressed in Twitter on predicting changes in stock index (Bollen *et al.*, 2011; Mao *et al.*, 2012; Sul *et al.*, 2017). Contrary to these findings, other researchers find that firm-specific Tweets predict trading volume but not returns (Oliveira *et al.*, 2013; Sprenger *et al.*, 2014). Such mixed evidence motivated us to study Facebook, a popular social media platform for corporate disclosures. In addition to expressing opinions without character limitations, subscribers to corporate Facebook pages can express their sentiments to posts through "likes," "comments" and/or "shares." Therefore, the total number of these reactions provides a simple functional metric for estimating market sentiment without exposing empirical analysis to biases from measurement errors associated with other forms of sentiment measures, like textual analysis. We focus specifically on posts and reactions to posts on corporate Facebook pages, thereby differentiating our study from other studies on opinions, which may or may not be relevant to corporate disclosures.

2.2 Hypotheses

Literature has shown that social media plays an important role in information dissemination, and more importantly that it generates additional information content (though opinion or sentiment) with which to supplement firm disclosure. For sophisticated users of financial statements (such as financial analysts), the dynamic nature of social media can offer a platform to filter this incremental information and retain the information pertaining to the valuation of the firm.

A study by Optimal Social (Brand Networks as of October 2013) showed that 75 percent of Facebook engagement or interactions happen within the first three hours of a post being live[6]. The dynamic interaction in social media can propagate information to a larger audience, almost creating a "buzz" or making the news go "viral" (e.g. the video posted on Facebook when United Airlines deplaned a passenger on April 10, 2017 generated 5.4m views, 77,000 likes, 33,909 shares and 12,000 comments)[7]. On the other hand, corporate social media management can better inform the stakeholders about the steps taken to address all public relations issues (e.g. the response by the CEO of United Airlines on April 10 generated 142,000 likes, 12,044 shares, 111,000 comments)[8]. The net effect of interaction by the users of social media on stakeholders – e.g., analysts, suppliers and creditors – is hard to assess ex-ante, making it an important empirical question. In this paper, we address whether and how analysts update their beliefs from the posts and reactions to posts by subscribers of corporate Facebook pages.

Existing literature documents that opinions expressed in social media affect stock return (Bartov *et al.*, 2017), trading volume (Das and Chen, 2007) and information asymmetry (Blankespoor *et al.*, 2014), while other studies find that these opinions have no incremental predictive value and do not predict future abnormal return (Chen *et al.*, 2014). At best, there is mixed evidence on stock market response to social media disclosure. Our study aims to understand the effect of social media information from a different angle. Unlike previous studies, we want to know how expert information intermediaries process the information being disclosed in social media. Analysts are expert information intermediaries with the ability to make precise inferences from a set of information. To the extent that corporate posts convey information about the firms, it is expected that information gap between management and other stakeholders will be reduced. Therefore, we expect that analysts can revise their beliefs and improve forecast accuracy by following corporate Facebook posts. It is very likely that corporate social media posts may contain same information available from other media outlets to comply with RegFD. Hence, corporate Facebook posts may not offer any incremental informational advantage for analysts in terms of improving forecast accuracy. Since it is not clear *ex-ante* what the effect of social media disclosures would be on analyst's forecast accuracy, our first hypothesis in alternative form is as follows:

H1. Corporate Facebook posts have a negative association with forecast error.

The current literature also suggests that sentiments expressed in social media platforms can have immediate and subsequent significant market reaction (Bollen *et al.*, 2011; Mao *et al.*, 2012; Sul *et al.*, 2017; Cade, 2017). This implies that the aggregate sentiment expressed through social media platforms can significantly change the information environment, which is critical for analysts' overall forecast accuracy. It is plausible that analysts with their superior analytical and interpretational skills are able to extract more insights from post-related reactions and sentiments ("likes," "comments" and "shares"). In essence, we are testing whether non-financial information (Dhaliwal *et al.*, 2012) in the form of reactions extracted from social media posts affect analysts' forecast accuracy. Our second hypothesis stated in alternative form is as follows:

H2. Reactions to corporate Facebook posts have a negative association with forecast error.

Our hypotheses focus on identifying the role or roles played by social media in terms of forecasting the performance of information intermediaries, i.e. analysts, who are considered expert information processors with access to multiple sources of information. Thus, if the information revealed on corporate social media – either posts or reactions to posts – have any ability or information content that can improve the average forecast performance of analysts, we expect to find evidence in support of our hypotheses; information generation

role of social media. However, if corporate social media only plays an information dissemination role, we do not expect to find evidence in support of either of our hypotheses. Such findings will suggest that the neither posts (*H1*) nor reactions to posts (*H2*) have any information content, i.e. corporate social media activities play no role in generating new information and only act as a new channel for information dissemination. We distinguish between our two hypotheses by focusing on two separate aspects of generated information. Our first hypothesis focuses on the posts made by companies, while our second hypothesis focuses on the reactions generated by such posts. This distinction helps us to identify whether both of these aspects of generated information are equally important to information intermediaries or not.

3. Methodology

3.1 Sample selection

We first collect analyst quarterly forecast data from the I/B/E/S database. The initial sample consists of all quarterly forecasts from the I/B/E/S database from 2008 to 2012. We restrict our sample to analysts' latest forecasts, which produces a sample of 255,733 observations. We exclude the 78,101 forecasts that came after the actual announcement dates. The number of latest forecasts that are made before the announcement dates are 177,632. After excluding non-S&P 500 firms and merging the I/B/E/S data with the Facebook data set, the number of observations becomes 5,164. Facebook information used in this study is hand-collected. We find the official Facebook page links for S&P 500 firms from corporate websites, and then collect information regarding number of posts, comments, likes and shares (CLS) on each day for the period from 2008 to 2012. We collect the financial information of firms from COMPUSTAT quarterly database. Because of the unavailability of financial information and the missing values of other forecast related variables, we delete 235 observations. Thus, our final sample consists of 4,929 quarterly forecasts for 436 firms.

3.2 Model specification

We employ the following regressions in order to test the research questions of this study:

$$\begin{aligned}\text{Forecast_Error}_{it} = {} & \alpha + \beta_1 \text{Post}_{it} + \beta_2 \text{Size}_{it} + \beta_3 \text{Leverage}_{it} + \beta_4 \text{ROE}_{it} \\ & + \beta_5 \text{Book_to_Mkt}_{it} + \beta_6 \text{Loss_Firm}_{it} + \beta_7 \text{Change_in_EPS}_{it} \\ & + \beta_8 \text{No_Analyst}_{it} + \beta_9 \text{Forecast_Horizon}_{it} + \beta_{10} \text{FourthQtr}_i + \varepsilon_t \ldots \quad (1)\end{aligned}$$

$$\begin{aligned}\text{Forecast_Error}_{it} = {} & \alpha + \beta_1 CLS_{it} + \beta_2 \text{Size}_{it} + \beta_3 \text{Leverage}_{it} + \beta_4 \text{ROE}_{it} \\ & + \beta_5 \text{Book_to_Mkt}_{it} + \beta_6 \text{Loss_Firm}_{it} + \beta_7 \text{Change_in_EPS}_{it} \\ & + \beta_8 \text{No_Analyst}_{it} + \beta_9 \text{Forecast_Horizon}_{it} + \beta_{10} \text{FourthQtr}_i + \varepsilon_t \ldots \quad (2)\end{aligned}$$

$$\begin{aligned}\text{Forecast_Error}_{it} = {} & \alpha + \beta_1 Post\&CLS_{it} + \beta_2 \text{Size}_{it} + \beta_3 \text{Leverage}_{it} + \beta_4 \text{ROE}_{it} \\ & + \beta_5 \text{Book_to_Mkt}_{it} + \beta_6 \text{Loss_Firm}_{it} + \beta_7 \text{Change_in_EPS}_{it} \\ & + \beta_8 \text{No_Analyst}_{it} + \beta_9 \text{Forecast_Horizon}_{it} + \beta_{10} \text{FourthQtr}_i + \varepsilon_t \ldots \quad (3)\end{aligned}$$

We use Equation (1) to test *H1* and Equation (2) to test *H2*. We use Equation (3) as an additional test in order to examine forecast accuracy from both posts and reactions. The dependent variable of our study is $\text{Forecast_Error}_{i,t}$. We estimate forecast errors by using two measures: forecast errors based on mean forecasts ($Forecast_Error_Mean_{i,t}$), and forecast errors based on median forecasts ($Forecast_Error_Median_{i,t}$). We follow prior literature

(Brown, 1993; Schipper, 1991) in order to define forecast errors as the absolute value of percentage of errors, where subscripts i and t denote firm i and quarter t, respectively:

$$\text{Forecasts_Error}_{it} = \left| \frac{\text{Actual}_{it} - \text{Forecasted}_{it}}{\text{Actual}_{it}} \right|.$$

We also disaggregate the information content into two main parts: *Posts* and *CLS*. Our variables of interest are *Post,* which is a daily average of the number of posts measuring the volume of information on corporate Facebook pages; *CLS*, which is the daily average of CLS, which measures reactions to posts; and *Post&CLS*, which measures the interplay between posting behavior and user reactions. *Post, CLS* and *Post&CLS* are calculated as the average number of posts, CLS and both on an official Facebook page for a firm during the 15 days before the I/B/E/S reported quarterly forecast dates.

We control for firm-specific economic factors and other determinants for analyst forecast errors. We also control for the size of the firm, because firm size is closely related to the information environment and to the disclosures that influence analyst forecasts (Lang and Lundholm, 1996). Analyst forecasts are more accurate for larger firms (Bushan, 1990; Lys and Soo, 1995; Brown, 1997; Hope, 2003a, b; Lang *et al.*, 2003). $Size_{i,t}$ is measured as the natural logarithm of the firm's market capitalization.

In our model, we also include leverage, profitability and company growth prospects, since these relate to the nature and complexity of company operations and analyst incentives for gathering information about them. We estimate $Leverage_{i,t}$ as the total long-term debt divided by total stockholder equity. The control for the profitability variable is $ROE_{i,t}$, which is calculated as net income divided by total stockholder equity. $Book_to_Mkt_{i,t}$, the ratio of book value per share to market value per share, captures the growth prospects of the firm. Prior studies find that analyst forecasts are less accurate for loss firms (Brown, 2001; Ciccone, 2001; Hwang *et al.*, 1996). We control the effect of loss firms on forecast errors by including an indicator variable, $Loss_Firm_{i,t}$, which equals 1 if the firm reports negative earnings, and 0 otherwise. Lang and Lundholm (1996) find that larger changes in earnings are associated with less accurate forecasts. In order to control the effect of earnings surprises on forecast errors, we include another variable, $Change_in_EPS_{i,t}$, which is the absolute value of the changes in earnings per share from the previous quarter to the current quarter. All of the financial control variables are measured based on quarterly reporting.

Lys and Soo (1995) suggest that the greater the number of analysts following a company, the higher the incentive to reduce forecast errors in the ongoing competition for reputation. We include the variable, $No_Analyst_{i,t}$ (natural logarithm of the number of analysts following the firm) (Dhaliwal *et al.*, 2012). Also, the degree of forecast error depends on the time horizon between the forecast dates and the actual announcement dates (Brown *et al.*, 1987; Lys and Soo, 1995; Jaggi and Jain, 1998). Earlier forecasts are subject to greater uncertainty but forecasts made closer to the timeof announcementare more likely to be accurate (Das and Saudaragan, 1998; Jacob *et al.*, 1999; Duru and Reeb, 2002). We control forecast time horizon by including the $\text{Forecast_Horizon}_{it,}$ which is the number of days between announcement dates and forecast dates. We also include dummy variables for fourth quarter, year, and industry-fixed effects. We estimate the model by clustering the standard errors by firms. Appendix summarizes variable definitions.

4. Results

4.1 Sample distributions

Facebook was first launched in 2004; however, it was made available for public in September 2006. The culture of maintaining a corporate Facebook page developed

around 2007, although very few companies shared information on their Facebook pages at that time. As Facebook gained more popularity, companies began sharing more and more information on their corporate Facebook pages. Our sample reflects this gradual adoption of Facebook for corporate disclosures (Table I Panel A). Panel A in Table I also shows that the average number of posts and CLS per day grew gradually since 2008. In terms of volume, the information content comes primarily from the CLS provided by the public and stakeholders. In 2008, 277 of our S&P 500 firms maintained Facebook pages. However, the number of posts and reactions to posts were very minimal during 2008 due to infrequent posting, which resulted in an average number of daily posts and reactions (CLS) that is close to zero (0).

Panel B shows that, in our sample, manufacturing is the largest sector followed by wholesale and retail trade. The smallest sectors are agriculture, forestry and fishing, and the public administration sector. Panel B also shows that transportation, communication, and utilities have the highest number of average posts and CLS per day at 193.81, followed by the wholesale and retail trade sector, with 178.97 posts and CLS per day.

Panel A year-wise sample distribution

Year	Frequency	Percentage	Average number of post per day	Average number of CLS per day	Average number of post and CLS per day
2008	885	17.95	0.00	0.00	0.00
2009	1,124	22.80	0.06	8.82	8.89
2010	1,175	23.84	0.34	67.53	67.88
2011	1,202	24.39	0.64	213.98	214.62
2012	543	11.02	0.80	376.74	377.54
Total	4,929	100.00			

Panel B sample distribution by industry

Industry	SIC codes	Frequency	Percentage	Average number of post and CLS per day	Average number of post per day	Average number of CLS per day
Agriculture, Forestry and Fishing	0100 – 0999	17	0.34	4.74	0.20	4.55
Mining and Constructions	1000 – 1799	172	3.49	3.29	0.16	3.13
Manufacturing	2000 – 3999	1,747	35.44	100.14	0.26	99.88
Transportation, Comm. and Utility	4000 – 4999	820	16.64	193.81	0.48	193.33
Wholesale and Retail Trade	5000 – 5900	1,022	20.73	178.97	0.47	178.49
Finance, Insurance and Real Estate	6000 – 6700	579	11.75	9.11	0.20	8.91
Services	7000 – 8999	553	11.22	51.90	0.37	51.53
Public Administrations	9100 – 9999	19	0.39	70.29	0.31	69.98
Total		4,929	100.00			

Notes: This table presents the distribution of the final sample used in this study. Our sample consists of 436 firms' 4,929 quarterly forecasts from 2008 to 2012, restricted to S&P 500 firms, and excludes the non-latest forecasts and forecasts made after the announcement date

Table I. Sample distribution by year and industry

4.2 Descriptive statistics

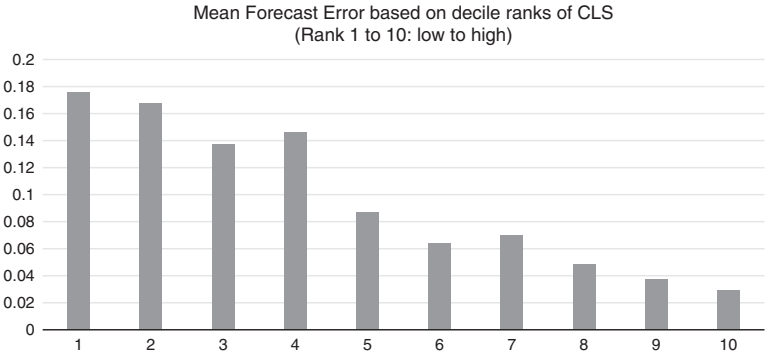
Table II reports that the mean value of *Posts* and *CLS* is 112.139 per day, with a maximum value of 35,580. The maximum value of *Post&CLS* represents the widespread popularity or reactions (known as "viral" posts) to some posts. Popularity among posts varies widely, as evident in the standard deviation of 951.625 for posts and CLS. The mean and standard deviation values of posts per day are 0.343 and 0.771, representing the fact that companies make one post every three days on average. The median value of post, CLS and *Post&CLS* are all "0," indicating skewness in the distributions. We use log transformation for each variable in order to address such skewness. The mean value of the analyst mean-estimates-based forecast errors is 0.113.The standard deviations of *Forecast_Error_Mean* and *Forecast_Error_Median* are 0.252 and 0.248, respectively. While the average number of analysts following a firm is 7.479, the minimum and maximum numbers are 1 and 41, respectively. The average forecast horizon is 283.19 days, with a standard deviation value of 49.669. The average size (natural logarithm of the market capitalization) of the firms in the sample is 9.09, and the standard deviation is 1.333. The mean and standard deviation of the leverage are 0.708 and 11.867, respectively. The variable *Book_to_Mkt* has a mean of 0.60 and a standard deviation of 0.892. The mean and standard deviation values of the variable *Change_in_EPS* are 0.625 and 2.308. All financial variables are winsorized at the 1 and 99 percent levels.

In order to check how average reactions (CLS) on corporate social media affect the average forecast errors, we plot the average forecast errors for each reaction deciles. We first rank CLS into ten separate groups (decile ranks) on a yearly basis, where group 1 represents the lowest level of CLS and group 10 represents the highest level. Then, we calculate the mean forecast error for each decile rank group for our full sample. Figure 1 shows that mean

Variable	*n*	Mean	SD	Lower quartile	Median	Upper quartile
Facebook variables						
Post_&_CLS	4,929	112.139	951.629	0.000	0.000	5.733
Post	4,929	0.343	0.771	0.000	0.000	0.400
CLS	4,929	111.796	951.464	0.000	0.000	5.267
(Log) Post_&_CLS[a]	4,929	1.225	2.003	0.000	0.000	1.907
(Log) Post[a]	4,929	0.214	0.352	0.000	0.000	0.336
(Log) CLS[a]	4,929	1.195	2.001	0.000	0.000	1.835
Forecast variables						
Forecast_Error_Mean	4,929	0.113	0.252	0.024	0.059	0.127
Forecast_Error_Median	4,929	0.112	0.248	0.025	0.059	0.126
(Log) No_Analyst	4,929	1.906	0.684	1.386	1.946	2.398
Forecast_Horizon	4,929	283.194	49.669	279.000	287.000	294.000
Financial variables						
Size	4,929	9.094	1.3335	8.2873	9.0948	9.8726
Leverage	4,929	0.709	11.8671	0.2325	0.5262	1.0624
ROE	4,929	0.0074	1.0103	0.0171	0.0345	0.0558
Book_to_Mkt	4,929	0.6007	0.8921	0.2906	0.4964	0.7991
Loss_Firm	4,929	0.1203	0.3254	0.00	0.00	0.00
Change_in_EPS	4,929	0.6258	2.3084	0.08	0.20	0.48

Notes: [a]Denotes log transformation of a variable. We use (Log) Post_&_CLS, (Log) Post, and (Log) CLS in our tests and denote them, respectively, as Post_&_CLS, Post, and CLS. Reported statistics without log are only for descriptive purposes. This table presents descriptive statistics for the key variables used in this study. Our sample consists of 436 firms' 4,929 quarterly forecasts from 2008 to 2012, restricted to S&P 500 firms, and excludes the non-latest forecasts and forecasts made after the announcement date

Table II.
Descriptive statistics



Note: Vertical axis shows mean forecast error and horizontal axis shows CLS (comments, likes and shares) groups based on yearly decile ranking

Figure 1.
Forecast error by social media reactions

forecast error gradually declines as we move up the CLS decile ranks (from 1 to 10). A test of means difference shows that the mean forecast error for CLS in the highest decile rank (10) is significantly lower than the mean forecast error in the lowest decile rank (1). Thus, it provides some preliminary evidence consistent with our *H2*, that these reactions on corporate social media have the ability to provide more information for discerning information intermediaries, such as analysts.

4.3 Regression results

The information in Facebook posts varies from sales promotion to merger-and-acquisition-related key decisions, and it appears that Facebook – a vast and interactive platform – engages the public and stakeholders in key corporate decisions. Stakeholder reactions to various corporate decisions are often critical, adding value to the information environment for financial analysts. The more CLS, the richer the information content that can help financial analysts reduce forecasting errors. Table III shows the regression results for the Facebook variable *Post* (Equation (1)). The regression results show that there is no significant association between the dependent variables, *Forecast_Error_Mean* and *Forecast_Error_Median*, and *Post*. This finding implies that financial analysts may gather no incremental information from corporate Facebook posts. One explanation for this finding is that Facebook post information is already available to financial analysts. Analysts could collect the information from other sources before the companies post their information on social media. It is also possible that, because of Reg FD, corporations would not provide material information only to the users of Facebook. Therefore, the information in these posts does not add incremental value to the information set that is already available to analysts.

Table IV reports the regression results in which the key explanatory variable is *CLS*. The variable *CLS* captures Facebook user reactions to corporate posts. The sentiment information in *CLS* is generated by the public and key stakeholders, such as investors and customers. The results for all regression models in Table IV show that there are significant negative associations between *CLS* and analyst forecast errors. *Forecast_Error_Mean* is positively correlated with firm size and *Loss_Firm*, and negatively associated with *No_Analyst*. This implies that analysts find earnings for loss firms more difficult to forecast, and a higher number of analysts on average tend to improve overall forecast accuracy of analysts. We find qualitatively similar results for our model with *Forecast_Error_Median* as the dependent variable. This finding implies that financial analysts use the information from public and stakeholder reactions on corporate Facebook pages and incorporate these

Table III.
Multiple regression of analysts' forecast errors on Facebook information content (post)

	Forecast_Error_Mean				Forecast_Error_Median			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.0202 (0.75)	0.0185 (0.32)	0.0212 (0.73)	0.0188 (0.34)	0.0224 (0.54)	0.0195 (0.41)	0.0230 (0.54)	0.0204 (0.40)
Post	−0.0162 (−0.73)	−0.0112 (−0.73)	−0.0157 (−0.79)	−0.0114 (−0.71)	−0.0172 (−0.96)	−0.0127 (−0.84)	−0.0175 (−0.97)	−0.0131 (−0.85)
Size		0.0085 (1.48)		0.0087 (1.46)		0.0082 (1.44)		0.0081 (1.43)
Leverage		0.0000 (0.15)		0.0001 (0.17)		0.0001 (0.24)		0.0002 (0.22)
ROE		−0.0006 (−0.21)		−0.0006 (−0.23)		−0.0008 (−0.31)		−0.0009 (−0.33)
Book_to_Mkt		0.0186 (1.52)		0.0189 (1.56)		0.0185 (1.55)		0.0188 (1.53)
Loss_Firm		0.0808*** (3.38)		0.0814*** (3.42)		0.0813*** (3.34)		0.0806*** (3.37)
Change_in_EPS		0.0052 (1.51)		0.0051 (1.48)		0.0051 (1.49)		0.0050 (1.48)
No_Analyst		−0.0415** (−2.53)		−0.0418** (−2.54)		−0.0403** (−2.49)		−0.0393** (−2.46)
Forecast_Horizon		0.0001 (1.62)		0.0001 (1.59)		0.0001 (1.60)		0.0001 (1.57)
FourthQtr		−0.0108 (−1.13)		−0.0112 (−1.12)		−0.01 (−0.99)		−0.01 (−0.99)
Firm fixed-effect	Yes	Yes	No	No	Yes	Yes	No	No
Industry fixed-effect	No	No	Yes	Yes	No	No	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	5.20%	7.81%	5.22%	7.88%	6.13%	7.32%	6.14%	7.41%
n	4,929	4,929	4,929	4,929	4,929	4,929	4,929	4,929

Notes: Standard errors are clustered by firm and t-statistics are reported in parentheses. This table reports multiple regressions results of analysts' forecast errors on average of Facebook posting for 15 days before forecast dates. Our variable of interest for this table is average number of Facebook posts. Our sample consists of 436 firms' 4,929 quarterly forecasts from 2008 to 2012, restricted to S&P 500 firms, and excludes the non-latest forecasts and forecasts made after the announcement date. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

Table IV.
Multiple regression of analysts' forecast errors on Facebook information content (comments, likes and shares)

	Forecast_Error_Mean					Forecast_Error_Median		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.0099 (0.22)	0.0097 (0.18)	0.0099 (0.22)	0.0095 (0.28)	0.0145 (0.29)	0.0114 (0.22)	0.0143 (0.30)	0.0114 (0.24)
CLS	−0.0072*** (−3.57)	−0.0064*** (−3.05)	−0.0073*** (−3.54)	−0.065*** (−3.15)	−0.0068*** (−3.76)	−0.0062*** (−3.33)	−0.0066*** (−3.75)	−0.0061*** (−3.28)
Size		0.0094* (1.67)		0.0096* (1.68)		0.0092 (1.59)		0.0088 (1.57)
Leverage		0.0000 (0.19)		0.0001 (0.19)		0.0001 (0.25)		0.0001 (0.21)
ROE		−0.0006 (−0.22)		−0.0007 (−0.26)		−0.0008 (−0.29)		−0.0008 (−0.27)
Book_to_Mkt		0.0181 (1.52)		0.0183 (1.54)		0.0182 (1.51)		0.0182 (1.51)
Loss_Firm		0.0825*** (3.45)		0.0827*** (3.38)		0.0827*** (3.44)		0.0824*** (3.47)
Change_in_EPS		0.0052 (1.51)		0.0055 (1.53)		0.0051 (1.49)		0.0052 (1.48)
No_Analyst		−0.0403** (−2.48)		−0.0408** (−2.49)		−0.0392** (−2.45)		−0.0390** (−2.49)
Forecast_Horizon		0.0001 (1.52)		0.0001 (1.52)		0.0001 (1.55)		0.0001 (1.54)
FourthQtr		−0.0101 (−1.13)		−0.012 (−1.15)		−0.0098 (−0.90)		−0.0101 (−0.95)
Firm fixed-effect	Yes	Yes	No	No	Yes	Yes	No	No
Industry fixed-effect	No	No	Yes	Yes	No	No	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	7.70%	11.36%	7.76%	11.42%	5.45%	8.11%	5.48%	8.20%
n	4,929	4,929	4,929	4,929	4,929	4,929	4,929	4,929

Notes: Standard errors are clustered by firm and t-statistics are reported in parentheses. This table reports multiple regressions results of analysts' forecast errors on average of Facebook posting for 15 days before forecast dates. Our variable of interest for this table is average number of CLS (Comments, Likes and Shares) on Facebook posts. Our sample consists of 436 firms' 4,929 quarterly forecasts from 2008 to 2012, restricted to S&P 500 firms, and excludes the non-latest forecasts and forecasts made after the announcement date. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

into their forecasting decisions. These results provide strong support for our *H2*, and we conclude that reactions to posts on corporate Facebook pages significantly help to improve analysts' forecast accuracy.

The key explanatory variable in Table V is *Post_&_CLS*. We put both post and CLS variables together in order to see the interplay between posts and CLS. The results show that *Post_&_CLS* is significantly and negatively associated with *Forecast_Error_Mean*. *Forecast_Error_Mean* is positively correlated with firm size and *Loss_Firm*, and negatively associated with *No_Analyst*. Table V also reports the regression model in which the dependent variable is *Forecast_Error_Median*. The results are consistent with columns 1 to 4, and provide additional support for our analysis. In column 6, the coefficient value on *Forecast_Error_Median* is −0.0059, with a *t*-stat value −3.49. The results in this table are largely driven by the influence of CLS, since we find that the *Post_&_CLS* coefficients are statistically indifferent from the *CLS* coefficients.

Table V provides strong evidence suggesting that corporate Facebook pages help to improve analysts' forecast performance, highlighting the importance of the "information generation" role rather than the "information dissemination" role of social media. Posts on corporate Facebook pages have no influence on forecast performance, but reactions to posts have significant influence in terms of improving analyst forecast performance.

As robustness checks, we conduct additional analysis to confirm that our results are not biased by the selection of the time-window for Facebook information before the analyst forecast dates. In our main analysis, we consider Facebook information content for 15 days before the forecast dates. We change the time-window to a 30-day, 45 day and 7 day periods before the announcement dates. Un-tabulated results are consistent with our reported findings. Our results are also not sensitive to the dropping of manufacturing sector from our sample, since the manufacturing sector constitutes a significant portion (approximately 35 percent) of our sample.

5. Conclusion

Our study provides early evidence about whether financial analysts use information on social media. We measure information content in corporate Facebook pages with both posts and reactions to posts. We find that there is a significant negative association between analyst forecast errors and reactions to posts on corporate Facebook pages. However, we find no evidence that corporate posts provide analysts with any information that improves their forecast accuracy. We separate the "information dissemination" role, which is the expanded dissemination of information through Facebook posts, from the "information generation" role, which is the sentiment related information in reactions to posts on Facebook pages. Our results provide support for the "information generation" role and show that reactions to corporate Facebook posts are the new and unique information generated by social media that help information intermediaries to improve their forecast accuracy.

Our study has some limitations. First, we focus on S&P 500 firms that are large and in a rich information environment. Hence, findings from similar analyses may differ for small or mid-sized firms. Second, the period in our sample coincides with the early period of corporate Facebook culture, and many firms did not have a Facebook presence that time and frequent posts on company Facebook pages did not appear until later. So, a more recent data set on Facebook content may provide better results. Third, we did not classify the type of information found in the posts. Future studies could analyze types of posts, with particular focus on reactions that subscribers generate about corporate postings, examining whether they influence the bias or revisions of analyst forecasts. Overall, our study provides evidence of the increasing importance of social media as an effective and interactive channel for providing and circulating corporate information for sophisticated users such as financial analysts.

	Forecast_Error_Mean					Forecast_Error_Median			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.0093 (0.22)	0.0105 (0.20)	0.0099 (0.24)	0.0095 (0.27)	0.0145 (0.24)	0.0117 (0.22)	0.0145 (0.24)	0.0114 (0.22)
Post_CLS	−0.0071*** (−3.55)	−0.062*** (−3.07)	−0.0071*** (−3.54)	−0.065*** (−3.17)	−0.0063*** (−3.76)	−0.0059*** (−3.49)	−0.0062*** (−3.77)	−0.0061*** (−3.52)
Size		0.0092* (1.65)		0.0092* (1.68)		0.0090 (1.58)		0.0088 (1.57)
Leverage		0.0000 (0.18)		0.0001 (0.19)		0.0001 (0.25)		0.0001 (0.21)
ROE		−0.0006 (−0.20)		−0.0007 (−0.21)		−0.0008 (−0.30)		−0.0008 (−0.27)
Book_to_Mkt		0.0180 (1.53)		0.0183 (1.54)		0.0181 (1.52)		0.0182 (1.51)
Loss_Firm		0.0818*** (3.36)		0.0822*** (3.38)		0.0824*** (3.47)		0.0829*** (3.48)
Change_in_EPS		0.0052 (1.50)		0.0055 (1.51)		0.0050 (1.49)		0.0052 (1.52)
No_Analyst		−0.0403** (−2.49)		−0.0408** (−2.48)		−0.0392** (−2.44)		−0.0394** (−2.49)
Forecast_Horizon		0.0001 (1.50)		0.0001 (1.52)		0.0001 (1.51)		0.0001 (1.54)
FourthQtr		−0.0112 (−1.16)		−0.0110 (−1.15)		−0.0109 (−0.97)		−0.0101 (−0.93)
Firm fixed-effect	Yes	Yes	No	No	Yes	Yes	No	No
Industry fixed-effect	No	No	Yes	Yes	No	No	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	7.04%	11.33%	7.11%	12.14%	5.60%	8.09%	5.77%	8.02%
n	4,929	4,929	4,929	4,929	4,929	4,929	4,929	4,929

Notes: Standard errors are clustered by firm and *t*-statistics are reported in parentheses. This table reports multiple regressions results of analysts' forecast errors on average of Facebook posting for 15 days before forecast dates. Our variable of interest for this table is average posts and CLS (Comments, Likes and Shares) for these posts. Our sample consists of 436 firms' 4,929 quarterly forecasts from 2008 to 2012, restricted to S&P 500 firms, and excludes the non-latest forecasts and forecasts made after the announcement date. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

Table V.
Multiple regression of analysts' forecast errors on Facebook information content (post and CLS)

Notes

1. Available at: www.sec.gov/news/press-release/2013-2013-51htm and www.sec.gov/investment/im-guidance-updates.html (accessed November 18, 2017).
2. For example, Netflix CEO's Facebook post on 1bn hours of content consumed on Netflix resulted in a 13 percent rise in stock price on the day of the post. (http://money.cnn.com/2012/12/07/technology/netflix-facebook-sec/index.html, last accessed on November 18, 2017).
3. For example, the recent customer deplane event by the United Airlines created an outrage mainly due to social media attention. A video posted on Facebook generated 5.4m views, and the CEO had to respond to the incident by sharing his sincere regrets, which was also shared by more than one hundred thousand followers. United lost $1.4bn of its market value in few days. (http://fortune.com/2017/04/11/united-airlines-stock-drop/, accessed November 18, 2017).
4. Available at: www.statista.com/statistics/272014/global-social-networks-ranked-by-number-of-users/ (accessed November 18, 2017).
5. Our results are robust to changing the pre-forecast aggregation window to 7 days, 30 days or 45 days.
6. Available at: http://venturebeat.com/2013/03/28/75-of-facebook-engagement-is-in-the-first-180-minutes-says-facebook-competition-winning-tool/ (accessed November 18, 2017).
7. Available at: www.facebook.com/cnn/videos/10156406273256509/ (accessed November 18, 2017).
8. Available at: www.washingtonpost.com/news/dr-gridlock/wp/2017/04/11/amid-pr-fiasco-over-dragged-passenger-united-ceo-defends-his-crew/?utm_term=.73c53f74f88b (accessed November 18, 2017).

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Appendix

Variable	Definition	Data source
Dependent variables		
Forecast_Error_Mean	Percentage of forecast errors calculated as the absolute difference between actual values and mean forecasts, divided by the actual values	I/B/E/S
Forecast_Error_Median	Percentage of forecast errors calculated as the absolute difference between actual values and median forecasts, divided by the actual values	I/B/E/S
Explanatory variables		
Post	Natural logarithm of average number of posts in an official Facebook page for a specific firm during the 15 days before the quarterly forecast dates	Hand-collected
CLS	Natural logarithm of average number of comments, likes and shares in an official Facebook page on corporate posting for a specific firm during the 15 days before the quarterly forecast dates	Hand-collected
Post_&_CLS	Natural logarithm of average number of posts, comments, likes and shares in an official Facebook page for a specific firm during the 15 days before the quarterly forecast dates	Hand-collected
Control variables		
Size	Natural logarithm of the market capitalization of the firm at the end of the quarter	CRSP and Compustat
Leverage	Total long-term debt divided by total stockholders' equity	Compustat
ROE	The net income divided by total stockholders' equity	Compustat
Book_to_Mkt	Book value per share and market value per share	CRSP and Compustat
Loss_Firm	An indicator variable, equals to 1 if the firm reports negative earnings, and 0 otherwise	Compustat
Change_in_EPS	Absolute value of the changes in earnings per share from the previous quarter to current quarter	Compustat
No_Analyst	Natural logarithm of the number of analysts that follow the firm throughout the quarter	I/B/E/S
Forecast_Horizon	Number of days between the actual announcement dates and forecast dates	I/B/E/S
FourthQtr	An indicator variable, equals to 1 if the forecast is for fourth fiscal quarter, and 0 otherwise	CRSP

Table AI.
Variable definitions

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Share classes, families and asset purchases: Canadian evidence

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Abstract

Purpose – The purpose of this paper is to test if relative asset purchase values (RAPVs) differ between single- and dual-class purchasers (not) differentiated by family ownership for Canadian firms.
Design/methodology/approach – The paper uses multivariate regressions and 2SLS estimations of simultaneous equations models with both continuous and dichotomous endogenous variables. Data on share structures and family involvements are hand collected.
Findings – RAPVs for dual-class purchasers are significantly different (larger) than their single-class counterparts only for family-controlled samples. Larger RAPVs for dual-class purchases are associated with higher degrees of dual-class structures, higher family ownerships and with boards with no more than one family member.
Research limitations/implications – RAPV is important because of its common use as a primary determinant of the wealth effects of M&As, its use as an exchange-rate proxy in two-stage regressions used to determine the amount of abnormal returns attributable to short selling activity around M&A announcements, and its use as a channel for conveying information about deal complexity, seller's bargaining power, additional monitoring benefits from purchase and/or greater challenges in incorporating a purchase into existing assets. Larger sample size would facilitate more differentiated examinations.
Practical implications – Findings imply that dual-class share structures assist family shareholders in elevating their control over corporate decisions involving asset purchases.
Social implications – This paper furthers the authors' knowledge about the effects of agency issues on corporate decisions.
Originality/value – It provides an extension and robustness test of the US evidence for asset purchases by providing evidence for Canada given its greater preponderance of families as the ultimate controlling shareholders, restricted or subordinated voting shares issued and pyramidal structures.

Keywords Asset purchases, Dual class, Family ownership and control

Paper type Research paper

1. Introduction

The central prediction of the model of Hege *et al.* (2009) is that large gains in wealth are associated with equity-based asset sales for both buyers and sellers. In sharp contrast with the unfavorable wealth effects from mergers, Warusawitharana (2008) reports that purchases and sales of operating firm assets have generated $162bn for shareholders over the past 20 years, and that corporate asset purchases and sales are consistent with efficient investment decisions.

While a number of papers reviewed in Section 2 have examined the abnormal returns associated with the purchase of assets, they do not examine the relation between the relative size of asset purchases and corporate share class structures given that family involvements are common among dual-class firms (DeAngelo and DeAngelo, 1985; McVey and Draho, 2005)[1]. Thus, this paper examines these relationships using a full sample of

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1,632 asset purchases by TSX- or TSX Venture-listed firms, and a subsample of 82 purchases by dual-class purchasers.

An examination of relative acquirer to target size is important for a number of reasons. First, it is commonly used as a primary determinant of the wealth effects of mergers and acquisitions (e.g. Fich *et al.*, 2018). Second, in their two-stage regression used to determine the amount of abnormal returns attributable to short selling activity around merger announcements, Mitchell *et al.* (2004) use relative size as a proxy for the exchange ratios that guide arbitrageurs (also see Kryzanowski and Nie, 2019). Finally, relative size is assumed to convey information about deal complexity, seller's bargaining power, additional monitoring benefits from the purchase and/or greater challenges in incorporating a purchase into the purchaser's existing assets (e.g. Fuller *et al.*, 2002).

Using the full sample, we first test whether the relative asset purchase values (RAPVs) differ between single- and dual-class purchasers. We find that the estimated coefficients of the class dummy variable are statistically insignificant at conventional levels. We then test if this finding changes when we control for whether the purchasers are family controlled using thresholds of 5 percent (or 10 percent) to identify family-controlled firms. We find that all the estimated coefficients for the class dummy variable are significantly positive using the subsample of family controlled but not for the subsample of purchasers that is not family controlled. Thus, the absence of a relation between the RAPVs and whether the buyer is single- or dual-class in the full sample may be attributed to the much larger sample size for non-family-controlled vs family-controlled purchasers. We then use the subsample of 82 asset purchases by dual-class firms to examine the relation between the degree of dual-class structures and RAPVs. We find that all of the estimated coefficients for this variable are significantly positive, which implies that a higher degree of dual-class structures is associated with a larger RAPV. Continuing with this subsample, we find that the RAPVs are positively associated with whether the dual-class purchasers are family controlled and with the values of family ownership, and negatively associated with dual-class purchasers with two or more family-related directors.

Thus, we provide evidence in support of greater risk-bearing hypotheses that RAPVs for family-controlled dual-class purchasers are greater than those for non-family-controlled one, that higher family ownerships are associated with larger RAPVs, and that the RAPVs are smaller for dual-class purchasers with more than one family member on their boards.

This paper makes three important contributions to the literature. First, we extend the literature on external asset purchases to include the effects of share class structures of firms, including the size of the divergence between insider voting and cash flow rights, and family involvements in their ownerships and directions on the relative values of such asset purchases. This is important because prior studies find that such purchases are consistent with efficient investment decisions at least in the short run (e.g. Warusawitharana, 2008; Amira *et al.*, 2013). Second, we test the robustness of the US evidence for asset purchases by providing evidence for Canada given its greater preponderance of families as the ultimate controlling shareholders, restricted or subordinated voting shares issued and pyramidal structures (e.g. Gadhoum, 2006; King and Santor, 2008). Third, we extend the literature on family involvement (e.g. Wilson *et al.*, 2013) by providing further evidence that the presence of multiple family members on firm boards has a material impact on the real investment decisions of firms that involve external purchases of assets (e.g. Bjuggren and Palmberg, 2010; Anderson *et al.*, 2012).

The remainder of the paper is organized as follows: Section 2 provides a brief review of the related literature. Section 3 presents the hypotheses and methodology used herein. Section 4 describes the sample and data. Section 5 tests for differences in the relative purchase values of single- vs dual-class purchasers of assets. Section 6 examines the relationship between RAPVs and family involvement for dual-class purchasers. Section 7 provides some additional tests of robustness. Section 8 concludes the paper.

2. Literature review

2.1 Previous studies dealing with dual-class firms

While pyramid structures are more common throughout the world than dual-class shares (La Porta *et al.*, 1999), dual-class firms are frequent in Brazil, Canada, Denmark, Finland, Germany, Italy, Norway, Korea, Mexico, Sweden and Switzerland, and less so in Australia, Chile, France, Hong-Kong, South Africa, the UK and the USA (Nenova, 2003). To illustrate, Faccio and Lang (2002) report that dual-class shares are employed by 66, 51 and 41 percent of the firms in Sweden, Switzerland and Italy, respectively.

As a ownership-leveraging device (Yurtoglu, 2003; Ben-Nasr *et al.*, 2012) and control device (Lins, 2003; Lubatkin *et al.*, 2007; Giannetti and Laeven, 2009), common shareholders hold a minority (majority) interest in the cash flows (voting) rights of a typical dual-class firm (DeAngelo and DeAngelo, 1985; Bebchuk and Weisbach, 2010; McGuire *et al.*, 2014). The divergence between control and ownership is related to the agency conflict between controlling and minority shareholders (King and Segal, 2009; Villalonga and Amit, 2009; Aguilera and Jackson, 2010; Amoako-Adu *et al.*, 2011). Dual-class shares and pyramids only enhance the control of the largest shareholders (Faccio and Lang, 2002; Hoskisson *et al.*, 2005; Stulz, 2005).

Since private benefits are higher for firms with dual-class share structures (DeAngelo and DeAngelo, 1985; Smart and Zutter, 2003; Doidge, 2004), dual-class firms have significant control premiums in the absence of coattail provisions (Nenova, 2003) and the values of their cash holdings for outside shareholders decrease with a wider divergence between insider voting and cash flow rights (Masulis *et al.*, 2009).

Dual-class ownership may entrench managers and allow them to perform at suboptimal levels. As the divergence between insider voting and cash flow rights widens, firm values decrease (McGuire *et al.*, 2014)[2] and CEO compensations and shareholder value-destroying acquisitions increase (Masulis *et al.*, 2009) but the extent of tax avoidance declines (McGuire *et al.*, 2014). Unlike their single-class counterparts, CEO turnover is not sensitive to firm performance (Smart *et al.*, 2008). While the announcements of dual-class recapitalizations are associated with significantly negative abnormal stock returns (Jarrell and Poulsen, 1988)[3], there are statistically and economically significant value gains associated with the unifications of multi- into single-class share structures (Smart *et al.*, 2008). Compared to their single-class counterparts, the earnings of firms with dual-class equity structures are less informative (Wang, 2006) or credible as a measure of firm performance (Francis *et al.*, 2005). Furthermore, a dual-class status is associated with both a poorer information environment and increased accrual-based earnings management (Li and Zaiats, 2017).

Dual-class share structures can have positive valuation effects by allowing founders to pursue a long-term idiosyncratic vision or strategy without fear of short-term repercussions (Winden, 2018), particularly in high growth sectors that require greater risk-taking (Jordan *et al.*, 2016). The positive association identified between patent output, quality and creativity with disproportionate insider control for a sample of IPOs is confined to financially constrained firms for the first five years post-IPO (Baran *et al.*, 2018). By providing a shield against short-term market pressures, dual-class shares help firms take on higher-risk, value-increasing projects (Jordan *et al.*, 2018). Short- and long-term value-enhancing benefits are relatively greater for dual- vs single-class acquirers after the passage of the Sarbanes-Oxley Act and its mandated transparency measures (Chourou *et al.*, 2019).

Dual-class share structures are associated with substantial family involvement (DeAngelo and DeAngelo, 1985; McVey and Draho, 2005). They provide the founder or heir with additional means to pursue their goals (La Porta *et al.*, 1999; Anderson *et al.*, 2009; Srinidhi *et al.*, 2014). Single-class family firms are primarily responsible for family firms exhibiting better disclosure practices and better disclosure-related consequences as compared to non-family firms (Ali *et al.*, 2007). A family with greater voting rights through dual-class shares has a greater incentive to increase firm value (Srinidhi *et al.*, 2014).

Methods used to reflect the existence of dual-class stock in prior empirical studies include: a dummy variable equal to 1 if a firm utilizes dual-class shares with differential voting rights, and 0 otherwise[4]; the difference between the voting rights and cash flow rights of insiders (McGuire *et al.*, 2014); the ratio of voting rights of insiders over their cash flow rights (Masulis *et al.*, 2009); and superior and inferior voting rights per share (Francis *et al.*, 2005).

2.2 Previous studies dealing with asset purchases

Firms typically purchase tangible assets more frequently than intangible assets (Teece, 1998; Barth *et al.*, 2001) using cash, shares and hybrid deals (Slovin *et al.*, 2005; Brauer and Wiersema, 2012; Hossain, 2015) and synthetic leases (Zechman, 2010) as the methods of payment. Assets are purchased for post-contractual opportunism or to prevent certain threats such as strategic maneuvering (King, 2007), or due to profit and reputational incentives (Dasgupta *et al.*, 2011) or promotional focus (Petersen *et al.*, 2015) or to obtain "fire-sale" discounts from sellers in financial distress, especially when the assets cannot be readily redeployed by firms outside of the industry (Shleifer and Vishny, 1992; Kiyotaki and Moore, 1997)[5]. However, competition among buyers can result in a price run-up by inducing buyers to purchase assets at a loss-making price to prevent rivals from purchasing at lower prices (Bond and Leitner, 2015), which can potentially offset the purchaser's abilities to exploit information disadvantages in the selling firm's managers (Bergh *et al.*, 2008). Positive short-run abnormal returns are found for asset purchasers (Coval and Stafford, 2007), especially for purchasers of state-owned assets (Borisova *et al.*, 2013; Vayanos and Woolley, 2013; Borisova and Cowan, 2014), and in the presence of better monitoring and better governance as proxied by higher private debt and lower antitakeover provisions in place, respectively (Amira *et al.*, 2013). In contrast, Chen *et al.* (2014) report that the stocks of asset purchasers, on average, underperform following purchases.

A few papers examine the association between dual-class structures and asset allocations. Hanson and Song (1996) find that managers with a strong preference for superior voting shares make unrelated asset acquisitions to diversify their employment risk. Hu and Black (2007) argue that such share structures make it easier for firms to make long-term, positive NPV investments with unobservable payoffs. Consistent with the conclusion of Lauterbach and Yafeh (2011), Dimitrov and Jain (2006) find higher past growth rates in sales and assets for dual- vs single-class firms. Bjuggren and Palmberg (2010) find that family control has a positive (negative) impact on investment performance when ownership and control are (not) aligned.

3. Hypotheses and methodology

Our first null hypothesis is that:

H_1. The relative value of asset purchases does not depend upon whether the purchaser is single- or dual-class.

To test, we examine the sign and significance of the estimated coefficient for RelAssetPurVal from the following regression where the control variables are derived from the previous literature (e.g. Warusawitharana, 2008; Yang, 2008[6]:

$$\begin{aligned}\text{Rel Asset Pur Val} = {} & \beta_0 + \beta_1\,\text{ClassDum}_i + \beta_2\text{Sequence1}_i + \beta_3\text{Sequence2}_i + \beta_4\text{ROA}_i \\ & + \beta_5\text{EPS}_i + \beta_6\text{StockRet}_i + \beta_7\text{Lev}_i + \beta_8\text{IndPart}_i + \beta_9\text{IndHHI}_i \\ & + \beta_{10}\text{IndLev}_i + \beta_{11}\text{GDPGrowth}_i + \varepsilon_i, \end{aligned} \quad (1)$$

where RelAssetPurVal is the relative asset purchase value obtained by dividing the Canadian dollar value of the purchase by the purchaser's total assets, ClassDum is a dummy variable which is equal to 1 if the asset purchaser is dual-class, and 0 otherwise, Sequence1 is a dummy variable which is equal to 1 if the purchaser traded after a sequence of buys in the sample period, and 0 otherwise. Dasgupta *et al.* (2011) find that a purchaser receiving a positive signal after a sequence of buys is even more willing to buy the asset, even if it results in an overpayment, Sequence2 is the number of buys in the same period before this particular asset purchase, ROA and EPS are return on assets (e.g. Warusawitharana, 2008; Li *et al.*, 2013) and earnings per share during the previous 12 months, StockRet is the stock return from four weeks to one week prior to the asset purchase announcement, Lev is the book value of debt divided by the book value of total assets at the end of the last 12 months to capture the purchaser's ability to finance the asset purchase with debt, IndPart is the number of firms which belong to the same industry as the purchaser, IndHHI is the value of the Herfindahl index calculated based on the market share of the top 5 firms in the same industry as the purchaser to reflect industry concentration, IndLev is the average leverage ratio of all firms in the same industry as the purchaser, GDPGrowth is the percentage change of real GDP compared to that for the previous year for the country in which the headquarters of the purchaser are located, which is included to capture the positive association of the number of asset purchases with the state of the economy (Yang, 2008).

Although our three industry-level control variables are based on two-, three- or four-digit SIC codes, we generally do not present tabulations of all the regression runs since they have no material impact on whether or not the variables of interest are significant. For greater details about all variables see the Appendix.

Our second null hypothesis is that:

H_2. The relative value of an asset purchase does not depend upon the degree of the divergence in cash flow and voting rights.

To test, we examine the sign and significance of the estimated coefficient for D-C_Degree when this variable replaces ClassDum in regression (1). As in Masulis *et al.* (2009), D-C_Degree is the sum of total votes for each share class, all divided by the total number of shares. As further addressed subsequently, this metric can provide counter-intuitive rankings if a share structure includes shares with no voting rights.

Our third null hypothesis is that:

H_3. The RAPV does not depend upon whether the dual-class purchaser is family-controlled, the value of family ownership or whether the dual-class purchaser has two or more family-related directors.

To test, we include one or more of three measures of family involvement in Equation (1). FamilyDum is a dummy variable which is equal to 1 if the purchaser is family controlled in that their ownership exceeds a threshold of 5 or 10 percent (Muñoz-Bullón and Sanchez-Bueno, 2011). FamilyOwn is the percentage of the total number of outstanding common shares held by family shareholders. DirectorDum is a dummy variable which is equal to 1 if the buyer has two or more directors who are related family members on the board, and 0 otherwise.

4. Sample and data

4.1 Sample and data sources

We begin by capturing 7,553 asset purchases with TSX- or TSX Venture-listed purchasers from SDC Platinum over the period from January 1, 2000 to July 13, 2015[7]. After adding five additional asset purchases identified from a Factiva search and deleting asset

purchases with unavailable asset purchase values, this sample is reduced to 5,262 asset purchases involving 3,002 with completed deal status. As is customary in the literature, asset purchases by financial firms are deleted. This reduces the sample further to 2,338 asset purchases. After deleting asset purchases with no values for total assets for the purchasers and those for which information concerning the purchaser's share class structure or family participation is unavailable in SEDAR, our final sample consists of 1,632 asset purchases with 82 involving dual-class purchasers.

A summary description of the data sources used herein is provided in the Appendix. RAPVs and the total assets of the purchasers are obtained from SDC Platinum, and from Factiva and SEDAR when unavailable in SDC Platinum. Voting rights and number of common shares in each share class and the holdings and directorships of family shareholders are manually collected from Proxy Circulars available on the SEDAR website. The variables, Sequence1 and Sequence2, are derived from the obtained sample and from examining the history of each firm. Values for other control variables, such as ROA, EPS, StockRet and Lev, are obtained from SDC Platinum. Data on industry participants, industry concentration and industry leverage are obtained from Compustat Monthly Updates available through Wharton Research Data Services (WRDS). GDP growth rates of various countries are obtained generally from the World Bank Open Data[8].

4.2 Summary statistics

Table I presents three panels of descriptive information for our sample of firms. In Panel A for the full sample, 789 and 848 of the purchases are by purchasers listed, respectively, on the TSX and TSX Venture, 389 purchases involve purchasers that are cross-listed in the USA, and 644 purchases involve purchasers who traded before their particular asset purchases. For the subsample of 82 dual-class purchases, the majority of purchases involve purchasers who are listed on the TSX. Furthermore, 38 of these purchasers are family-controlled, have more than one family-related director on their boards and did not trade prior to the asset purchases. In addition, 96.34 and 96.26 percent of the dual- and single-class purchasers, respectively, are headquartered in Canada.

Panel B reports that the mean RAPV is 0.7952 for all 1,632 purchases, and that the mean number of previous purchases is 0.8817. Panel C reports on the 82 purchases in which only dual-class buyers participated. The variable RelAssetPurVal has a mean value of 0.2411 with a maximum and minimum value of 5.3934 and 0.0005, respectively. The index reflecting the degree of dual-class structure is 2.7130 on average. The percentage of the total number of outstanding common shares held by family shareholders is 13.06 percent. The average number of previous purchases is 1.6829, nearly twice as many as for the full sample.

5. Relative asset purchase values for single- and dual-class purchasers

We first test the first hypothesis that:

H_1. The relative value of asset purchases does not depend upon whether the purchaser is single- or dual-class by estimating Equation (1) using various combinations of firm-level, industry-level and macro economy-level variables as controls.

Based on Table II, we observe that the estimated coefficients of our major independent variable ClassDum are not statistically significant at conventional levels. In contrast, the estimated coefficients of many of the control variables such as ROA and Lev are always significant.

We cannot conclude that the relative values of the purchases are not significantly different for all types of single- and dual-class purchasers because the RAPVs may differ

Panel A: classification of asset purchases for the full sample and the subsample based on various deletion criteria

	1,632 purchases		82 purchases	
Listing venue of purchaser				
TSX	789		74	
TSX Venture	848		11	
Cross-listed in the USA	389		33	
Dummy variable	1	0	1	0
ClassDum	82	1,550	–	–
FamilyDum	–	–	38	44
DirectorDum	–	–	38	44
Sequence1	644	988	44	38

Panel B: summary statistics for variables for the full sample of 1,632 asset purchases

Variable	Mean	Median	SD	Max.	Min.	Number of asset purchases
RelAssetPurVal	0.7952	0.0825	6.4698	221.7391	0.0001	1,632
Sequence2	0.8817	0	1.6721	13	0	1,632
ROA	−0.2203	−0.0188	0.9427	4.5000	−20.0000	1,632
EPS	−0.0641	−0.0160	4.6002	23.7123	−153.6986	1,580
StockRet	0.0015	−0.0058	0.1880	1.1528	−0.7436	1,412
Lev	0.3246	0.3175	0.2247	0.9853	0.0061	1,512
IndPart2	229.3553	56	257.9173	1054	1	1,545
IndPart3	179.0736	38	213.4694	909	1	1,290
IndPart4	191.5396	96	180.4213	621	1	858
IndHHI2	0.2147	0.1042	0.2121	1.0000	0.0085	1,545
IndHHI3	0.2333	0.1620	0.2105	1.0000	0.0162	1,290
IndHHI4	0.2004	0.1460	0.1847	1.0000	0.0162	858
IndLev2	0.3104	0.3409	0.1591	0.8932	0.0064	1,506
IndLev3	0.3229	0.3452	0.1593	0.8948	0.0064	1,224
IndLev4	0.3986	0.3748	0.1437	0.9701	0.0490	790
GDPGrowth	0.0203	0.0253	0.0175	0.0677	−0.0431	1,632

Panel C: summary statistics for the variables for the subsample of 82 asset purchases by dual-class purchasers

Variable	Mean	Median	SD	Max.	Min.	Number of asset purchases
RelAssetPurVal	0.2411	0.0443	0.7594	5.3934	0.0005	82
D-C_Degree	2.7130	1.1296	3.2072	10.9221	0.0403	82
FamilyOwn	0.1306	0.0067	0.1812	0.8127	0	82
Sequence2	1.6829	1	2.6428	12	0	82
ROA	−0.0471	0.0520	0.5465	0.2576	−4.4857	82
EPS	1.0502	0.7553	1.3805	4.9925	−2.2890	82
StockRet	0.0164	0.0076	0.1019	0.3749	−0.1923	55
Lev	0.5078	0.5272	0.1673	0.8750	0.1000	82
IndPart2	230.4568	188	254.0158	976	1	81
IndPart3	93.0141	38	163.7255	828	1	71
IndPart4	44.3538	27	70.2456	377	5	65
IndHHI2	0.1033	0.0472	0.1390	1.0000	0.0122	81
IndHHI3	0.1511	0.0841	0.1477	1.0000	0.0197	71
IndHHI4	0.1896	0.1885	0.1173	0.6881	0.0370	65
IndLev2	0.4446	0.4702	0.1221	0.6285	0.0692	71
IndLev3	0.4323	0.4244	0.1406	0.7144	0.0692	55
IndLev4	0.5110	0.4892	0.1801	0.9658	0.1995	51
GDPGrowth	0.0233	0.0253	0.0178	0.0512	−0.0271	82

Notes: Panel A: Number in samples of criteria. This table presents three panels of descriptive information for the sample of firms. Variables are defined in the Appendix

Table I.
Summary statistics

Table II.
Relative asset purchase values and share class structures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ClassDum	−0.583 (−0.8)	−0.418 (−0.57)	−0.397 (−0.54)	−0.571 (−0.61)	−0.554 (−0.59)	0.153 (0.83)	0.144 (0.78)
Sequence1		−0.159 (−0.47)		−0.385 (−1.01)		−0.073 (−0.81)	
Sequence2			−0.051 (−0.53)		−0.065 (−0.62)		−0.046* (−1.88)
ROA		−1.009*** (−3.94)	−1.007*** (−3.93)	−1.009*** (−3.60)	−1.013*** (−3.61)	−0.277** (−2.40)	−0.267** (−2.32)
EPS				−0.006 (−0.15)	−0.007 (−0.18)		
StockRet				−0.411 (−0.4)	−0.423 (−0.42)		
Lev		0.807 (1.08)	0.795 (1.07)	1.344 (1.58)	1.276 (1.51)	−0.414* (−1.69)	−0.424* (−1.73)
IndPart3							
IndPart4						0.001*** (2.68)	0.001*** (2.70)
IndHHI3							
IndHHI4						0.135 (0.37)	0.099 (0.27)
IndLev3							
IndLev4						−0.082 (−0.22)	−0.051 (−0.14)
GDPGrowth							
F-value	0.63	4.22***	4.23***	2.75**	2.64**	3.67***	4.10***
Adj. R^2	−0.000	0.009	0.009	0.008	0.008	0.024	0.028
Observations	1,632	1,512	1,512	1,265	1,265	759	759
	(8)	(9)	(10)	(11)	(12)	(13)	
ClassDum	−0.512 (−0.5)	−0.519 (−0.51)	0.150 (0.81)	0.141 (0.76)	−0.563 (−0.55)	−0.569 (−0.55)	
Sequence1	−0.139 (−0.32)		−0.069 (−0.76)		−0.110 (−0.25)		
Sequence2		−0.037 (−0.27)		−0.046* (−1.85)		−0.029 (−0.22)	
ROA	−0.755** (−2.41)	−0.754** (−2.41)	−0.278** (−2.41)	−0.267** (−2.32)	−0.755** (−2.41)	−0.755** (−2.41)	
EPS							
StockRet							
Lev	2.305* (1.94)	2.292* (1.93)	−0.418* (−1.70)	−0.427* (−1.75)	2.212* (1.86)	2.202* (1.85)	
IndPart3	−0.001 (−0.61)	−0.001 (−0.59)			−0.001 (−0.74)	−0.001 (−0.72)	
IndPart4			0.001*** (2.65)	0.001*** (2.67)			
IndHHI3	−0.490 (−0.32)	−0.483 (−0.31)			−0.589 (−0.38)	−0.584 (−0.38)	
IndHHI4			0.132 (0.36)	0.097 (0.27)			
IndLev3	−3.134* (−1.69)	−3.116* (−1.68)			−3.264* (−1.76)	−3.250* (−1.75)	
IndLev4			−0.087 (−0.24)	−0.057 (−0.16)			
GDPGrowth			1.601 (0.57)	1.479 (0.53)	15.981 (1.28)	16.025 (1.28)	
F-value	1.90*	1.90*	3.25***	3.62***	1.87*	1.87*	
Adj. R^2	0.006	0.006	0.023	0.027	0.006	0.006	
Observations	1,135	1,135	759	759	1,135	1,135	

Notes: This table presents the results of whether the relative asset purchase values (RAPVs) differ for single- and dual-class asset purchasers for the full sample of 1,632 asset purchases. The variables are described in the Appendix. The *t*-statistics are reported in the parentheses below the coefficient estimates. *,**,***Significant at the 0.10, 0.05 and 0.01 levels, respectively

when we account for family involvement. To explore this possibility, we create four subsamples based on whether purchasers are family controlled or not and whether the threshold used to identify family-controlled firms is 5 or 10 percent. Based on the results summarized in Panel A of Table III for the subsample of family-controlled purchasers based on a 5 percent threshold, we find that all of the estimated coefficients for the variable ClassDum are significantly positive and relatively constant across the various formulations of Equation (1). Thus, the RAPV for a family-controlled dual-class purchaser is significantly larger than that for a family-controlled single-class purchaser. Furthermore, the estimated coefficients of control variables such as IndLev4 and GDPGrowth are statistically significant in all the regressions, which imply that both industry leverage and GDP growth are negatively associated with the relative value of asset purchases. More specifically based on Column (2), the RAPV decreases by 0.333 standard deviation with a one standard deviation increase in industry leverage. The untabulated relationship between the RAPVs and ClassDum is also consistently positive and significant using a 10 percent threshold[9].

Regression results using a sample of non-family-controlled purchasers based on a threshold of 5 percent are reported in Panel B. Like their untabulated counterparts for a 10 percent threshold, we find no significant relation between the dependent variable RelAssetPurVal and our main explanatory variable ClassDum. The control variable ROA continues to be always negatively related to the relative value of the asset purchases, and the number of participants in the same industry is significantly and positively associated with RelAssetPurVal. We surmise that the lack of a significant relation in the full sample between the relative value of a purchase and whether the buyer is single- or dual-class is due to the much larger sample size of purchases for non-family-controlled vs family-controlled purchasers.

These findings imply that a dual-class share structure is a more effective tool or mechanism for families to consolidate their power to influence corporate management, particularly in terms of growth through asset purchases. They support the findings of DeAngelo and DeAngelo (1985) and Bethel *et al.* (1998) that the dual-class share structure affects corporate decisions, and are consistent with the conjecture of Srinidhi *et al.* (2014) that a family with greater voting rights through holdings of dual-class shares has greater incentives to influence corporate management.

Next, we examine the association between the degree of the dual-class structure, DC_Degree, and the relative purchase value, RelAssetPurVal, for a sample of 82 asset purchases by dual-class purchasers. Based on the regression results summarized in Table IV, the signs of the coefficients of D-C_Degree are positive except when the three industry controls (IndPart, IndHHI and IndLev) are measured at the three- and not four-digit SIC level.

The change in the significance of the estimated coefficients of D-C_Degree could be due to a problem of using this particular variable as a proxy for the degree of dual-class structure when a firm's share structure includes a class with no voting rights. To illustrate, suppose Firms X and Y have 100 Class B shares with ten votes per share but the 100 Class A shares for Firm X have zero voting rights while those for Firm Y have one vote per share. The D-C_Degree values for Firm X and Y are 5 and 5.5, respectively. It is obvious that Firm X with a lower value of D-C_Degree has a much higher degree of dual-class structure from a voting-rights perspective than Firm Y. To test the effect of this potential problem on our results, we use a subsample where all asset purchases are by purchasers who have share classes with at least one vote per share.

Based on the regression results reported in Table V for this subsample, we observe that all the estimated coefficients of D-C_Degree are significantly positive[10]. The control variables such as Sequence2 and IndLev are significant. This result illustrates that a

Table III.
Relative asset purchase values and share class structures with(out) family controls

Panel A: for the subsample of family-controlled purchasers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ClassDum	0.223* (1.93)	0.528** (2.26)	0.519** (2.21)	0.670*** (2.77)	0.674*** (2.76)	0.576** (2.50)	0.569** (2.44)	0.700*** (2.95)	0.710*** (2.95)
Sequence1		−0.151 (−0.93)		−0.069 (−0.41)		−0.160 (−0.99)		−0.088 (−0.53)	
Sequence2			−0.027 (−0.76)		−0.006 (−0.17)		−0.022 (−0.65)		−0.004 (−0.11)
ROA		0.457 (1.19)	0.458 (1.19)			0.356 (0.94)	0.352 (0.92)		
EPS				−0.144 (−1.34)	−0.150 (−1.38)			−0.130 (−1.23)	−0.142 (−1.33)
Lev		−0.389 (−0.82)	−0.469 (−1.01)	−0.297 (−0.63)	−0.333 (−0.71)	−0.334 (−0.72)	−0.424 (−0.93)	−0.251 (−0.54)	−0.297 (−0.65)
IndPart4		−0.001 (−1.53)	−0.001 (−1.47)	−0.001 (−1.29)	−0.001 (−1.27)	−0.001* (−1.73)	−0.001* (−1.66)	−0.001 (−1.52)	−0.001 (−1.49)
IndHHI4		−0.590 (−0.87)	−0.522 (−0.78)	−0.767 (−1.13)	−0.728 (−1.08)	−0.671 (−1.01)	−0.583 (−0.89)	−0.826 (−1.24)	−0.771 (−1.17)
IndLev4		−1.705** (−2.59)	−1.579** (−2.39)	−1.410** (−2.02)	−1.352* (−1.97)	−1.900*** (−2.90)	−1.772*** (−2.69)	−1.635** (−2.35)	−1.558** (−2.29)
GDPGrowth						−9.473* (−1.93)	−9.130* (−1.85)	−9.725** (−2.00)	−9.561* (−1.97)
F-value	3.74*	2.86**	2.81**	2.92***	2.90***	3.05***	2.96***	3.16***	3.11***
Adj. R^2	0.018	0.134	0.131	0.138	0.137	0.164	0.157	0.171	0.168
Observations	149	85	85	85	85	85	85	85	85

Panel B: for the subsample of non-family-controlled purchasers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ClassDum	−0.740 (−0.58)	−0.145 (−0.61)	−0.152 (−0.52)	−0.703 (−0.71)	−0.710 (−0.52)	−0.148 (−0.6)	−0.154 (−0.62)	−0.751 (−0.55)	−0.757 (−0.55)
Sequence1		−0.063 (−0.27)	−0.131 (−0.63)			−0.056 (−0.56)	−0.096 (−0.2)		
Sequence2		−0.047* (−1.66)			−0.040 (−0.26)		−0.045 (−0.2)	−0.030 (−1.6)	
ROA		−0.314** (−2.58)	−0.304** (−2.50)	−0.763** (−2.30)	−0.763** (−2.30)	−0.315*** (−2.59)	−0.305** (−2.51)	−0.764** (−2.31)	−0.764** (−2.31)
Leverage		−0.452* (−1.67)	−0.457* (−1.69)	2.569* (1.96)	2.563* (1.95)	−0.458* (−1.69)	−0.461* (−1.70)	2.471* (1.88)	2.466* (1.88)
IndPart3				−0.001 (−0.54)	−0.001 (−0.52)			−0.001 (−0.68)	−0.001 (−0.66)
IndPart4		0.001*** (2.96)	0.001*** (2.98)			0.001*** (2.90)	0.001*** (2.92)		
IndHHI3				−0.423 (−0.25)	−0.416 (−0.25)			−0.564 (−0.33)	−0.560 (−0.33)
IndHHI4		0.249 (0.62)	0.215 (0.54)			0.241 (0.6)	0.208 (0.52)		
IndLev3				−3.293 (−1.62)	−3.282 (−1.61)			−3.476* (−1.71)	−3.468*(−1.70)
IndLev4		0.137 (0.34)	0.155 (0.39)			0.122 (0.3)	0.141 (0.35)		
GDPGrowth						2.509 (0.81)	2.316 (0.75)	18.528 (1.35)	18.551 (1.36)
F-value	0.51	3.88***	4.23***	1.78*	1.78*	3.47***	3.77***	1.79*	1.79*
Adj. R^2	−0.000	0.029	0.033	0.005	0.005	0.029	0.032	0.006	0.006
Observations	1,482	674	674	1,033	1,033	674	674	1,033	1,033

Notes: This table reports the results of tests of (H_1): the relative asset purchase values (RAPVs) do not depend upon whether the purchaser is single- or dual-class for subsamples based on whether purchasers are family-controlled based on a 5 percent threshold. The variables are described in the Appendix. The *t*-statistics are reported in the parentheses below the coefficient estimates. *,**,***Significant at the 0.10, 0.05 and 0.01 levels, respectively

Table IV.
Relative asset purchase values and degrees of share class structures for dual-class purchasers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
D-C_Degree	0.060** (2.35)	0.115** (2.68)	0.119*** (2.76)	0.040 (0.92)	0.046 (1.02)	0.133*** (3.01)	0.147*** (3.27)	0.050 (1.17)
Sequence1		−0.093 (−0.38)		−0.055 (−0.24)		−0.173 (−0.69)		−0.117 (−0.5)
Sequence2			−0.073 (−0.71)		−0.054 (−0.52)		−0.154 (−1.39)	
ROA		−0.230 (−1.17)	−0.228 (−1.17)	−0.181 (−0.91)	−0.186 (−0.94)	−0.305 (−1.52)	−0.325 (−1.64)	−0.239 (−1.2)
Lev		−0.480 (−0.57)	−0.470 (−0.56)	−0.579 (−0.67)	−0.614 (−0.71)	−0.636 (−0.75)	−0.661 (−0.8)	−0.501 (−0.59)
IndParticipant3				−0.001* (−1.84)	−0.001* (−1.84)			−0.001* (−1.80)
IndParticipant4		−0.002 (−1.15)	−0.002 (−1.18)			−0.003 (−1.51)	−0.003* (−1.68)	
IndHHI3				−3.666* (−2.01)	−3.550* (−1.94)			−4.259** (−2.32)
IndHHI4		0.124 (0.11)	0.172 (0.15)			−0.065 (−0.06)	−0.022 (−0.02)	
IndLev3				−2.940** (−2.44)	−2.741** (−2.15)			−3.329*** (−2.75)
IndLev4		−2.450*** (−3.10)	−2.342*** (−2.90)			−2.488*** (−3.18)	−2.274*** (−2.89)	
GDPGrowth						−10.167 (−1.44)	−13.244* (−1.79)	−10.743 (−1.56)
F-value	5.54**	2.89**	2.97**	2.54**	2.58**	2.85**	3.13***	2.59**
Adj. R^2	0.053	0.209	0.216	0.166	0.170	0.229	0.254	0.191
Obs.	82	51	51	55	55	51	51	55

Notes: This table presents the results when examining the association between the degrees of the dual-class structures (D-C_Degree) and the relative asset purchase values (RAPVs) for a sample of 82 asset purchases confined to dual-class purchasers. The variables are described in the Appendix. The *t*-statistics are reported in the parentheses below the coefficient estimates. *,**,***Significant at the 0.10, 0.05 and 0.01 levels, respectively

Table V.
Relative asset purchase values and degrees of dual-class structures excluding purchasers with no-vote shares

	(1)	(2)	(3)	(4)
D-C_Degree	0.222*** (2.95)	0.240*** (2.98)	0.238*** (3.22)	0.280*** (3.56)
Sequence1	−0.655 (−1.67)		−0.721* (−1.88)	
Sequence2		−0.291 (−1.66)		−0.397** (−2.29)
ROA	−0.325 (−1.25)	−0.365 (−1.4)	−0.448 (−1.7)	−0.538** (−2.07)
Lev	−1.817 (−1.45)	−1.735 (−1.38)	−1.675 (−1.37)	−1.547 (−1.3)
IndParticipant3	−0.001 (−0.59)	−0.001 (−0.62)	0.001 (−0.04)	0.001 (0.15)
IndLev3	−3.875** (−2.45)	−3.009* (−1.92)	−4.045** (−2.63)	−3.034* (−2.05)
GDPGrowth			−26.793 (−1.59)	−35.095* (−2.05)
F-value	2.87**	2.86**	2.96**	3.35**
Adj. R^2	0.254	0.253	0.294	0.332

Notes: Number of observations is 34. This table presents the regression results for the association between relative asset purchase values (RAPVs) and the degrees of the dual-class structures (D-C_Degree) when the purchases by purchasers who have no-vote shares in their share structures are excluded. The variables are described in the Appendix. The *t*-statistics are reported in the parentheses below the coefficient estimates. *,**,***Significant at the 0.10, 0.05 and 0.01 levels, respectively

higher degree of dual-class structure leads to larger RAPVs. RelAssetPurVal increases by 0.732 standard deviation with a one standard deviation increase in D-C_Degree (see Column (1) of Table V).

We also examine the robustness of D-C_Degree as a proxy of the degree of dual-class structure by adding an interactive term, D-C_Degree×VoteDum, where VoteDum is a dummy variable equal to 1 if a share class has no votes per share and to 0 otherwise. Based on untabulated results, we find that the estimated coefficients of D-C_Degree are always statistically significant, which is consistent with the results in Table V, while those of the interactive variable are not significant.

6. Relative asset purchase values and family involvements for dual-class purchases

Due to the high correlation between FamilyDum and FamilyOwn[11], we examine the separate effects of these two variables for the 82 purchases by dual-class purchasers in this section of the paper. Based on the results summarized in Table VI, we observe that all the estimated coefficients are positive for FamilyDum and FamilyOwn and significantly negative for DirectorDum. These results imply that the relative values of asset purchases are greater for family- than non-family-controlled dual-class purchases, greater with greater family ownership, and smaller if there are two or more family directors. This latter result may be attributable to a greater potential for family conflict from various sources such as ownership dispersion, sibling rivalry and identity conflict (Schulze *et al.*, 2003; Wilson *et al.*, 2013).

7. Some further tests of robustness

Our previous results indicate that RAPVs are positively associated with both dual-class degree and family ownership, and negatively associated with the director dummy. We now include these three variables in the same equation to further test the relation between RAPVs and dual-class degrees. Since the effects of dual-class degree may not be monotonic, we rank this variable into terciles and create three indicator variables to distinguish the tercile assignment of dual-class degree with the 82 purchases that only involve dual-class purchasers.

	(1)	(2)	(3)	(4)
FamilyDum	0.865*** (2.91)	0.853*** (2.87)		
FamilyOwn			3.270*** (6.41)	3.267*** (6.43)
DirectorDum	−0.693** (−2.30)	−0.672** (−2.24)	−0.597*** (−2.76)	−0.572** (−2.67)
Sequence1	0.062 (0.28)		0.024 (0.14)	
Sequence2		−0.001 (−0.01)		−0.040 (−0.54)
ROA	−0.239 (−1.28)	−0.236 (−1.27)	−0.251* (−1.73)	−0.250* (−1.73)
Lev	−0.142 (−0.17)	−0.146 (−0.17)	0.234 (0.36)	0.231 (0.35)
IndPart3	−0.001 (−1.37)	−0.001 (−1.37)	0.001 (−0.24)	0.001 (−0.22)
IndHHI3	−3.581** (−2.15)	−3.662** (−2.20)	−0.900 (−0.64)	−1.009 (−0.72)
IndLev3	−3.375*** (−3.26)	−3.381*** (−3.25)	−1.360 (−1.51)	−1.306 (−1.45)
GDPGrowth	−12.022* (−1.87)	−12.228* (−1.86)	−9.797* (−1.94)	−10.523** (−2.04)
F-value	3.55***	3.54***	8.77***	8.85***
Adj. R^2	0.299	0.297	0.564	0.567

Notes: This table presents the results for the association between relative asset purchase values (RAPVs) and two measures of family involvement (namely, whether the purchaser is family-controlled (FamilyDum) and the family's percentage ownership (FamilyOwn)) for the sample of 82 asset purchases by dual-class purchasers. The variables are described in the Appendix. The *t*-statistics are reported in the parentheses below the coefficient estimates. *,**,***Significant at the 0.10, 0.05 and 0.01 levels, respectively

Table VI.
Relative asset purchase values and family involvements for dual-class purchasers

Our OLS coefficient estimates reported in Table VII indicate that the relative value of asset purchases has a monotonic positive association with dual-class degree. Relative to the highest tercile, the lowest tercile of dual-class degrees has a more muted positive association with RAPVs. The results for the other variables are similar to those presented earlier.

Our final test deals with endogeneity using the 2SLS estimation method described in Maddala (1983) for simultaneous equations models in which one of the endogenous variables is continuous (the RAPV) and the other endogenous variable is dichotomous (dual-class degree). Our results summarized in Table VIII are consistent with the notion that purchasers with greater dual-class degree (for D-C_DegreeIII) tend to engage in asset purchases with greater RAPVs (with *t*-statistics ranging from 2.01 to 11.11).

8. Conclusion

We initially find that the RAPVs are not significantly different for single- and dual-class purchasers. We find that the RAPVs are significantly different (greater) for dual- vs single-class purchasers that are family controlled but not for their non-family-controlled counterparts. We find that the RAPVs of dual-class asset purchasers are significantly and positively associated with the degree of the dual-class share structure, which implies that asset purchasers with higher degrees of dual-class structures, on average, participate in asset purchases with larger RAPVs. We also find that the relative values of asset purchases for family-controlled dual-class purchasers are significantly larger than those for their non-family-controlled counterparts, that dual-class purchasers with higher family ownership tend to be engaged in asset purchases with larger relative values and that the RAPVs for dual-class purchasers with more than one family director are smaller. These findings imply that dual-class share structures assist family shareholders in elevating their control over corporate decisions involving asset purchases.

Table VII.
Relative asset purchase values and dual-class degrees

	(1)	(2)	(3)	(4)	(5)	(6)
D-C_Degree						
(I)	0.035*** (4.66)	0.029** (2.54)	0.084* (1.71)	0.061** (2.01)	0.057*** (3.84)	0.022*** (6.91)
(III)	0.771*** (11.23)	0.598*** (8.14)	0.427** (1.97)	0.204*** (8.02)	0.378*** (7.11)	0.642*** (15.18)
FamilyOwn	1.204*** (5.23)	2.366*** (6.01)	1.978** (2.03)	1.624*** (9.11)	2.109*** (13.26)	3.002*** (4.77)
DirectorDum	−0.468** (−1.98)	−0.387*** (−4.66)	−0.458* (−1.71)	−0.551** (−2.05)	−0.482** (−1.99)	−0.515* (−1.87)
ROA	−0.235* (−1.70)	−0.187 (−0.56)	−0.198* (−0.77)	−0.237* (−1.67)	−0.223 (−0.31)	−0.199 (−0.80)
IndPart2					0.001 (0.41)	−0.001 (−0.55)
IndPart3			−0.001 (−0.23)	0.001 (0.74)		
IndPart4	0.001 (0.82)	0.001 (0.63)				
IndHHI2					0.211 (0.42)	0.254 (0.39)
IndHHI3			−0.878 (−0.99)	−0.651 (−0.81)		
IndHHI4	0.464 (1.01)	0.357 (0.61)				
Lev	0.029 (1.14)		0.039 (0.89)		0.024 (0.67)	
IndLev2					−0.678 (−0.44)	−0.711 (−0.31)
IndLev3			−1.234 (−0.66)	−1.259 (−0.23)		
IndLev4	−0.345 (−0.99)	−0.411 (−0.82)				
GDPGrowth		−11.582** (−2.01)		−12.559 (−0.27)		−14.234* (−1.88)
Intercept	−1.456** (−2.11)	9.216 (0.36)	0.239* (1.78)	13.367 (0.59)	−1.397* (−1.93)	11.741** (2.37)
F-value	9.89***	11.84***	12.65***	9.04***	10.11***	11.77***
Adj. R^2	0.564	0.595	0.617	0.598	0.623	0.610
Observations	51	51	55	55	81	81

Notes: This table reports the OLS regression results with relative asset purchase values (RAPVs) as the dependent variable for the sample of 82 purchases by dual-class purchasers. I and III refer to the first and third (from lowest to highest) dual-class degree tercile. The second tercile (II) is omitted to avoid the dummy variable trap. The definitions of all variables are provided in the Appendix. The *t*-statistics are reported in the parentheses below the coefficient estimates. *,**,***Significant at the 0.10, 0.05 and 0.01 levels, respectively

Table VIII.
Relative asset purchase values, dual-class degrees and family involvements

Dependent variable	(1) ($n = 51$) RAPV	(1) ($n = 51$) D-C_DegreeIII	(2) ($n = 55$) RAPV	(2) ($n = 55$) D-C_DegreeIII	(3) ($n = 81$) RAPV	(3) ($n = 81$) D-C_DegreeIII
RelAssetPurVal		0.116*** (9.14)		0.131*** (2.67)		0.098*** (3.44)
D-C_DegreeIII	0.769*** (11.11)		0.415** (2.01)		0.369*** (7.65)	
FamilyOwn	1.212*** (5.26)	−0.360** (−2.30)	1.983** (2.07)	−0.315*** (−6.98)	2.361*** (13.64)	−0.339** (−2.11)
DirectorDum	−0.467** (−1.97)	0.094* (1.69)	−0.457* (−1.72)	0.088** (2.11)	−0.511** (−2.03)	0.097** (1.97)
ROA	−0.235* (−1.70)	0.057 (0.42)	−0.195* (−0.77)	0.059* (1.81)	−0.311 (−0.35)	0.044* (1.80)
IndPart2					0.001 (0.49)	−0.001 (−0.52)
IndPart3			−0.001 (−0.21)	0.001 (0.71)		
IndPart4	0.001 (0.81)	−0.001 (−0.20)				
IndHHI2					0.360 (0.39)	−0.022 (−0.77)
IndHHI3			−0.823 (−0.91)	0.091 (0.44)		
IndHHI4	0.467 (1.03)	−0.072 (−0.63)				
Leverage	0.029 (1.15)	−0.003 (−0.11)	0.031 (0.77)	−0.003 (−0.36)	0.029 (0.63)	−0.003 (−0.49)
IndLev2					−0.701 (−0.41)	0.034 (0.66)
IndLev3			−1.443 (−0.64)	0.051 (0.54)		
IndLev4	−0.351 (−0.98)	0.011 (0.23)				
GDPGrowth	−11.412** (−2.13)	0.946* (1.87)	−10.239 (−0.36)	0.741** (1.98)	−13.560* (−1.91)	1.003 (0.87)
Intercept	−1.461** (−2.14)	−0.651 (−1.14)	0.324* (1.85)	−0.722* (−1.79)	−1.432* (−1.96)	−0.782** (−2.39)
F-value	9.72***	11.01***	11.71***	9.34***	11.78***	12.06***
Adj. R^2	0.554	0.493	0.596	0.511	0.650	0.612

Notes: *N* is the number of observations. This table reports the results from a two-stage least square estimation method described in Maddala (1983) for simultaneous equations models in which one of the endogenous variables is continuous (RelAssetPurVal or RAPV) and the other endogenous variable is dichotomous (D-C_DegreeIII). The sample consists of 82 purchases by dual-class purchasers. The definitions of all variables are provided in the Appendix. The *t*-statistics are adjusted for robust and clustered (by firm) standard errors and are reported in the parentheses below the coefficient estimates. *,**,***Significant at the 0.10, 0.05 and 0.01 levels, respectively

Notes

1. The relation between share class structures and asset purchases is dealt with qualitatively in DeAngelo and DeAngelo (1985) and Bethel *et al.* (1998).
2. Similarly, Gompers *et al.* (2010) provide evidence that firm value is increasing (decreasing) in the cash flow (voting) rights of insiders.
3. In contrast, Kryzanowski and Zhang (1992) find no anomalous abnormal returns or beta nonstationarity associated with the ex-dates for dual-class-creating stock splits for Canadian firms.
4. This includes Smart and Zutter (2003), Ali *et al.* (2007), Smart *et al.* (2008), King and Segal (2009), Gompers *et al.* (2010), Ryngaert and Thomas (2012) and McGuire *et al.* (2014).
5. Studies dealing with the benefits for asset sellers include Hite *et al.* (1987), John and Ofek (1995), Slovin *et al.* (2005), King (2007), Yang (2008), He (2009), Hege *et al.* (2009), and House and Masatlioglu (2015).
6. Other measures of asset purchases used in the literature to examine other issues include the percentage of plants that change ownership in the industry (Maksimovic and Philips, 2001; Yang, 2008); total value of asset purchases during the 3-year period after buyout completion divided by post-buyout capital (Guo *et al.*, 2011); and the dollar amount of the assets bought or sold directly (Ryngaert and Thomas, 2012).
7. This is 4.45 percent of the 169,718 asset purchases included in SDC Platinum for this time period.
8. Exceptions include the 2015 rates for Canada and the USA which are the averages of Economist Intelligence Unit forecasts, International Monetary Fund forecasts and United Nations forecasts; and 2009 GDP growth rate for Guernsey which comes from the Guernsey Economic Overview 2013.
9. All untabulated results are available upon request from the authors.
10. This result holds when the industry controls are measured using a four-digit SIC level.
11. There are no dual-class purchasers with family ownership between 5 and 10 percent for this test.
12. The suffixes of 2, 3 and 4 for IndHHI, IndLev and IndPart indicate that the variable is based on the two-, three- and four-digit SIC codes, respectively.

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Appendix. Summary description of variables

This Appendix lists the definition, calculation method and data source for each variable:

- ClassDum: dummy variable which is equal to 1 if the purchaser is dual-class and 0 if not. (SEDAR)
- DirectorDum: dummy variable equal to 1 if the purchaser has two or more family-related directors and 0 otherwise. (SEDAR)
- D-C_Degree: sum of total votes for each share class, all divided by total number of shares. (SEDAR)
- D-C_DegreeIII: dummy variable equal to 1 if the dual-class degree is in the highest tercile of the all dual-class degree distribution indicated by the suffix III, otherwise equal to 0.
- EPS: purchaser earnings per share for the previous 12 months. SDC Platinum
- FamilyDum: dummy variable equal to 1 if the purchaser is family-controlled and 0 if not. (SEDAR)
- FamilyOwn: percentage of total number of outstanding common shares held by family shareholders. (SEDAR)
- GDPGrowth: percentage change of real GDP compared to the previous year for the country in which the purchaser is headquartered. World Bank Open Data, EIU, IMF, UN and Guernsey Economic Overview 2013.
- IndHHI: industry concentration ratio based on the market share of the top five firms based on the sales of all the firms in the same industry as the purchaser[12]. (WRDS)
- IndLev: average leverage ratio of all firms in the same industry as the purchaser. (WRDS)
- IndPart: number of firms which belong to the same industry as the purchaser. (WRDS)
- Lev: purchaser's total liabilities for the last 12 months divided by the purchaser's total assets for the same period. (SDC Platinum)
- RelAssetPurVal (RAPV): asset purchase value divided by purchaser's total assets. SDC Platinum and Factiva.
- ROA: purchaser's net income for the last 12 months divided by the purchaser's total assets for the same period. (SDC Platinum)
- Sequence1: dummy variable equal to 1 if purchaser traded after a sequence of purchases; 0 otherwise.
- Sequence2: number of buys before this particular asset purchase.

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Sarbanes-Oxley, agency conflicts and the marginal value of capital expenditure

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Abstract

Purpose – The purpose of this paper is to examine the relationship between the strength of corporate governance and the value of firm-level investment policies following the passage of the Sarbanes–Oxley (SOX) Act of 2002 and the associated changes to the listing requirements of major stock exchanges. In particular the authors seek to examine potential changes in the market's assessed value of capital expenditures after the passage of the SOX Act relative to before.

Design/methodology/approach – The authors employ a difference-in-difference methodology, centred on the year of the passage of the SOX Act to test for the role of governance on the marginal value of capital expenditures. Excess stock returns are calculated by subtracting Fama and French (1993) size and book-to-market portfolio value-weighted returns from the firms' annual stock returns. Each firm is grouped into one of 25 size and book-to-market portfolios for each year in the sample, with size and the book-to-market ratio proxying for sensitivity to common risk factors in stock returns (Fama and French, 1993).

Findings – The authors find that markets responded to the change in governance brought about by the new regulation by altering the value of firm-level capital expenditures in a way that is generally consistent with predictions of agency theory. While the overall findings imply a reduction in agency conflicts post-SOX, there is some evidence that certain firms may have suffered excessive costs of compliance, while still others saw managers become excessively risk averse.

Research limitations/implications – The study has implications related to the efficacy of legislation. Cross-sectional variation in the effect of SOX on the marginal value of capital expenditures suggests that one-size-fits-all legislative approach can have both expected as well as unintended consequences. The study limits its analysis to examining the impact of three significant provisions of the Act. While, the value implications of the Act are largely captured by the selected three, a more comprehensive study could expand on the set of provisions studies to obtain a more granular level impact.

Practical implications – This research should add to the growing body of the literature examining the effect of SOX on firms' real activities and decisions, as well as contribute to the debate on whether the Act was beneficial or costly to firms. With particular reference to the impact of capital expenditure on firm value, the research contributes to the sparse literature examining the contribution of capital expenditures to firm value and the role that agency conflicts play in this relationship. Additionally, this research adds to the growing body of the literature that examines the costs and benefits of the sweeping new regulations brought on by the adoption of SOX.

Social implications – Given the importance of investment policy for economic productivity and growth, the insights provided by findings in this research should benefit lawmakers both within the USA as well as in countries where corporate misconduct and fraud is a concern.

Originality/value – This is the first study that examines the impact of the SOX Act on the way capital markets value firm-level investment in capital expenditures. Since use of corporate resources by managers is fraught with agency conflicts, the role of SOX in potentially alleviating this conflict as revealed by the tests in this study are very valuable.

Keywords Corporate governance, Sarbanes–Oxley Act, Capital expenditure, Investment policy

Paper type Research paper

1. Introduction

We examine the value implications of corporate capital expenditures following the passage of the Sarbanes–Oxley Act of 2002 (henceforth SOX or the Act) and the associated changes to the listing requirements of major US stock exchanges[1]. A raft of regulatory

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changes proposed under SOX represented a concerted effort towards tightening the governance of US-listed companies following the high-profile governance failures in Enron and WorldCom, among others. Provisions in the Act are designed to increase the quantity and quality of information flow between insiders and outside investors with an overarching aim to tighten governance. Given the increased penalties for corporate misconduct, increase in oversight, and generally tighter monitoring, has potential to reduce managerial discretion over corporate resources and therefore should potentially reduce agency conflicts. Since SOX represents an exogenous shock to corporate governance, it presents a unique opportunity to examine the relationship between changes to governance strength and value of investments.

The literature, however, is divided on the potential benefits of the Act. While the free cash theory of Jensen (1986) and Shleifer and Vishny (1989) suggests that a potential tightening of governance should lead to more efficient investment policies, concerns have been raised that the Act may over-regulate firms, leading to inefficiencies through increased managerial risk aversion or through increase in compliance costs, with the latter being especially detrimental to small firms as shown in Chhaochharia and Grinstein (2007).

Investment through capital expenditure is necessary for firms to grow and create value. While, ideally one would expect firms to invest in every positive net present value (NPV) project, imperfect capital markets engender inefficiencies such as agency conflicts or asymmetric information and the associated costs that could lead to poor quality investment decisions. For example, agency conflicts between managers and shareholders as outlined in Jensen (1986) would suggest that entrenched managers with discretion over free cash flows may over-invest in the pursuit of private benefits. With reference to capital expenditures, this may be in the form of empire building, undertaking managers' pet projects even if returns are below the cost of capital, or merely sustaining unprofitable divisions, all of which may harm shareholder value. Similarly, as Myers and Majluf (1984) argue, if managers have information about investment opportunities which cannot credibly be conveyed to shareholders, the discount rate applied to investments will rise and consequently lead to forgoing of positive NPV projects.

Entrenchment increasing/decreasing shocks have been shown in the literature to affect policy choices through their impact on managerial preferences. For example, John and Litov (2010) show that entrenched managers take on more debt and increase leverage ratios using adoption of state anti-takeover laws. Similarly, Francis *et al.* (2011) demonstrate a decrease in payout propensity as well as an increase in investment-cash flow sensitivity upon adoption of state anti-takeover laws. Further evidence of changes to investment policy following an exogenous shock to governance is provided in Iliev (2010), Cohen *et al.* (2007), Bargeron *et al.* (2010), Bhabra and Hossain (2017a) and Kang *et al.* (2010) among others. While the previous literature has shown governance to affect corporate policies, including investment policy, the direct and indirect value implications of corporate capital expenditure following the passage of the SOX Act has not received much attention. In this study, we examine the role of SOX in shaping incentives which may influence market participants' perceptions regarding the value of firm-level investments.

Capital expenditures represent a channel through which expropriation of shareholder wealth may take place, as these expenses are undertaken often at the discretion of management. These expenditures therefore have the potential to either add or destroy value. Masulis *et al.* (2009) undertake an interesting study which demonstrates that, consistent with predictions in agency theory, the contribution of capital expenditures to firm value decreases monotonically as managers become more entrenched in their jobs. However, the divergence between control and cash flow rights (their measure for managerial entrenchment) and investment policies are simultaneously determined and this endogeneity obscures a clear assessment of causal relations.

We circumvent endogeneity-related problems of inference by examining the impact of the passage of the SOX Act and associated changes to listing requirements of major US stock exchanges since such regulatory changes represent exogenous shock to governance. We hypothesise the existence of a causal relation where changes in governance engendered by SOX will impact on the contribution of capital expenditures to firm value. Specifically, if the rules and regulations imposed by the Act decrease agency conflicts, then we expect to see the marginal value of capital expenditure to increase post-SOX resulting from either decreases in the extent of over-investment or due to cheaper access to external funds, both stemming from a reduction in perceived agency problems. Alternatively, if the increased accountability and responsibility facing executives and managers decreases risk-taking (see, e.g. Iliev, 2010; Kang *et al.*, 2010; Bargeron *et al.*, 2010), then less-efficient capital expenditures may result following the new regulatory environment as managers apply a higher discount rate to investments. Finally, if significant compliance costs are imposed by SOX forcing funds away from capital expenditure purposes, then this too may lead to less-efficient investment practices post-SOX.

To avoid the confounding effects of contemporaneous events and isolate the effect of governance changes purely due to the passage of SOX, we employ the difference-in-differences technique and compare changes in firms that were non-compliant with the provisions of the Act prior to 2002 with compliant-firms post-SOX. We find that post-SOX, firms' marginal value of capital expenditure increased, supporting a reduction in agency conflicts following the governance changes, and this holds even after controlling for measures of financing constraints. In addition, we find significant cross-sectional variation in the impact of the various provisions. For example, while the financial reporting provision significantly reduced the contribution of capital expenditure to firm value for non-compliant firms presumably driven by increased managerial risk aversion since these results are limited only to large firms, the related party transaction provision was observed to have no significant influence across the sample. On the other extreme, however, changes in the board and committee independence provisions were mostly associated with significant increase in the marginal value of capital expenditure. Most of these results held across large and small firms and across high- and low-payout firms suggesting that these were not the artefact of reduction in traditional frictions associated with access to external funds but more likely a cause of reduced agency conflicts.

In general, given the importance of investment policy for economic productivity and growth, the insights provided by findings in this research should benefit lawmakers both within the USA as well as in countries where corporate misconduct and fraud is a concern. This research should also add to the growing body of the literature examining the effect of SOX on firms' real activities and decisions, as well as contribute to the debate on whether the Act was beneficial or costly to firms. With particular reference to the impact of capital expenditure on firm value, our research contributes to the sparse literature examining the contribution of capital expenditures to firm value and the role that agency conflicts play in this relationship. Additionally, this research adds to the growing body of literature that examines the costs and benefits of the sweeping new regulations brought on by the adoption of SOX (see, e.g. Bargeron *et al.*, 2010; Chhaochharia and Grinstein, 2007). To the best of our knowledge, ours is the first study that has examined the effects of potential governance changes following passage of SOX on firms' marginal value of capital expenditures. In that sense, we see this as a significant contribution towards our understanding of the role of capital expenditure in creating value that is free of endogeneity-related inference concerns.

2. Literature review and hypotheses development

McConnell and Muscarella (1985) examine stock price reactions around capital expenditure announcements for US exchange-listed companies and find that industrial firms experience

significant positive excess returns surrounding announcements of increases in planned capital expenditures and vice versa[2]. Consistent with McConnell and Muscarella (1985), a positive share price reaction to announcements of a variety of corporate investment decisions, including plant and equipment purchases, R&D expenditures, new product introductions, and joint ventures, is found by Woolridge (1988). Significant excess stock returns surrounding announcements of varying types of investment projects are likewise identified by Woolridge and Snow (1990), with the different types of investments varying in the degree of respective excess returns.

Not all investments are value increasing, however. Shleifer and Vishny (1989) provide a model of how investments at times are made by managers with the objective of entrenching themselves in their jobs, thus making them costly to replace. Such entrenchment increasing actions allow managers the freedom to consume greater private benefits such as perquisites and increased wages suggesting that value-maximising investment behaviour is not always pursued. Brailsford and Yeoh (2004) investigate the role of free cash flow related agency costs in explaining market reaction to capital expenditure announcements in listed Australian companies and find that, consistent with agency theory, reactions to capital expenditures in firms with no or low growth opportunities were negative when levels of free cash flow were high, while firms with low levels of free cash flow exhibited insignificant abnormal returns. In addition, Masulis *et al.* (2009) find that the marginal value of capital expenditures decreases in the divergence of insiders' voting and cash flow rights, consistent with Jensen's (1986) agency costs of free cash flow theory. This result demonstrates that when agency conflicts are high, managers are more likely to make less-efficient capital expenditures.

SOX was enacted expressly with the goal of reducing managerial misconduct and fraud, thereby reducing agency conflicts between managers and shareholders. If the various provisions of SOX did indeed have the desired effect, then all US firms subject to the new rules should experience a reduction in agency conflicts, leading to more efficient investment policies. Wasteful capital expenditure through over-investment should reduce, ultimately leading to increased firm valuation. In other words, the managerial over-investment hypothesis would suggest that one extra dollar of capital expenditure should contribute more to firm value due to the exogenous shock to governance following the enactment of SOX than previously.

In addition, capital market participants will demand a higher premium to supply external funds to firms perceived to face high agency conflicts. If SOX reduces agency conflicts between managers and shareholders, then external funds should become accessible at lower cost in the new regulatory environment. This lower-cost access essentially decreases the discount rate applied to investment projects, resulting in greater firm valuation after controlling for growth opportunities. In other words, an additional dollar spent on capital investments post-SOX would consequently contribute more to firm value than it did prior to the law's passage.

Alternatively, if SOX increases risk aversion as was found in Iliev (2010), Kang *et al.* (2010) and Bargeron *et al.* (2010), then managers' perceived discount rate applied to investment projects would essentially increase due to the perception of increased liabilities these managers now face post-SOX. The greater penalties imposed for fraud and misconduct as well as increased accountability and responsibility facing managers increasing the risk of job displacement may all contribute to a decrease in risk-taking behaviour. For example, the stock exchange requirement of boards being comprised of a majority of independent directors directly increases the risk of job displacement for CEOs, as independent directors have been shown to be more active in the dismissal of executives (Renneboog, 2000; Dahya *et al.*, 2002; Hermalin and Weisbach, 2003).

The literature on SOX shows that a major criticism of the legislation is the excessive cost and over-regulation imposed by various provisions, the most notable of which are the

internal control and the director independence provisions (Ribstein, 2002, 2005; Holmstrom and Kaplan, 2003). If the costs are substantial, then potential under-investment may ensue as funds are diverted away from productive investments towards meeting excessive compliance costs. Consequently, the marginal value of capital expenditures would fall. We, therefore, test the following set of hypotheses:

H1. Marginal value of capital expenditure will increase post-SOX due to a reduction in agency conflicts and associated over-investment.

H2. Marginal value of capital expenditure will increase post-SOX due to a reduction in agency conflicts leading to lower-cost access to external funds.

H3. Marginal value of capital expenditure will decrease post-SOX due to an increase in managerial risk aversion raising the discount rate applied to investments.

H4. Marginal value of capital expenditure will decrease post-SOX due to increased compliance costs diverting funds away from investment purposes.

Notwithstanding the broad impact of SOX, its effect has been shown to vary across firm size, specifically with reference to compliance costs (Holmstrom and Kaplan, 2003; Ribstein, 2002, 2005; Chhaochharia and Grinstein, 2007). We therefore investigate all the cross-sectional impacts across both large and small firms. In addition, since firm size is frequently used as a proxy for financing constraints, testing across size helps isolate the role of governance distinct from any effects related to asymmetry in information.

Following findings in Billett *et al.* (2011) and Bøhren *et al.* (2007) suggesting that financing constraints interact with corporate governance to influence investment behaviours, we also split the sample based on payout ratios as a measure of financing constraint commonly used in the literature (see, e.g. Fazzari *et al.*, 1988; Hubbard *et al.*, 1995).

3. Sample selection, data and variable construction

The overall sample is comprised of the S&P 1,500 index constituents as at December 2002, listed on the Compustat database. This index was chosen as it combines the S&P 500 index, the S&P MidCap 400 index, and the S&P SmallCap 600 index, presenting a large sample size while excluding micro- and nano-capitalisation stocks, which are not the focus of this research. This research spans the period 1999–2005 inclusive. The year 2002 is excluded from all analyses to provide conclusive pre- and post-SOX time periods. Financial variables needed to conduct the statistical tests are obtained either directly from the Compustat and the Center for Research in Security Prices (CRSP) databases or are constructed using raw financial data from these databases. Information regarding these variables is outlined below, while a discussion of the variables resulting from interactions between non-compliant dummy variables, post-SOX dummy variables and various other variables is deferred until the methodology section.

The dependent variable for the marginal value of capital expenditures is a firms' annual excess stock returns. Following Faulkender and Wang (2006) and Masulis *et al.* (2009), excess stock returns are calculated by subtracting Fama and French (1993) size and book-to-market portfolio value-weighted returns from the firms' annual stock returns. Each firm is grouped into one of 25 size and book-to-market portfolios for each year in the sample, with size and the book-to-market ratio proxying for sensitivity to common risk factors in stock returns (Fama and French, 1993). Firms are able to switch between the various size and book-to-market portfolios from year-to-year. Annual returns are calculated as the annualised average of continuously compounded daily returns using daily stock prices adjusted for distributions obtained from CRSP (Safieddine and Titman, 1999). The annual returns and breakpoints for the 25 Fama–French size and book-to-

market portfolios are obtained from Kenneth R. French's online data library (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html). Calculating excess returns using this matching approach based on size and book-to-market measures provides more detailed and specific excess returns compared with a simple approach of using annual returns of an overall index.

Since the book-to-market ratio is endogenous, in addition to using the Fama–French size and book-to-market portfolio returns, Masulis *et al.* (2009) also calculate excess returns of a firm's stock by subtracting the Fama–French value-weighted industry returns using the 48-industry classification of Fama and French (1997). For completeness, we also measure excess returns in this manner and report them alongside the excess stock returns calculated using the method discussed previously. The returns and breakpoints for the value-weighted industries are also obtained from Kenneth R. French's online data library.

4. Methodology

4.1 Marginal value of capital expenditure methodology

The contribution of an extra dollar of firms' capital expenditure to firm value is defined as the marginal value of capital expenditure. Like cash, capital expenditures are another channel through which managers can expropriate wealth at shareholders' expense. We follow the method in Masulis *et al.* (2009) with respect to the marginal value of capital expenditure as in the following regression specification:

$$r_{i,t} - R^{B}_{i,t} = \alpha + \beta_1 \frac{\Delta \text{Capex}_{i,t}}{\text{Mktcap}_{i,t-1}} + \beta_2 D_{\text{Post-SOX}} \times \frac{\Delta \text{Capex}_{i,t}}{\text{Mktcap}_{i,t-1}}$$

$$+ \beta_3 D_{\text{Post-SOX}} + \gamma' \text{Controls} + e_{i,t}. \quad (1)$$

Equation (1) is used to investigate whether there has been a change in the marginal value of capital expenditure across all firms following the passage of SOX. The coefficient of the interaction term between the post-SOX dummy variable and the scaled change in capital expenditure, β_2, is of primary interest and should reflect this change if there is any. A solitary post-SOX dummy variable is included so that the interaction variable does not simply pick up the effects of SOX itself. The dependent variable in Equation (1) is a firm's annual excess stock.

Controls in Equation (1) represent firm-specific characteristics that past research have identified as potentially being simultaneously correlated with both changes in capital expenditure and excess stock returns (see, e.g. Masulis *et al.*, 2009). The variables included are net financing over the year, changes in earnings, changes in net assets, changes in R&D expense, changes in interest expense, changes in dividends and lagged capital expenditure, all scaled by the market capitalisation of the previous year. Leverage is also included as a control variable. To provide additional insights into cross-sectional variations of SOX's effects, the sample is once again split into sub-samples based on size and dividend payout ratios. This is also performed to examine the effect of changes in governance on the marginal value of capital expenditure after controlling for traditional measures of financing constraints.

4.2 The difference-in-differences approach

Analysis using the above methodology is designed to demonstrate how the marginal value of capital expenditure has changed between the pre- and post-SOX time periods for all firms in general. However, if there are other contemporaneous events occurring synchronously, the changes we attribute to SOX may in fact be unrelated to SOX entirely. Therefore, to isolate the effect of SOX, we employ the difference-in-differences methodology (see, e.g.

Bertrand and Mullainathan, 2003; Chhaochharia and Grinstein, 2007; Low, 2009, among others). In following the approach of Chhaochharia and Grinstein (2007), we classify firms into non-compliant and compliant categories with the various provisions of SOX and treat the compliant set as a control group since these firms should be relatively unaffected by the rules. Measuring the difference between the non-compliant and compliant-firms post-SOX relative to the difference pre-SOX provides a more robust investigation into SOX as outside effects are controlled for. To utilise the difference-in-differences technique, we modify Equation (1) resulting in the equation:

$$r_{i,t} - R^{B}_{i,t} = \alpha + \beta_1 \frac{\Delta \text{Capex}_{i,t}}{\text{Mktcap}_{i,t-1}} + \beta_2 D_{\text{NC}} \times \frac{\Delta \text{Capex}_{i,t}}{\text{Mktcap}_{i,t-1}} + \beta_3 D_{\text{Post-SOX}} \times D_{\text{NC}} \times \frac{\Delta \text{Capex}_{i,t}}{\text{Mktcap}_{i,t-1}} + \beta_4 D_{\text{Post-SOX}} + \gamma' \text{Controls} + e_{i,t}. \quad (2)$$

The coefficient of interest in Equation (2) is β_3, which captures the change in marginal value of cash for non-compliant relative to compliant firms post-SOX. The excess stock returns will be calculated using both the Fama and French (1993) size and book-to-market portfolio returns as well as the Fama and French (1997) value-weighted industry portfolio returns. The analysis will again be repeated for the three provisions of SOX investigated, as well as for various sub-samples split on both size and payout ratios.

5. Results and discussion

Summary statistics are displayed in Table I for pre- and post-SOX time periods. Excess stock returns using both measures are shown to have lower mean and medians in the post-SOX period where the *t*-test of the mean difference for the first measure of performance is *t*-stat. = −4.64 and that for the second measure is *t*-stat. = −6.18 both statistically significant at less than the 1 per cent level of significance. Net assets have increased, and leverage appears to have decreased slightly post-2002 and these changes are significant at less than the 5 per cent level of significance. Earnings, and similarly dividends, are higher in

	Pre-SOX			Post-SOX			
	No. of Obs	Mean	Median	No. of Obs	Mean	Median	*t*-Test of difference in means
Annual excess stock returns (1)	3,255	−0.03373	−0.02022	3,180	−0.07605	−0.06616	−4.639***
Annual excess stock returns (2)	3,315	0.02057	0.03268	3,250	−0.03300	−0.03233	−6.182***
NetAssets_t	3,573	4,821.75	846.67	3,394	6,374.29	1,226.92	2.617**
Leverage_t	3,490	0.14882	0.11470	3,374	0.13255	0.10666	−5.075***
Earnings_t	3,571	319.67	64.31	3,397	468.81	86.60	3.533***
$\text{R\&D}_t$	3,453	118.64	4.63	3,480	137.47	2.90	1.382
Interest_t	3,579	100.74	13.24	3,579	104.31	12.94	0.264
Payout_t	3,556	79.87	0	3,390	119.06	1.41	2.527**
NetFinancing_t	2,893	86.16	0.16	2,871	−90.53	−5.00	−5.218***
CapEx_t	3,514	329.64	50.09	3,395	315.12	54.33	−0.468
Market Value of Equity$_t$	3,507	8,238.32	1,194.24	3,384	8,131.75	1,727.34	−0.158

Notes: The pre-SOX time period is 1999–2001 and the post-SOX period is 2003–2005. See Table AI for a discussion of the variables. **,***Significant at the 5 and 1 per cent levels, respectively

Table I. Summary statistics – all firms

the post-regulation period. R&D while interest expenses have remained the same. Net financing is shown to become negative and statistically lower than in the pre-SOX period. Finally, capital expenditures show no difference between the pre and post-SOX periods. While strong conclusions cannot be drawn, the statistics do appear to vary across the two time periods, suggesting that the new regulatory environment could potentially be a driver. We next undertake a multiple regression analysis to examine the impact of the governance changes post-SOX upon the marginal value of capital expenditure.

Results for the impact of SOX on the marginal value of capital expenditure across all firms are depicted in Table II. The coefficient on the interaction term post-SOX × $\Delta CapEx_t$ is significantly positive for both measures of excess stock returns, implying that an extra dollar of capital expenditure contributes more to firm value in the post-SOX period than it did previously, a result consistent with findings in Bhabra and Hossain (2017a). This result is consistent with the agency cost hypotheses. While one interpretation could be that a reduction in agency conflicts post-SOX reduces over-investment and hence the increase in marginal value of capital expenditure (see, e.g. Bhabra and Hossain, 2017b), another possibility is that a possible reduction in the premium demanded by investors, thus reducing the discount rate applied to investment projects and consequently increasing the contribution that capital expenditures make to firm value. There is no evidence to suggest an increase in risk aversion or of SOX imposing excessive costs for the full sample, unless one believes that capital expenditures forgone following an increase in the perceived discount rate or because of a lack of funds due to compliance costs were actually value destroying in the first place. In order to isolate the effect of changes in governance strength and/or compliance costs, we next test our hypotheses over sub-samples of large and small firms, and high and low-payout firms.

The results displayed in Table III for the sample split on the median firm size as captured by market capitalisation reveal that our full-sample results are driven primarily by small firms, since the one meaningful result for large firms is only marginally significant while both the measures of excess returns for the small firms are significant at less than the

	Dependent variable: annual excess stock returns (1)	(2)
$\Delta CapEx_t$	0.960** (*0.016*)	1.109*** (*0.000*)
Post-SOX × $\Delta CapEx_t$	1.352*** (*0.002*)	0.669*** (*0.003*)
Post-SOX	−0.103*** (*0.000*)	−0.202*** (*0.000*)
$CapEx_{t-1}$	3.445*** (*0.000*)	3.246*** (*0.000*)
$Leverage_t$	−1.347*** (*0.000*)	−1.071*** (*0.000*)
$\Delta Earnings_t$	1.048*** (*0.000*)	0.957*** (*0.000*)
$\Delta NetAssets_t$	0.106 (*0.103*)	0.057 (*0.221*)
$\Delta R\&D_t$	2.212*** (*0.000*)	1.548*** (*0.000*)
$\Delta Interest_t$	−2.133*** (*0.005*)	−2.062*** (*0.000*)
ΔPayout	−0.274 (*0.955*)	−2.644 (*0.656*)
$NetFinancing_t$	0.136* (*0.078*)	0.120* (*0.063*)
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Number of obs	5,023	5,092
R^2 (%)	15.99	15.69

Table II.
Effects of SOX on the marginal value of capital expenditure – full sample

Notes: The dependent variable in Column (1) is the size and book-to-market adjusted excess stock returns during year *t*, with the dependent variable in Column (2) being the value-weighted industry adjusted excess stock returns during year *t*. See Table AI for a discussion of the variables. Reported in parentheses are *p*-values based on Driscoll and Kraay (1998) standard errors. All regressions control for year and firm fixed effects with the coefficient estimates suppressed. *,**,***Significant at the 10, 5 and 1 per cent levels, respectively

	Dependent variable: annual excess stock returns			
	Large firms		Small firms	
	(1)	(2)	(1)	(2)
$\Delta CapEx_t$	0.692 (*0.305*)	1.952*** (*0.000*)	1.006*** (*0.005*)	0.840** (*0.011*)
Post-SOX × $\Delta CapEx_t$	1.188* (*0.097*)	−0.109 (*0.788*)	1.256*** (*0.001*)	0.949*** (*0.001*)
Post-SOX	−0.113*** (*0.000*)	−0.159*** (*0.000*)	−0.100*** (*0.000*)	−0.219*** (*0.000*)
$CapEx_{t-1}$	4.207*** (*0.000*)	4.129*** (*0.000*)	3.058*** (*0.000*)	2.885*** (*0.000*)
$Leverage_t$	−2.145*** (*0.000*)	−1.443*** (*0.000*)	−1.031*** (*0.000*)	−0.908*** (*0.000*)
$\Delta Earnings_t$	0.968*** (*0.000*)	0.779*** (*0.000*)	1.098*** (*0.000*)	1.003*** (*0.000*)
$\Delta NetAssets_t$	0.071 (*0.372*)	−0.006 (*0.896*)	0.151** (*0.045*)	0.105* (*0.095*)
$\Delta R\&D_t$	1.222 (*0.300*)	2.253*** (*0.006*)	2.800*** (*0.000*)	0.996 (*0.247*)
$\Delta Interest_t$	−1.912 (*0.376*)	−1.519 (*0.245*)	−1.791*** (*0.000*)	−1.730** (*0.040*)
ΔPayout	−3.034 (*0.492*)	−7.967* (*0.068*)	2.170 (*0.593*)	0.488 (*0.943*)
$NetFinancing_t$	0.418*** (*0.002*)	0.353*** (*0.003*)	−0.117 (*0.226*)	−0.122** (*0.025*)
Year fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Number of obs	2,527	2,568	2,496	2,524
R^2 (%)	18.48	16.36	16.46	17.46

Notes: The dependent variable in Column (1) is the size and book-to-market adjusted excess stock returns during year *t*, with the dependent variable in Column (2) being the value-weighted industry adjusted excess stock returns during year *t*. Firms are classified large firms if their market capitalisation is larger than the sample median else they are classified small firms. See Table AI for a discussion of the variables. Reported in parentheses are *p*-values based on Driscoll and Kraay (1998) standard errors. All regressions control for year and firm fixed effects with the coefficient estimates suppressed. *,**,***Significant at the 10, 5 and 1 per cent levels, respectively

Table III. Effects of SOX on the marginal value of capital expenditure – sample split on size

1 per cent level. This suggests that perhaps reduced agency conflicts resulting from better quality reporting may be permitting small firms better access to capital markets thereby causing the increase in the marginal value of capital expenditure.

We next conduct further tests using sub-samples based on the median payout ratio since payout ratio has also been widely recognised to proxy for the strength of internal control (see, e.g. John and Knyazeva, 2006). Consistent with potential reduction in agency conflicts, results from the analysis presented in Table IV are similar to those shown above in Table III; that is, overall it appears that both measures of excess returns produce significant results for only the low-payout firms which are hypothesised to suffer from higher agency conflicts.

To eliminate the effects of any contemporaneous events that are independent of SOX which may in fact be driving these results, we employ the difference-in-differences methodology discussed earlier. To reiterate the basic premise, firms already compliant with the provisions of the Act are argued to be relatively unaffected by the new requirements and are therefore treated as a control group. The difference in the marginal value of capital expenditure between compliant and non-compliant firms after the passage of SOX is compared with the difference pre-SOX; this approach better allows for isolation of the influence of SOX.

5.1 Impact of the financial reporting provision – full sample[3]

Given that we are interested in analysing the difference in the marginal impact across compliant/non-compliant companies, we have to report results separately across the three different SOX provisions examined in this study. This approach has the added advantage of shedding light on the likely difference in the effectiveness across the provisions since not every provision is likely to be equally effective in producing the desired outcome.

With respect to the financial reporting provision, results in Table V show that for the full sample, there is a significant decrease in the contribution of capital expenditure to firm value for firms that were non-compliant with the provisions of SOX prior to the passage of the Act

	Dependent variable: annual excess stock returns			
	High-payout firms		Low-payout firms	
	(1)	(2)	(1)	(2)
$\Delta CapEx_t$	0.105 (*0.641*)	0.852*** (*0.000*)	1.657*** (*0.007*)	1.255** (*0.015*)
Post-SOX × $\Delta CapEx_t$	1.783*** (*0.000*)	0.169 (*0.620*)	1.214** (*0.030*)	1.152*** (*0.000*)
Post-SOX	0.167*** (*0.000*)	−0.141*** (*0.000*)	−0.036** (*0.016*)	0.054*** (*0.000*)
$CapEx_{t-1}$	2.694*** (*0.000*)	2.316*** (*0.000*)	4.315*** (*0.000*)	4.225*** (*0.000*)
$Leverage_t$	−1.212*** (*0.000*)	−0.755*** (*0.000*)	−1.473*** (*0.000*)	−1.283*** (*0.000*)
$\Delta Earnings_t$	1.175*** (*0.000*)	1.037*** (*0.000*)	1.097*** (*0.000*)	1.049*** (*0.000*)
$\Delta NetAssets_t$	0.131*** (*0.005*)	0.072 (*0.127*)	0.091* (*0.076*)	0.070 (*0.106*)
$\Delta R\&D_t$	1.210 (*0.280*)	0.934 (*0.386*)	2.411** (*0.023*)	2.333*** (*0.004*)
$\Delta Interest_t$	−1.763*** (*0.005*)	−2.477*** (*0.000*)	−1.360** (*0.035*)	−1.384* (*0.098*)
$\Delta Payout$	−0.156 (*0.955*)	−2.916 (*0.396*)	35.682*** (*0.000*)	25.455* (*0.083*)
$NetFinancing_t$	0.026 (*0.779*)	−0.001 (*0.991*)	0.198*** (*0.000*)	0.181*** (*0.000*)
Year fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Number of obs	2,376	2,392	2,647	2,700
R^2	22.54	17.65	16.89	17.84

Notes: The dependent variable in Column (1) is the size and book-to-market adjusted excess stock returns during year *t*, with the dependent variable in Column (2) being the value-weighted industry adjusted excess stock returns during year *t*. Firms are classified High-Payout if their market payout ratio is larger than the sample median else they are classified low-payout. See Table AI or "Sample, Selection, Data, and Variable Construction" for a discussion of the variables. Reported in parentheses are *p*-values based on Driscoll and Kraay (1998) standard errors. All regressions control for year and firm fixed effects with the coefficient estimates suppressed. The coefficient on the intercept is also suppressed. *,**,***Significant at the 10, 5 and 1 per cent levels, respectively

Table IV.
Effects of SOX on the marginal value of capital expenditure – sample split on payout

relative to compliant firms. This finding is interesting, as it is contrary to that found in Table II and the subsequent findings of Tables III and IV, which were in support of agency theory. The results for the full sample in Table V demonstrating a significant decrease in the variable of interest support the risk-aversion hypothesis (in a sense, a manifestation of the agency conflict between managers and shareholders) as well as the excessive-cost hypothesis. For example, firms that were prone to restatement may have become excessively conservative, leading to the application of higher discount rates to investment projects hence the discounted valuation.

5.1.1 Sub-sample analysis: sample split on firm size and payout. Results from splitting the sample on median market capitalisation and median payout and examining the impacts of SOX for non-compliant vs compliant firms with regards to the financial reporting provision are reported in Panels A and B of Table V. It appears from the results in Panels A and B that the reduction in the marginal value of capital expenditure with respect to this provision as reported for the full sample is driven entirely by large and low-payout companies, as the coefficient for small firms is negative but statistically insignificant. The findings for the large firms agrees with the risk aversion (see, e.g. Bargeron *et al.*, 2010) and excessive-cost hypotheses; however, it is more plausible that the risk-aversion hypothesis is causing these results as small firms are argued to be more negatively affected by compliance costs, which would result in these firms having the greater relative decrease (see Holmstrom and Kaplan, 2003; Ribstein, 2002, 2005; Chhaochharia and Grinstein, 2007, among others). In addition, the do-or-die argument applicable to small firms and the fact that managerial ownership is lower in large firms add support to the risk-aversion theory.

5.2 Impact of the related party transactions provision – full sample

We next investigate firms that were non-compliant with respect to the related party transaction provision relative to compliant companies before the passage of the Act.

Panel A: full sample and sub-samples based on size

	Dependent variable: annual excess stock returns		
	All firms	Large firms	Small firms
	(1)	(2)	(3)
$\Delta CapEx_t$	1.672*** (*0.000*)	1.287*** (*0.000*)	1.716*** (*0.000*)
NC × $\Delta CapEx_t$	−1.423*** (*0.002*)	0.745 (*0.555*)	−2.685*** (*0.000*)
Post-SOX × NC × $\Delta CapEx_t$	−1.517** (*0.039*)	−2.555** (*0.040*)	−0.337 (*0.736*)
Post-SOX	−0.099*** (*0.000*)	−0.111*** (*0.000*)	−0.097*** (*0.000*)
Controls	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Number of obs	5,023	2,527	2,496
R^2	15.94	18.39	16.55

Panel B: full sample and sub-samples based on payout

	Dependent variable: annual excess stock returns		
	Full sample	High-payout	Low-payout
	(1)	(2)	(3)
$\Delta CapEx_t$	1.672*** (*0.000*)	0.993*** (*0.000*)	2.395*** (*0.000*)
NC × $\Delta CapEx_t$	−1.423*** (*0.002*)	−1.709*** (*0.004*)	−2.395*** (*0.001*)
Post-SOX × NC × $\Delta CapEx_t$	−1.517** (*0.039*)	−0.410 (*0.720*)	−2.283** (*0.011*)
Post-SOX	−0.099*** (*0.000*)	0.174*** (*0.000*)	−0.031** (*0.019*)
Controls	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Number of obs	5,023	2,376	2,647
R^2	15.94	22.25	17.04

Notes: The dependent variable is the size and book-to-market adjusted excess stock returns during year *t*. Firms are classified large firms if their market capitalisation is larger than the sample median else they are classified small firms. Firms are classified high-payout if their market payout ratio is larger than the sample median else they are classified low-payout. See Table AI for a discussion of the variables. Reported in parentheses are *p*-values based on Driscoll and Kraay (1998) standard errors. All regressions control for year and firm fixed effects with the coefficient estimates suppressed. **,***Significant at the 5 and 1 per cent levels, respectively

Table V.
Impact of the financial reporting provision

Our results for the full sample reported in Table VI show that the interaction term of interest is insignificant using both measures of excess stock returns implying that there was no discernible difference in the relative impact on the marginal value of capital expenditure post-SOX between compliant and non-compliant firms.

5.2.1 Sub-sample analysis: sample split on firm size and payout. Controlling for size and payout, the related party transaction provision produces the results displayed in Panels A and B of Table VI. Consistent with the insignificant results reported for the full sample, this provision does not seem to impose any significant changes to the marginal value of capital expenditure for non-compliant vs compliant firms post-SOX across size classification. However, results in Panel B do suggest that high-payout firms that were not compliant with this provision prior to the passage of the Act have their capital expenditures valued significantly higher post-SOX relative to compliant firms. Since high-payout companies are more likely generate higher cash flows to support their payout, a potential reduction in use of high cash flow in related party transactions would suggest that the higher valuation of such firms would be more consistent with potential reduction in agency conflicts post-SOX.

5.3 Impact of the board and committee independence provision – full sample

Results from an examination of the board and committee independence provision for the full sample displayed in Table VII demonstrate a significant increase in the marginal value of

Panel A: full sample and sub-samples based on size

	Dependent variable: annual excess stock returns		
	Full sample	Large firms	Small firms
	(1)	(2)	(3)
$CapEx_t$	2.211*** (*0.003*)	3.570*** (*0.006*)	1.353* (*0.081*)
NC × $\Delta CapEx_t$	−0.075 (*0.922*)	−1.674*** (*0.001*)	1.885 (*0.181*)
Post-SOX × NC × $\Delta CapEx_t$	0.193 (*0.877*)	0.425 (*0.818*)	−1.668 (*0.176*)
Post-SOX	−0.113*** (*0.000*)	0.134*** (*0.000*)	0.083*** (*0.000*)
Controls	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Number of obs	1,148	654	494
R^2 (%)	20.16	25.09	23.08

Panel B: full sample and sub-samples based on payout

	Dependent variable: annual excess stock returns		
	Full sample	High-payout	Low-payout
	(1)	(2)	(3)
$\Delta CapEx_t$	2.211*** (*0.003*)	−0.307 (*0.718*)	3.548*** (*0.000*)
NC × $\Delta CapEx_t$	−0.075 (*0.922*)	1.417*** (*0.000*)	−1.563 (*0.189*)
Post-SOX × NC × $\Delta CapEx_t$	0.193 (*0.877*)	3.226*** (*0.007*)	−0.231 (*0.902*)
Post-SOX	−0.113*** (*0.000*)	−0.109*** (*0.000*)	0.031 (*0.455*)
Controls	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Number of obs	1,148	565	583
R^2 (%)	20.16	29.39	19.95

Notes: The dependent variable is the size and book-to-market adjusted excess stock returns during year *t*. Firms are classified large firms if their market capitalisation is larger than the sample median else they are classified Small Firms. Firms are classified high-payout if their market payout ratio is larger than the sample median else they are classified low-payout. See Table AI for a discussion of the variables. Reported in parentheses are *p*-values based on Driscoll and Kraay (1998) standard errors. All regressions control for year and firm fixed effects with the coefficient estimates suppressed. *,***Significant at the 10 and 1 per cent levels, respectively

Table VI.
Impact of related party transaction provision

capital expenditure for non-compliant companies. The relative increase is significance using the size and book-to-market as well as the value-weighted measures of excess returns agrees with both hypotheses based on agency theory, that is, a decrease in over-investment or a lowering of the premium placed on external funds. Because the board and committee independence provisions directly influence the internal governance quality of firms, it is more likely that the increase in value of capital expenditure stems from potential reduction in managerial over-investment.

5.3.1 Sub-sample analysis: sample split on firm size and payout. Panels A and B of Table VII provide results for the impact of board and committee independence provision across sub-samples split on size and payout ratio, respectively. Results in Panel A suggest that the marginal value of capital expenditure is insignificant for large firms but significantly positive for small firms. These results provide strong support for the argument that the board and committee independence provision significantly contributed towards a reduction in agency conflicts post-SOX. Such a conclusion is further evident in Panel B where the positive reaction is limited only to low-payout firms while high-payout firms do not register any change in their value of capital expenditures.

Overall, we find that the marginal value of capital expenditure increases post-SOX for the full sample, consistent with agency theory and this result holds after controlling for measures of financing constraints. Employing the difference-in-differences technique to

Panel A: full sample and sub-samples based on size

	Dependent variable: annual excess stock returns		
	Full sample	Large firms	Small firms
	(1)	(2)	(3)
$\Delta CapEx_t$	1.275*** (*0.000*)	1.005*** (*0.000*)	1.277*** (*0.000*)
$NC \times \Delta CapEx_t$	−1.220*** (*0.007*)	−0.982 (*0.204*)	−1.168*** (*0.001*)
Post-SOX × NC × $\Delta CapEx_t$	2.419*** (*0.004*)	1.199 (*0.203*)	2.238*** (*0.000*)
Post-SOX	−0.176*** (*0.000*)	0.120*** (*0.000*)	−0.100*** (*0.000*)
Controls	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Number of obs	3,625	1,896	1,729
R^2 (%)	16.01	19.83	15.69

Panel B: full sample and sub-samples based on payout

	Dependent variable: annual excess stock returns		
	Full sample	High-payout	Low-payout
	(1)	(2)	(3)
$\Delta CapEx_t$	1.275*** (*0.000*)	0.402** (*0.033*)	1.867*** (*0.000*)
$NC \times \Delta CapEx_t$	−1.220*** (*0.007*)	0.233 (*0.471*)	−1.999** (*0.016*)
Post-SOX × NC × $\Delta CapEx_t$	2.419*** (*0.004*)	0.587 (*0.635*)	3.262*** (*0.002*)
Post-SOX	−0.176*** (*0.000*)	−0.246*** (*0.000*)	−0.078*** (*0.000*)
Controls	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Number of obs	3,625	1,779	1,846
R^2 (%)	16.01	23.09	16.30

Notes: The dependent variable is the size and book-to-market adjusted excess stock returns during year *t*. Firms are classified large firms if their market capitalisation is larger than the sample median else they are classified small firms. Firms are classified high-payout if their market payout ratio is larger than the sample median else they are classified low-payout. See Table AI for a discussion of the variables. Reported in parentheses are *p*-values based on Driscoll and Kraay (1998) standard errors. All regressions control for year and firm fixed effects with the coefficient estimates suppressed. **,***Significant at the 5 and 1 per cent levels, respectively

Table VII. Impact of board and committee independence provision

isolate the effect of SOX lead to some interesting findings. Upon examination of the financial reporting provision, it was found that non-compliant firms in general experienced a decrease in the marginal value of capital expenditure. The related party transaction provision produces results which are not pervasive. Finally, the board and committee independence provisions suggest an associated increase in the marginal value of capital expenditure suggesting that this provision may be driving our full-sample results.

6. Conclusions

Scandals surrounding the spectacular corporate failures resulting in some of the biggest bankruptcies in the US led Congress to swiftly enact legislation aimed at tightening corporate governance to deal with misconduct, share price manipulation and accounting irregularities. Additionally, the SEC called upon major stock exchanges to review their listing requirements, which, when combined with the provisions of the SOX Act of 2002 resulted in sweeping regulatory reforms. While proponents argued that the expected tightening in governance would reduce agency conflicts, opponents maintained that the provisions imposed substantial compliance costs and that Congress effectively over-regulated in its haste to address the issues surrounding the demise of major corporations. As capital expenditures are a direct channel through which self-interested managers can pursue private benefits, changes to the contribution these investments make

to firm value following an exogenous shock to corporate governance provide an interesting aspect of investment policy to examine. As SOX represents an exogenous shock, it also avoids potential endogeneity issues of examining the relation between governance and investment policy that have plagued the previous literature.

We find that the marginal value of capital expenditure increased on average for all firms in the S&P 1500 as at December 2002. A reduction in over-investment or lower-cost access to external funds could potentially explain these results. The findings are therefore consistent with agency theory and hold across size and payout classified sub-samples. Given that other contemporaneous events may be occurring simultaneously with the enactment of the new regulations and hence cloud our inferences, we identify firms compliant/non-compliant with the various provisions prior to the passage of the Act and employ the difference-in-differences approach to isolate the effect of SOX. The findings suggest that different provisions of SOX affect firms in different ways, with evidence supporting a reduction in agency conflicts as well as potential in compliance costs, or that firms may have become excessively conservative in their risk-taking practices following the governance changes.

Contrary to the findings for the full sample, examination of the financial reporting provision reveals that non-compliant firms experience a relative decrease in the marginal value of capital expenditure post-SOX. This is consistent with heightened risk aversion causing an increase in managers' perceived discount rate leading to lower firm valuation. Excessive compliance costs imposed by SOX diverting funds away from investment purposes may also be driving the results. However, since cross-sectional results reveal that this finding of a reduction in the contribution of capital expenditure to firm value holds primarily for large firms, increase in risk aversion is the most likely cause behind the full-sample results.

We do not find any relationship between the related party transaction provision and the marginal value of capital expenditure. On the other hand, consistent with agency theory, the board and committee independence provisions were found to be associated with a relative increase in the marginal value of capital expenditure for non-compliant firms post-SOX. This result held for large and small firms, as well as for low-payout firms.

The new rules and regulations imposed by the legislation and major stock exchanges are found to impact significantly upon the marginal value of capital expenditure for firms non-compliant with the provisions in SOX prior to its passage. SOX was enacted to tighten corporate governance, with the aim of reducing misconduct, fraud and accounting irregularities, thereby restoring investors' confidence in the US securities markets. While the overwhelming evidence in our study suggests significant reduction in agency conflicts post-SOX, there is, however, some evidence with respect to changes in the marginal value of capital expenditure which suggests over-regulation and potential increase in managerial risk aversion.

Notes

1. I will use the terms "SOX", "the rules", "the act" or "the law change" in reference to both the Sarbanes-Oxley Act of 2002 and the associated changes to the listing requirements imposed by the major stock exchanges, treating these two components as one single event in this research. If the two components need to be disentangled, then the terms "Sarbanes-Oxley Act" and "changes to the listing requirements of the major stock exchanges" will be used to separate them.
2. The only exception was the oil and gas explorations industry, which attracted a negative market reaction to announcements of increased expenditure.
3. To conserve space, results in Tables V–VII are reported only for the size and book-to-market adjusted measure of excess return.

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Appendix

PostSOX	Dummy variable: 1 for observations in the post-SOX time period, and 0 otherwise
NC	Dummy variable: 1 for non-compliant firms, 0 for compliant firms (see Methodology section for details)
r	Raw returns of firms' stock. Source: CRSP
RB	Fama and French (1993) size and book-to-market matched portfolio returns, or Fama and French (1997) industry value-weighed returns. Source: Ken French's website (please see Footnote 3)
ΔCapEx	Changes in capital expenditures (item 128) in Compustat
ΔEarnings	Change in earnings before extraordinary items (item 18 + item 15 + item 50 + item 51). Source: Compustat
ΔNetAssets	Change in total assets net of cash (item 6 – item 1) in Compustat
ΔR&D	Change in R&D (item 46, set to 0 if missing) in Compustat
ΔInterest	Change in interest (item 15, set to 0 if missing) in Compustat
ΔDividends	Change in common dividends (item 21). Source: Compustat
NetFinancing	Net new equity issues (item 108 – item 115) + Net new debt issues (item 111 – item 114). Source: Compustat
Leverage	All debt (item 9 + item 34)/Market value of total assets (item 6 – item 60 + item 25 × item 199). Source: Compustat

Table AI.
Variable definitions

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An overview of C-SOX and directions for future research

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Abstract

Purpose – The purpose of this paper is to examine existing literature, including both academic and practitioner publications, related to Canadian SOX (or C-SOX as it is popularly known). The study discusses the origins of the Act, the underlying motivations for enacting this legislation in Canada and its impact on corporate decisions since its inception in 2003.

Design/methodology/approach – The principal focus of this literature review is on C-SOX, its inception, reception, compliance and impact in Canada, both from business' and investors' critical perspectives. The authors have followed a two-step process to gather all the articles. First, the authors used a keyword search at Google Scholar and ProQuest (e.g. C-SOX, Canadian SOX, Bill 198, etc.) to gather all the articles. Second, the authors retained articles and abstracts that primarily dealt with the background framework and impact of the legislation. It is to be noted that C-SOX was mainly a reactionary legislation following the adoption of US-SOX in 2002. Any discussion of C-SOX is, therefore, incomplete without referencing the literature related to US-SOX.

Findings – In this review paper the evolution of C-SOX over time in Canada, as well as studies on its impacts and criticisms have been summarized. Based on the extensive research that followed the enactment of US-SOX, the authors also provide suggested research directions related to C-SOX in the future.

Research limitations/implications – C-SOX has been relatively underexplored and therefore, not much academic work is available presently. This study highlights this gap in the literature with the hope that researchers will devote their energy to understanding the broader ramifications of major legislations such as C-SOX which will potentially also inform future public policy choices.

Practical implications – This research will help both businesses and investors to understand each other's perspectives and concerns regarding C-SOX. This paper will also be helpful to policy makers to identify potential areas of improvement in this and future legislative decisions in the future.

Originality/value – Using a qualitative approach this study combines the development of C-SOX as a legislation in Canada, its overall effectivity/drawbacks and explores the areas it impacts, both positively and negatively, along with criticisms and appreciations.

Keywords SOX, C-SOX, Bill 198

Paper type Literature review

1. Introduction

In the early 2000s Enron was a Wall Street favorite and even got awarded the "America's Most Innovative Company" title by *Fortune* magazine, for six consecutive years (http://news.bbc.co.uk/2/hi/business/3398913.stm). Just a year later, in 2001, Enron fell from grace as it filed for bankruptcy – the biggest ever in the USA at the time – losing approximately

The authors would like to convey the sincerest apologies to the authors of any paper(s) in case of any unintentional exclusions in this review.

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$74bn in value in the process. Subsequently, it was discovered that in collusion with the public accounting firm – Arthur Andersen LLP, the top executives at Enron siphoned off millions of dollars in illicit earnings by way of "complex, off-the-book" partnership (www.cnn.com/2013/07/02/us/enron-fast-facts/index.html). Unfortunately, Enron was not the only one guilty at the time of corporate wrongdoings. WorldCom, the second largest US telecommunication service provider at the time, was also guilty of misrepresenting its financial health and in 2002 announced that it will rectify its financial statements to reflect corrections to the tune of $3.85bn. Profits turned to losses in an instant as it was discovered that regular expenditures were deliberately misclassified as capital investments (http://knowledge.wharton.upenn.edu/article/what-went-wrong-at-worldcom/). Tyco, a security systems company that operated in the USA around the same time, was also found to fraudulently inflate profits by $185m as the CEO embezzled millions of dollars from the company (www.nytimes.com/2002/12/31/business/corporate-conduct-overview-tyco-admits-using-accounting-tricks-inflate-earnings.html). Waste Management scandal is still another example, where the top 5 executives were found to misrepresent financial results between 1992 and 1997 by way of charging no depreciation on assets, assigning random salvage values to assets which in fact had none, having insufficient reserves to pay for dues, improper expense capitalization, etc., and made substantial illicit gains in the process (www.sec.gov/news/headlines/wastemgmt6.htm). The US Congress moved quickly, following these major scandals, to restore investor confidence in capital markets by enacting US-SOX in 2002, which introduced comprehensive reforms related to information disclosure, financial reporting standards, corporate governance requirements and stiffer penalties for corporate wrongdoing. Since its passage in 2002, academic and practitioner research on the impact of US-SOX has grown phenomenally and continues to attract attention from researchers.

Canada followed the USA by enacting Bill 198 (or commonly referred to as Canadian SOX or C-SOX) in 2003. Canada had also seen its fair share of corporate corruption scandals by then. The Livent incident is an example, where in the late 1990s "multi-faceted accounting fraud" was uncovered (www.thestar.com/news/crime/2011/09/12/livent_timeline_a_drama_with_many_acts.html). Around the same time, the Bre-X the scandal revealed an alleged billion dollar "stock fraud" by some key personnel and cost investors substantially (www.theglobeandmail.com/report-on-business/industry-news/the-law-page/the-bre-x-case-finally-closes/article18124172/). Similarly, the Nortel debacle also surfaced, where corporate profits were inflated between 2000 and 2003 to the tune of over $500m (www.reuters.com/article/us-nortel-charges-chro/chronology-key-dates-in-nortels-accounting-scandal-idUSN1936265020080619). Although Canada had not seen frauds the size of Enron, yet these were viewed as wakeup calls and may very well have worked as a catalyst to accelerate the enactment of C-SOX and subsequent implementation. However, Canada did continue to see corporate frauds even after the C-SOX was implemented, but without the regulatory compliance we can well assume that there would have been greater probability of such incidents to recur and fewer opportunities on the part of stakeholders to protect themselves from any resulting damages.

Unlike in the USA, both academic and non-academic research on the impact of C-SOX is very limited, which both presents challenges when conducting a review as well as questions the merits of undertaking such an exercise in the first place. Our motivation for undertaking this review, nonetheless, is based on our extensive discussions with our academic colleagues (faculty and doctoral students) at our respective institutions and in our network as well as conversations with members of the business community. One common theme that emerged from these discussions was that there is a need to comprehensively examine all pertaining information, academic and practitioner, related to C-SOX so that we could better fill the gaps in our understanding of the scope and impact of C-SOX by encouraging researchers to undertake relevant studies. A critical examination of legislative decisions is important to inform future reforms as well as make changes to existing legislations. The paucity of

research on C-SOX, compared to the plethora of studies on US-SOX, is in itself a significant finding in this study and highlights the need to encourage researchers to pursue empirical work related to regulatory reforms. It is important to bear in mind that even though the two markets have similarities and the two legislations have common features, their impact can vary substantially given the context of the two markets in which the firms operate in the respective countries. It would be wrong to assume that the research findings on US-SOX necessarily will be similar to those on C-SOX. Corporate scandals do not disappear as the recent examples of SNC Lavalin and the alleged interference from the PMO, Kinross Gold Corp's bribery in Africa, the alleged accounting fraud by Penn West Petroleum, and Valeant Pharmaceuticals' accounting and drug-pricing strategies highlight. Over 3,000 Canadian individuals and institutions have also been named in the Paradise Paper leak (www.cbc.ca/news/business/paradise-papers-canada-connection-1.4386126).

Among all such instances on both sides of the border, although the modus operandi may have varied but there happened to be one prominent trend – the top management and key officials were always actively involved and responsible for the frauds. This triggered US Government's attention on the matter and Paul Sarbanes' (a Democrat), along with Michael Oxley's (a Republican) bills were consolidated to form the Sarbanes–Oxley Act of 2002 (Heisz, 2009)[1]. This ensured more transparency in the financial activities by way of making company executives fully accountable for the financial reports of the company (http://archives.cpajournal.com/2003/0703/features/f073603.htm). Subsequently, SOX led to greater transparency in the US market (Hossain, 2013b) and checked self-centered "opportunistic" behaviors on the part of management in the form of "value destroying acquisitions" (Bhabra and Hossain, 2017a, b)[2]. Hence soon after, Canada followed the USA as well and introduced Bill 198 (C-SOX) in Ontario as regulators in Canada felt the pressure (Hossain, 2013a), in addition to that Canadian cross-listed businesses lobbied in its favor, to enact comparable reforms so that the investor confidence in the Canadian regulatory system is preserved and also the capital market integrity is upheld (Bhabra and Hossain, 2018a, b). In fact, Anand and Moloney (2004), confirmed that prior to the legal reforms, shareholders had limited remedies against officials involved in such misdeeds. It goes on to discuss the manner in which the legislative setup in common law countries (including Canada) at the time impaired the shareholders from seeking legal remedies in such instances. Essentially it was that way due to two possible reasons: it was hard for individual investors to establish that the misinterpretations caused due to negligence of the auditor under the common law system and, class/derivative actions, as applied, were procedurally cumbersome to execute against the defendants (Anand and Moloney, 2004). Hence, at least initially, there was a lot of optimism associated with C-SOX. In this review, among other things, we study C-SOX's place in Canada, reception of C-SOX in Canada, along with its impacts in the Canadian business world.

2. Need for C-SOX and the US inspiration behind it

As noted earlier, Canada at the time did not have any comparable legislation to that of the US-SOX. Hence, the enactment of SOX in the USA had already triggered enough inquisitiveness in the minds of the Canadian leadership. Moreover, just not the government, but the businesses too began to lobby to have a US-SOX equivalent in Canada (Bhabra and Hossain, 2018a, b). This was essentially because, undoubtedly SOX remains as one of the most important pieces of legislations enacted to regulate corporate conduct in the USA and has prompted a positive impact over time by having to increase responsibilities of key officers involved in the governance system (Bolt-Lee *et al.*, 2011). Although the US-SOX is considered resource intensive and is perceived to be a legal mandate that actually forces corporate boards to adopt a "narrow" view based on financial reporting and ignoring strategy in the process (Cohen *et al.*, 2013), experts including audit firm principals, audit committee members and educators confirm that SOX has strengthened "business oversight"

(Tysiac, 2012). Some of the most visible impact has been on corporate governance in firms, which often had weak governing infrastructure at the board-level and committee-level before the enactment of SOX (Chang *et al.*, 2011) and is considered capable of impacting auditor–client rearrangements (Cassell *et al.*, 2012). It has also been established that inadequate corporate governance controls lead to "executive entrenchment" which in turn increases probability for bankruptcies (Chan *et al.*, 2016). Research even states that the internal controls (IC) requirements, laid down under US-SOX, provides competitive advantage (Jeffrey, 2008) and, in the post-SOX era, it has been established that the enhanced governance mechanisms (under increased regulations) led to a visible reduction in discretionary financial accruals in the books of a business (Chang and Sun, 2010). Hence, the overall acceptance and effectivity of the legislation in the USA is likely to have prompted the Canadian law makers to consider C-SOX to be implemented in Canada.

3. Relevant Components of C-SOX

In 2002, Bill 198 (C-SOX) was presented by the Ontario Securities Commission (OSC) to the policy makers as the Canadian equivalent of the legislative reforms seen south of the border. Soon after, C-SOX was complemented with three regulatory components, that had the potential of having far reaching effects and they are discussed below (see Ferris, 2007):

- Multilateral Instrument 52-109 – Certification of Disclosure in Issuer's Annual and Interim Filings: it was aimed at improving the disclosure quality and legitimacy of the information stated in the reports. Under this ruling, the respective CEOs and CFOs had to attest that they not only designed or supervised the development of such designs, for controls and procedures related to disclosure, but also have implemented them. The implicit interpretation of this, even among law makers and stakeholders, was that CEOs were to be held responsible for a company's ethical and legal conduct[3]. The specific guidelines regarding the same, however, were not provided. Every year, the effectiveness of those controls and procedures will be required to be assessed and the findings disclosed in the Management Discussion and Analysis (MD&A) section of the annual report. In addition, if there had been any instance of deficiency, weakness and/or malpractice discovered in the control mechanisms, such had to be formally presented to the Audit committee and the internal auditors (*National Post*, 2002).
- Multilateral Instrument 52-108 – Auditor Oversight: this was to ensure that the auditor, from the appointed public accounting firm, who is validating the company's financial records, is a member of Canadian Public Accounting Board's (CPAB) in good standing.
- Multilateral Instrument 52-110 – Audit Committees: this section was used to define independence, experience and/or education necessary to become a part of the issuer's Audit Committee. It also detailed responsibilities of the Committee.

4. C-SOX reception in Canada

From a Canadian perspective, the incidents to the south of the border carried significance. Although Canada traditionally had not witnessed financial scandals as big as those in the USA, it nevertheless was felt that proactive measures needed to be put in place before any such incidents happened. Therefore, on April 7, 2003 the "Keeping the Promise for a Strong Economy Act (Budget Measures), 2002" (C-SOX) became effective in Ontario (www.poltext.org/sites/poltext.org/files/discours/ON/ON_2003_B_37_04.pdf). It has since largely been referred to as the "Canadian" Sarbanes–Oxley Act (C-SOX) and is aimed toward improving the accuracy and reliability of disclosures by companies in Canada by way of empowering investors to sue the issuers and concerned individuals validating any misrepresented statements or concealing any major information. Most importantly, even investors in the

secondary market had been granted the right, where traditionally investors buying under the prospectus could exercise the right to legal recourse (Desjardine, 2006).

On the other side, due to these very provisions, there have been criticisms to the bill as well. For instance, AIG Canada CEO implied that in the long run these legal provisions can be concerning for Directors and Officers Insurance providers (because of the potential volume of lawsuits) (Desjardine, 2006). Ironically, around the same time AIG was gripped by an accounting scandal in the USA that led to $1.6bn in fines and trials of a few executives (www.nbcnews.com/id/14704060/ns/business-us_business/t/two-charges-against-aigs-greenberg-dropped/). Prominent lawyers of the time, like Won Kim of the erstwhile Roy Elliott Kim O'Connor LLP, Barbara Murray of Dolden Wallace Folick LLP and Michael Spencer of Milberg Weiss Bershad and Schulman LLP, described C-SOX in a similar manner and indicated that it favors the plaintiffs more, as any investor who faced losses/damages due to misrepresentation are empowered to sue without even having to prove that damages were caused due to investor's reliance on the incorrect information (unlike in the USA). However, to protect companies against such massive risks, C-SOX assesses damages on a proportionate basis and caps the compensation to the greater of $1m or 5 percent of market cap for the company, whereas experts are liable to pay up to $1m and individual directors/officers will pay a maximum of $25,000 or 50 percent of their compensation (12 month preceding the incident) and for experts it is a million dollars. Nevertheless, the caps can vanish if the plaintiff can prove that the defendant authorized/permitted such actions (Desjardine, 2006).

5. Initial skepticism and subsequent impact

Initially in Canada, C-SOX faced considerable skepticism especially from conservative investors. In a news article, the rise in (then) proposed court fines from $1m to $5m and jail terms of up to five years (less a day) got prominence. According to *National Post*, some professionals even opined to such power to impose a fine by the OSC as "unconstitutional" because apparently such stringent measures, as some opine, are more punitive than they are preventive (Mills, 2003).

By 2007 only 10 percent of the executives in Canada thought the companies are ready to comply with the provisions of C-SOX as per a research sponsored by a compliance software company Symantec Corp (Compliance Reporter, 2007). According to the feedback collected by the survey, more than half (55 percent) of the respondents said they were "mostly" complaint, whereas 35 percent admitted of their company being partially compliant, on the face of impending fines and jail terms (Compliance Reporter, 2007). Still, several Canadian provinces including Alberta, Manitoba and British Columbia were in the process to amend legislations concerning corporate affairs, particularly disclosures, in line with what Ontario had done a few years back. However, the harmonization movement of other provinces toward C-SOX was only capable of having little, if any, impact in Canada as most of the businesses are listed in the Toronto Stock Exchange (TSX) and therefore had to already comply to that Ontario's securities law including C-SOX. One positive aspect to the changing scenario was that in the absence of any central securities regulator in Canada, the provinces act-as-one and this move on their part strengthened the public policy outlook toward curbing down on corporate frauds heavily throughout the country and not just in a single jurisdiction. Interestingly, contrary to the expert opinions on C-SOX, there was no significant spike in class action lawsuits in Ontario or elsewhere during this period. Only one company – IMAX Corp. was sued under C-SOX in Ontario. Even the directors' and officers' (D&O) insurance coverage sector remained relatively stable around that time (Gonzalez, 2007).

6. Financial implications of C-SOX over time

In the aftermath of the global financial meltdown in 2008 though, both Canada and the USA had seen a surge in class action filings by investors against several companies. With prominent institutions accused of corporate malpractices as numerous people were left homeless, a

stakeholder backlash was imminent. By 2010, the number of cases had spiked to 24, with each involving claims between CAD $16m and $1.7bn. At that point it was even being speculated that, given the legislative advantage on the plaintiffs' part, Canada can be the next major target destination for expansion by legal firms offering suitable services to potential plaintiffs. But most actions were at a preliminary stage and were yet to receive court approval, so this possibility remained farfetched. Nevertheless, settlements ranging between CAD $2 and $28m were seen to materialize, so the chances could not be ignored entirely. In fact, such settlements posed a bigger risk. Given that smaller settlements were more likely in such cases than continuing a costly (potentially multimillion dollar) legal battle and that D&O contracts were available to be viewed at the preliminary stages, some firms selectively "reverse" engineered to choose which businesses to target. On the other hand, directors and officers may just chose to utilize the D&O policy coverage to settle and gain respite from the complexities that would have followed. This created a potential conflict situation in the D&O insuring business soon. At this point a need for better balance was being felt and as it was understood that law firms were treating C-SOX as purely a business opportunity (Cassidy, 2010).

According to the National Economic Research Associates reports, the secondary market liability provisions could be attributed to the surge in the class action filings in Canada (especially Ontario) (Steinberg and Prescott, 2014). This report pointed to the possibility of the huge claims made, serving as potential incentives for future plaintiffs – within or outside Canada – deliberating on seeking legal recourse. With 90 percent capital market transactions that usually take place in the secondary market, C-SOX had given access to a huge number of additional investors to pursue legal recourse.

However, instead of a shielding mechanism for investors, some believed that C-SOX had been turned into a weapon by a handful of legal firms who used it in the business of negotiating justice selectively. In fact, upon further research it was found that by 2013 end, the number of such filings surpassed fifty and the collective claim figure stood in excess of $16bn and there existed a steadily rising trend toward the same. The main reasons behind this phenomenon could be attributed to: increase in the plaintiff base in Canada, the payouts working as incentives. Professionals, including auditors, were also included in the penalty radius under C-SOX as it was believed that easing of accountabilities led them being negligent and/or prone to collusions with corrupt executives (Steinberg and Prescott, 2014).

7. Compliance effects of C-SOX

7.1 From the perspective of issuance cost

Issuance cost is expenses involved in the underwriting and issuing of securities – both debt and equity (www.accountingtools.com/articles/2017/5/13/issuance-costs). For instance, legal fees, registration fees, marketing costs, etc., are some very commonly occurring items. It does not include any recurring expenses made by the company, like quarterly review expenses, annual financial audit, control audit, etc (www.nbcnews.com/id/14704060/ns/business-us_business/t/two-charges-against-aigs-greenberg-dropped/).

It has been established that "security issue announcements" and "market reaction" are interrelated. The interrelation is (mostly) negative, including issuers who employ named underwriters to handle the marketing of the financial instrument(s). The degree of impact, however, is governed by factors like flotation method selected, existence of investment opportunities and shareholder's participation in the issue, among other things. This generally dilutes the proceeds from any secondary equity offerings, by up to 15 percent. If such dilutions are considered as issue costs, then regulations (such as US-SOX) do indeed increase such costs. However, such market reactions are less intense for more secured and smaller issues (Eckbo *et al.*, 2007).

It has been inferred that traditionally regulatory changes have impacts on the issuance costs as well. The market reaction has been found to be around −2 percent of the firm value for seasoned equity offerings. However, this reaction did not witness any changes due to

C-SOX implementation as, most speculate, it was done gradually over three years. This holds true for both cross-listed and non-cross-listed companies that are otherwise comparable. Apparently, this gave investors, companies and investment banks adequate time to prepare for the regulatory compliance. Hence, C-SOX led to no additional implementation costs, unlike SOX where several errors hampered its prompt implementation in the USA. However, for the post bill period, marketed underwritten offers had a less positive market reaction than bought deals. According to Pandes (2010), this is because bought deals are certified by underwriters and in an environment of strengthening legislation, people prefer the security of having a certification attached to their financial deals (Rubalcava, 2018). Therefore, we can also infer that since the C-SOX did not have the element of surprise and was implemented over time, it did not impact businesses negatively like US-SOX when it came to financing costs.

7.2 From the perspective of technological integration

As of the end of last decade, companies in Canada were having a difficult time when it came to C-SOX compliance and the major aspect to the problem was the lack of directions and no existing procedure that could be used toward the information technology (IT) control objectives, as mandated under the Act, by the technical staff. For US-SOX, in 2004, IT Governance Institute published a framework based on Control Objectives for Information and Related Technologies (COBIT) (www.qualified-audit-partners.be/index.php?cont=315&lgn=3) Lite to achieve similar IT control objectives. However, given differences between C-SOX and US-SOX, the same solution could not be applied to address the issues that were being faced in Canada. Technical solutions proposed included "aligning" the COBIT 4.1 (International Organization for Standardization) ISO 27002 and (Information Technology Infrastructure Library) ITIL v3 frameworks, all of which are popular for control purposes. COBIT 4.1's focus has been on efficiently delivering information as per business requirements, for information security management ISO 27002 had been the best practice and ITIL was included to manage the IT processes effectively. Although it was claimed that proposed framework was "expected" to be more efficient than the others based on some preliminary analysis, yet when it came to the effectiveness of the system or the economic feasibility of the system, there was no concrete evidence. Actually, there can be various frameworks available, but people will prefer using the one that they know will fit their specific requirements better. For instance, when USA and Canada were using Committee of Sponsoring Organizations of the Treadway Commission, in Japan it was decided that a different framework will be used for complying with the provisions of the Japanese equivalent of the US-SOX. So, Canada too was right in not adopting the exact IT compliance framework from the USA, but still needs to analyze more options in detail and come up with the best fit for fulfilling the Canadian IT compliance requirements (Huang *et al.*, 2009).

In addition, Kumar *et al.* (2008) established that there were major challenges that are being faced by companies in the USA and Canada because of SOX and C-SOX legislations. The challenges were especially impactful when it came to the enterprise resource planning (ERP) systems used for maintaining the IC requirements as specified in the new legislative changes. The level of difficulty encountered in the process also depended on the specific control requirement being addressed, compliance stage, and even may exist outside the ERP system because of the lack of flexibility in the system and/or the heavy investment required to update them. Hence, the degree of difficulty encountered for compliance varied by company. System security and duty allocation were most commonly faced issues while undertaking such projects, however, the key is to follow a systematic approach for implementing such changes which may likely include process analysis, documentations for controls, etc. Assistance external to the organization may also become necessary, if the internal staff is lacking that expertise. The organizational outlook toward change, affinity to

existing setup and mismatch in attitudes, also can play significant role in creating resistance within organizations trying to cope with changes as big as C-SOX or US-SOX. However, compliance is not a one-time activity, but an on-going process and further updates are more than likely in case of monitoring, evaluation, future changes in regulations, etc. (Kumar *et al.*, 2008). Hence, at least in the beginning, compliance was both a complicated and costly affair and given its ongoing nature it may as well be now.

8. Direct impacts of C-SOX

From a financial perspective, C-SOX led to class action filing ranging from a few millions to over a billion, with huge chances of settlements that amounted to millions. A lot even criticized law firms to treat this as a business opportunity, rather than defending plaintiffs. This also led to a lot of speculations about insurance getting costly for D&O policies. Although often seen as a diluted version of the US-SOX, C-SOX has proved that it too in its present form can contribute to a positive change in corporate performance in Canada. One such area is corporate acquisitions, where both the target and acquiring firms' returns around the tender announcement period has improved in Canada. The target firms are receiving more value, as the acquiring firm can make more confident decisions. As a result of the better and more timely disclosure environment after C-SOX, empirical research shows lower levels of information leakage prior to acquisition announcements and consequently more fairer valuations around the announcement date. For acquirers, shareholders also have been found to benefit from higher returns around announcements. The operating underperformance of acquirers after acquisitions which has been robustly documented in the M&A literature has also witnessed a decline in acquisitions after C-SOX was enacted. Research concludes that C-SOX had brought harsher penalties and hence promoted good governance that was largely the reason why both the management and shareholder could be better aligned to achieve positive results in the post-acquisition period (Hossain, 2013a).

9. Comparison between US-SOX and C-SOX

So far, in this review, we have noted that although C-SOX was enacted along the lines of US-SOX, yet there remain prominent differences between the two. These differences are briefly discussed below:

- Though US-SOX was implemented throughout the nation as it was a federal legislation, C-SOX in Canada had limited geographic coverage as it was a provincial (Ontario) legislation. It had to be that way in Canada as they do not have a centralized regulatory body like the Securities and Exchange Commission (SEC) in the USA; rather, each province has their own autonomy in deciding their security regulations. However, the initial geographic restriction did not necessarily translate to significant differences when it came to be covering the businesses, as "majority" of businesses operating in Canada generally had their presence in Ontario because of the TSX.
- Canadian businesses tend to go for initial public offering (IPO) sooner (compared to their US counterparts) in their corporate life and that potentially puts them in a comparatively difficult spot when it comes to compliance costs relating to stringent provisions of corporate regulations, including C-SOX.
- US-SOX is a product to fit the "rule-based" compliance environment in the USA. On the other hand, Canada's "principle-based" environment rather encourages voluntary practice of good governance in the companies to develop a culture of obedience. Hence, the legal penalties are comparatively lighter under C-SOX. Therefore, section of stakeholders perceives the US-SOX as something more rigorous than C-SOX.

- Although Section 404 of US-SOX necessitates external opinions from auditors on company assessment reports of the IC; however C-SOX does not require such auditor opinions pertaining to adequacy of IC (www.complianceonline.com/sarbanes-oxley-vs-bill-198-key-differences-11103-prdad).
- Under US-SOX, the companies are required to have in place IC adequate to counter risks that are even considered as "remote chance" of occurrence. On the other hand, although high commitment, attention and intricacy are encouraged for IC, C-SOX only requires companies to ensure a "reasonable assurance" level of tackling any potential instances of corporate misappropriations (www.qualified-audit-partners.be/index.php?cont=315&lgn=3).
- From the operations standpoint as well, there exists a difference between the two when it comes to "independence and transparency" of the respective governing bodies. In the USA, the Public Company Accounting Oversight Board (PCAOB) enjoys a greater level of autonomy than its Canadian counterpart (www.qualified-audit-partners.be/index.php?cont=315&lgn=3).

Given that C-SOX followed and is modeled after US-SOX, there are major similarities between the two legislations. These are discussed next:

- Section 404 of US-SOX is not only the governing regulation on reporting of IC but also on attestations from auditors. Similarly, as discussed, Multilateral Instrument (MI) 52-109 of C-SOX lays down the obligation for managing the certification for IC (Ben-Ishai, 2008).
- Section 302 of US-SOX mandates the respective CEO and CFO of the issuing company to attest to the legitimacy of the financial reports presented. Similarly, MI 52-110 of C-SOX includes similar requirements that obligate top executives to be responsible for the accuracy of the issued financial statements. Also, this regulation requires the audit committee overseeing the process, to be independent (Ben-Ishai, 2008).
- Section 101 and Section 105 of US-Sox established the PCAOB and allowed public accounting firms to conduct investigations of potential instances of US-SOX violations, respectively. Similarly, MI 52-108 of C-SOX obligates public companies in Canada to use accounting firms that are registered with CPAB for auditing purposes (Ben-Ishai, 2008).

10. Criticisms of C-SOX

Although it may appear that C-SOX implementation was a definite success in Canada, there are advocates against this view, who opine that a SOX-based model is not suited for Canada. The foremost argument made in this context is that a significant number of Canadian businesses already have listings in the USA due to which they automatically need to comply with the provisions of SOX and so having a Canadian version of SOX for the remaining non-cross-listed ones in Canada is not viable. In fact, the relatively smaller Canadian capital market was suggested to adopt a tired system where proportionate regulations will apply by the tier a business comes under (Sibold, 2009). For US-SOX, it was discovered that direct costs associated with implementation affected smaller businesses disproportionately (Coates and Srinivasan, 2014). The possibility of a similar phenomenon occurring in Canada due to C-SOX was not considered too remote either. Then, it is also being argued that the development of C-SOX framework from US-SOX lacked analysis and was rather a political move to keep the US investments flowing into Canada. Unsurprisingly, a more independent and customized version of the Canadian SOX is advocated for. Finally, C-SOX is also criticized on the grounds of being based on minimal critical evaluation, which argues for having independent outside directors whereas some studies exist that suggest too many

outside personnel may hamper a business' interests (Sibold, 2009). Sibold even goes on to describe C-SOX as a response to a solution, rather than a problem.

In fact, due to the North American legislative renaissance in the post Enron period, the Canadian legislation has been well on its way to converge with the USA's, according to Bozec and Dia's research findings. However, this research uncovers a critical behavior among the Canadian companies – most are complying in areas where they absolutely must, just to be viewed as good corporate citizens and reduce non-compliance costs along the way. These are mainly areas of composition, attributes and working of the company leadership. The main idea behind having such legislation in place, i.e., facilitating good governance, is thus not achieving its purpose in Canada. In turn, this signals a disturbing trend where the idea of investor protection and corporate-fraud eradication, is mostly not valued by the corporate leadership and is just done to avoid fines and lengthy legal proceedings (Bozec and Dia, 2010).

Although a lot of the discussion above is argumentative, yet it is difficult to negate one point – both the US and Canadian markets are deeply connected to each other and consequently it is a popular assumption in Canada that if the regulatory provisions for fraud prevention are made significantly different than that of the USA, the Canadian cross-listed businesses my stand to lose the compliance relaxation in USA. Possibly, given this apprehension the Canadian Securities Administrators decided to design the legislation governing corporate disclosure to resemble the SEC (USA) guidelines at least in the key areas like certifications and audit committee (International Financial Law Review, 2005).

11. Future research

Future research into C-SOX can focus on evaluating the success of the legislation based on resulting advantages and disadvantages. Here, analysis of net costs and resulting impacts (on areas like shareholder wealth) can play a key role in estimating the overall utility of C-SOX in the Canadian market. Specifically, the marginal cost for being a public company in Canada must be assessed against the benefits, along with the resulting possibility that such businesses may consider going private/dark needs to be analyzed based on criteria including size, performance, growth opportunities and capital structure. The impact of C-SOX on IPOs value over time will be another excellent area for future research as well because that can cater as an index of success for the legislation. Did C-SOX deter private companies from going public as was observed in the USA after US-SOX? The long-term implications from such trends in terms of capital formation in the economy and economic growth can be huge, and a proper understanding of the costs and benefits of such major regulatory reforms is vital to find the optimal balance between regulatory oversight and market oversight.

The extent to which businesses are ready to spend for having a strong IC mechanism must be looked into to ascertain if there exists a threshold after which the businesses would rather prefer disclosing a weak IC mechanism and save costs.

Another interesting area would be to research if C-SOX has directly led or indirectly influenced any changes or modifications to any federal or provincial laws in the country and its possible long-term impacts on the Canadian market. In addition, the possibility of C-SOX legislation leading to businesses moving to other countries and/or dissuading foreign corporations to expand into Canada needs to be analyzed to avoid being sucked into a zero-sum game in the long run. The profiles of migrating companies, if any, need to be looked at as well to assess if there is a business segment being disproportionately affected and to find out if any other interesting trends exist.

Although it is evident that compliance costs are more for cross-listed companies who need to comply with both US-SOX and C-SOX, it is unclear if C-SOX costs affect smaller Canadian companies more than the bigger ones who have enough of a resource base to fulfill the compliance requirements. It will be interesting to see research that quantifies such gap and flags the C-SOX provision(s) that is (are) contributing the most to it, so that the figures

can later be used by policy makers to legislate on potential rebates and/or relaxation provisions for smaller businesses in Canada.

Another research area can be of ascertaining objective methods for more accurate estimation of direct and indirect costs of the legislation and how impact varies, if at all, given the size of businesses. Research is also required for analyzing the investment-to-capital ratio for Canada as well for post C-SOX period. Although we know that C-SOX has somewhat strengthened the business environment, yet we are unaware of its impacts on the ground. It will be important to see future studies explore the existence of statistical significance between the number of corporate frauds emerging before and after implementation of C-SOX in Canada.

Future studies can also explore how much does the profitability of business concerns and of professional service providers gets impacted and if the impact is substantial enough to deter them from repeating the offence(s) in future. Research should also focus on the suitability of the provisions of C-SOX to fit the requirements and norms of the Canadian market, keeping in mind that the principles-based business culture in Canada (vs rule-based US approach) is driven less by legal coercion and more under the faith of ethical conduct and personal integrity/responsibility (Bhabra and Hossain, 2018a, b), so that C-SOX can be amended more meaningfully in future.

Overall, C-SOX is a step forward toward having more corporate consciousness and transparency. However substantial research is required in some of the suggested areas in this section to enhance our understanding of C-SOX's effectiveness currently and how it can be updated to address compliance and oversight needs in the future.

12. Conclusion

There exist structural and philosophical differences between the USA and Canada (Bhabra and Hossain, 2018a, b), which affected, affects and will continue to affect the form, necessity and perceived utility (success) of C-SOX over time. However, any discussion on the subject would have been incomplete without contrasting discussions on its US predecessor which is not faced with a lack of academic research like it is in the case of C-SOX. In this paper, we have provided an overview of C-SOX and the context in which it was enacted, and reviewed the limited research that has attempted to examine its impact. Our study shows a glaring lack of the systematic examination of the impact of C-SOX on corporate decisions. To assume that the impact of C-SOX in Canada would be similar to that of US-SOX in the USA, since both legislations have many similar features and were enacted around the same time, and the two markets have a lot in common, is misplaced. As discussed in this study, there remain significant differences between the two markets. Having a major legislation modeled along the lines of a US regulation, it is important to understand the impact of this reform in the Canadian context. We identify and suggest several areas specific to the Canadian context where research can be conducted to gain a better insight into C-SOX's successes, impact enhancements and reasons for failures, if any. The empirical findings from these studies can help guide how C-SOX can be modified to suit the needs of the Canadian business environment.

Notes

1. Coates and Srinivasan (2014) has an extensive review done on US-SOX literature.
2. Cleary and Hossain (2018) find that recent financial crisis had significance influence on M&A strategic decision making and an investigation from that perspective looking into C-SOX will be interesting. Other papers by these authors that relate to SOX are Bhabra and Hossain (2015, 2017a, 2018a) as well as Chourou *et al.* (2019) that looks into a specific type of firms, i.e. dual-class firms.
3. Ferrell and Ferrell (2011) discuss the relevance of CEO and CFO ethical attitude on corporate transparency.

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Auditors' quality, footnotes, and earnings persistence

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Abstract

Purpose – The purpose of this paper is to investigate the role of auditors in financial statement readability. Using a simple proxy for financial statement obfuscation (number of footnotes), the authors examine the relationship between auditor quality, financial statement readability and earnings persistence.
Design/methodology/approach – The authors use regression analysis to test two hypotheses. In the first hypothesis, the authors investigate whether firms audited by Big 4 auditors have a lower number of footnotes than firms audited by non-Big 4 auditors. In the second hypothesis, the authors show that the firms with more footnotes have less earning persistence in comparison to the firms with less footnotes.
Findings – The authors find that firms audited by Big 4 auditors have fewer footnotes than firms audited by non-Big 4 auditors, and a larger number of footnotes reduces earnings persistence one-year and two-years ahead of the financial statement, although a larger number of footnotes does not reduce earning persistence when firms use Big 4 auditors. Overall, firms that use non-Big 4 auditors tend to obfuscate annual reports by using more footnotes and, in turn, reduce earnings persistence.
Originality/value – This is the first paper that has used number of footnotes in 10Ks as a proxy for financial statement readability. This paper shows how auditors' reputation plays a key role in the readability of the financial statement. Prior studies related to readability have ignored the importance of auditors' quality with respect to the readability of financial statements.

Keywords Auditor reputation, Earnings persistence

Paper type Research paper

> A horse called "Read the Footnotes" ran in the 2004 Kentucky Derby. He finished seventh, but if he had won, it would have been a victory for financial literacy proponents everywhere. It's so important to read the footnotes[1].

1. Introduction

Footnotes are important components of 10Ks. In addition to the quote above, on the same website, the SEC states that footnotes are "packed with information." To illustrate the importance of footnotes, International Paper Company added billions of dollars in one-time tax credit income to its earnings in 2009. Investors who did not look at the footnotes calculated the return on investment (ROI) as 7.6 percent while the ROI was 2.2 percent when footnotes were taken into consideration[2]. Academic literature also recognizes the importance of footnotes. For example, Imhoff *et al.* (1993) note that there are many instances, especially not mandated instances, when information is disclosed in the notes of the financial statements. However, there is not much academic literature available, investigating footnotes in detail. This is somewhat surprising, given the recent flurry of academic studies investigating the informativeness, usefulness and readability of financial statements. This stream of research is

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clearly important as it attempts to determine whether various parts of the financial statements are proxies used to obfuscate information or are truly helping investors in analyzing 10Ks. Examples in this line of research are papers such as Li (2008), Biddle *et al.* (2009), Miller (2010), Lehavy *et al.* (2011), Dougal *et al.* (2012) and Lawrence (2013). These papers analyze the lexical properties of financial statements using fog index. Others use file size of 10K filings (e.g. Loughran and McDonald, 2014) as fog index may have measurement flaws. Our paper empirically investigates the importance of footnotes as regulators and academicians suggest. We add to the literature by proposing and examining a very simple metric: the number of footnotes in 10Ks. For a sample of 1,072 firm years, we count the number of footnotes in the 10Ks and first investigate whether this number is correlated with auditor quality. After controlling for several other possible factors (such as market-to-book (MTB), leverage, special items (SI), age, size, mergers, seasoned equity offerings (SEO), dividends and state of incorporation) we find, consistent with our first hypothesis, that the number of footnotes is fewer when a 10K is audited by a Big 4 auditor. The extant literature suggests that these auditors tend to provide relatively higher quality audits and, as a result, 10Ks (e.g. Khurana and Raman, 2004; Raman and Wilson, 1994; Teoh and Wong, 1993). This could suggest that footnotes are indeed used to obfuscate information rather than being informative, given that higher quality auditors have been shown to be associated with higher quality reporting and tend to use fewer footnotes after controlling for other relevant explanatory factors.

To further investigate whether the number of footnotes is associated with higher quality reporting, we investigate the relationship between the number of footnotes in 10K filings and the earnings persistence of firms, while controlling for auditor quality. Earnings persistence has been shown to be related to earnings quality by a number of authors (e.g. Li, 2008; Dechow *et al.,* 2010). We find, consistent with our second hypothesis, that 10Ks with more footnotes are associated with less earnings persistence (both one and two years after the year of the 10K). Hence, it appears that the number of footnotes is associated with lower reporting quality. So, in short, our paper provides evidence that when a relatively large number of footnotes is included in a 10K, 10K is more likely audited by a lower quality auditor and is of lower reporting quality. Overall, this finding lends credence to the idea that footnotes may be used to obfuscate information.

Chychyla *et al.* (2019) find that financial reporting complexities and negative reporting can be mitigated by the presence of accounting expertise on a firm's board of directors and audit committee. The authors emphasize the importance of internal stakeholders' role in increasing financial reporting quality. In the current paper, we focus on how external stakeholders (i.e. external auditors) impact annual reports. Also, Francis and Wang (2008) emphasize that the auditor quality plays an integral role in stronger investor protection regime. Their findings show that the auditor quality is the main explanatory factor of earnings quality differences across countries. Hence, in this paper we examine how auditor quality (i.e. Big 4 vs non-Big 4 auditors) affects financial reporting quality. The contribution of the paper is twofold. First, we use the number of footnotes as a proxy to financial reporting quality and, second, we explore the role of auditors in financial statement readability.

Our paper proceeds as follows: Section 2 presents related literature, our hypothesis development and methodology; Section 3 describes the data; Section 4 presents our results; and, finally, Section 5 concludes.

2. Literature review and hypothesis development

2.1 Readability and footnotes

Disclosure is an important component for capital markets to function efficiently. 10Ks contain several sections, some of which firms can use to disclose (or hide) information. For example, managers use financial statements, footnotes and management discussion and analysis sections to disclose information (Healy and Palepu, 2001). Historically, the SEC put

significant emphasis on the readability of annual reports. In 1969, the SEC issued the Wheat Report to improve disclosure to investors. One of the recommendations of this report was to avoid lengthy writings. In 1998, the SEC published the Plain English Handbook where the SEC advocated to use plain English in disclosure related documents.

Academic research has also investigated the readability of annual statements. In this stream of research, researchers investigate whether managers attempt to obfuscate or disseminate information using firms' 10Ks. Examples in this line of research are papers such as Li (2008), Biddle *et al.* (2009), Miller (2010), Lehavy *et al.* (2011), Dougal *et al.* (2012) and Lawrence (2013). These papers analyze lexical properties of financial statements using the fog index. On the other hand, Loughran and McDonald (2014) argue that fog index is poorly specified when measuring readability due to the extremely high percentage of complex words (one of the two fox index components) used in financial documents. They suggest that the file size of 10K filings is a better readability proxy for financial statements than fog index.

There is also some research examining footnotes. Early research such as Smith and Smith (1971) investigates the readability level of the notes and finds that there is no relation between the external auditor and the comprehension ease of the notes. More recently, Li (2008) uses a large sample of 55,719 firm years and shows that the annual reports of firms with lower earnings have a higher fog index (i.e. reports are harder to read) and also longer. Li also finds that firms with annual reports that have a lower fog index (easier to read) exhibit persistent positive earnings.

2.2 Auditor reputation and financial reporting

Accounting literature studied auditor reputation extensively. This stream of literature documented that firms' financial reporting differs when big auditors (Big 4, 6 or 8) are employed, compared to financial reports audited by relatively smaller auditors. For example, Becker *et al.* (1998) finds that the clients of non-Big 6 auditors have higher discretionary accruals than the clients of Big 6 auditors. They also find that the absolute values of the discretionary earnings are greater for firms who use non-Big 6 auditors. Others, such as Lennox (1999), show that the larger auditors are more accurate in representing financial reports. The author also shows that the threat of litigation risk drives the incentive of higher quality audits for reputed auditors[3]. Behn *et al.* (2008) report that the analysts' earnings forecasts are higher and forecast dispersion is smaller for firms audited by Big 5 auditors. Auditors may also work as a monitoring mechanism. DeFond (1992), for example, shows a positive relationship between audit firm quality and Big 4 auditors and its ability to reduce agency problems. Hence, there is ample research suggesting that reputed auditors are associated with higher quality financial reporting[4]. Bushee *et al.* (2018) state that complex language need not necessarily mean obfuscation. Complexity of the language used in financial reporting can arise due to the technical nature of the business. Hence, if complex language is being used, it does not always mean obfuscation or increasing information asymmetry. Such postulation undermines the validity of the fog index in examining the readability of financial statements. We are using auditor quality as a proxy to validate whether the increase in footnotes is because of complexity or if it simply creates more obfuscation.

2.3 The number of footnotes

According to the management obfuscation hypothesis, managers have an incentive to obfuscate or complicate information when firm performance is poor as markets may react with a delayed reaction due to complicated information (Bloomfield, 2002; Li, 2008). The underlying assumption behind the management obfuscation hypothesis is the incomplete revelation hypothesis. Grossman and Stiglitz (1980), Bloomfield (2002) and Li (2008) state

that information which is costly to process is less likely to exhibit itself in stock prices and managers try to hide negative information by making it more opaque. The main goal of the manager is to increase the processing costs of the adverse information so that stock prices do not reflect the adverse information. Hence, the management obfuscation hypothesis predicts a negative relationship between firm performance and annual report complexity.

Most prior studies except Li (2008) use earnings quality as a proxy of disclosure (e.g. Francis *et al.*, 2005; Riedl and Srinivasan, 2005). Li (2008) postulates that complicated annual reports may hide adverse information by increasing investors' processing costs. He documents that the relationship between annual report readability and current performance is not straightforward. First, annual reports contain both current and historical financial information. It will be difficult for managers to obfuscate information for the current period as historical information is already present. Therefore, it is unlikely that the firm will write a complicated annual report to hide adverse information for the current period. Second, if manipulation of financial information leads to positive current earnings then there is no reason to believe why managers will make the annual reports more complicated. It is more likely that managers will try to obfuscate information for a future period rather than the current period. Due to these reasons, Li (2008) advocates using future performance in order to capture obfuscation behavior. Managers are more likely to complicate information if good earnings are short-lived or poor earnings are persistent. For example Lehavy *et al.* (2011) finds that the analysts take more time to generate reports for firms with less readable communication. Though the analyst reports of firms with less readable 10K filing are more informative as analysts spends more time, at the same time, analyst reports are less accurate for firms with less readable 10Ks.

2.4 Hypotheses and methodology

The discussion above suggests that financial statements are important as they carry important signals about future performance and auditors play an important role in the formatting/certifying of this information. Hence, if reputed auditors are associated with higher quality financial reporting and if footnotes are used to make information more opaque, one can hypothesize the following:

H1. Firms audited by reputed auditors (i.e. the Big 4 auditors) will have fewer footnotes than firms audited by non-Big 4 auditors auditor.

In order to test this hypothesis, we conduct a firm year level cross-sectional analysis. We hypothesize that firms audited by Big 4 auditors have a lower number of footnotes than firms audited by non-Big 4 auditors. In our regressions we use the number of footnotes for firm i in year t as our dependent variable. Our main interest variable is the auditor reputation dummy and we expect a negative regression coefficient on this dummy. We follow Li (2008) for our control variables. Specifically, we include MTB ratio as one of our control variables as high MTB firms have more investment opportunities and growth potential. MTB is defined as the market value of the firm divided by its book value [Compustat data items: ((data25 × data199 + data181)/(data6))]. Leverage is total liabilities [Compustat data items: (data181)/(data6)]. We include SI as firms with SI are more likely to have unusual events. SI [Compustat data items: (data 17)] is equal to SI scaled by total assets [Compustat data items: (data 6)]. Firm age (Age) can also affect the number of footnotes. As investors are more aware of the business operations of older firms, one would expect a lower number of footnotes for older firms. We proxy for firm age using the number of years since a firm's first appearance in the CRSP monthly stock return files (AGE). We include size [Compustat data item: (total assets (data6))] as a proxy for a firm's political cost (e.g. Watts and Zimmerman, 1986; Li, 2008). Mergers and acquisitions (MA) and SEO are included to capture firm events that could also affect the number of footnotes. Both SEO and MA are

dummy variables. *MA* is equal to 1 for a fiscal year in which a firm appears to be an acquirer in the SDC Platinum M&A database and 0 otherwise. *SEO* is equal to 1 for a fiscal year in which a firm has common equity offering in the secondary market (from the SDC Global New Issues database) and 0 otherwise. We also use the state of incorporation as a control variable as firms incorporated in the state of Delaware have different corporate laws, have more investor protection, receive more takeover bids and also have a higher valuation than firms incorporated in a different state (Daines, 2001; Li, 2008). Firms that are incorporated in Delaware (DEL) are labeled with a dummy variable set to 1 and 0 otherwise. We also include dividends (DIV) as one of our controls. Firms paying dividend may have additional footnotes. Dividend (DIV) is equal to 1 if a firm pays dividend in the fiscal year and 0 otherwise.

Our base model to test *H1* is as follows:

$$\begin{aligned} Footnotes_{i,t} = {} & \alpha_0 + \beta_1 Big4_{i,t} + \beta_2 MTB_{i,t} + \beta_3 Leverage_{i,t} + \beta_4 SI_{i,t} + \beta_5 Size_{i,t} \\ & + \beta_6 Age_{i,t} + \beta_7 SEO_{i,t} + \beta_8 MA_{i,t} + \beta_9 DLW_{i,t} + \beta_{10} Div_{i,t} \\ & + Year\ Dummies + Industry\ Dummy + \varepsilon_{i,t}. \end{aligned} \tag{1}$$

Our next hypothesis tests the effects of number of footnotes on earnings persistence (i.e. our proxy for reporting quality):

H2. Firms with more footnotes have less earning persistence in comparison to firms with fewer footnotes.

In order to test this hypothesis we incorporate earnings persistence (i.e. earnings in period $t+1$ and $t+2$ as our dependent variable (Li, 2008; Riedl and Srinivasan, 2005)). We use earnings in the current period ($Earnings_t$) as our independent variable. $Earnings_t$ is calculated as operating earnings (Compustat data item 178) scaled by book value of assets (Compustat data item 6). In addition to previously mentioned control variables in our model 1, we incorporate accruals as an additional control variable. Sloan (1996) and Li (2008) find a negative association between accrual and earning persistence. Accruals (*ACC*) is equal to (Compustat data item data178 − data308)/(data6). Following Li (2008), we also include interaction terms of some controls with current period earnings ($Earnings_t$) in our regression model.

Our base model to test *H2* is as follows:

$$\begin{aligned} Earnings_{i,t+1} = {} & \alpha_0 + \beta_1 Earnings_{i,t} + \beta_2 Footnotes_{i,t} \times Big4_{i,t} + \beta_3 Earnings_{i,t} \times Footnotes_{i,t} \times Big4_{i,t} \\ & + \beta_4 Earnings_{i,t} \times Footnotes_{i,t} + \beta_4 Earnings_{i,t} \times Big4_{i,t} + \beta_6 Earnings_{i,t} \times SEO_{i,t} \\ & + \beta_7 Earnings_{i,t} \times MA_{i,t} + \beta_8 Earnings_{i,t} \times Dividends_{i,t} + \beta_9 Earnings_{i,t} \times DLW_{i,t} \\ & + \beta_{10} Earnings_{i,t} \times ACC_{i,t} + \beta_{11} Earnings_{i,t} \times MTB_{i,t} + \beta_{12} Earnings_{i,t} \times Age_{i,t} \\ & + \beta_{13} Earnings_{i,t} \times Leverage_{i,t} + \beta_{14} Earnings_{i,t} \times SI_{i,t} + \beta_{15} Earnings_{i,t} \times Size_{i,t} \\ & + \beta_{16} Footnotes_{i,t} + \beta_{17} Big4_{i,t} + \beta_{18} ACC_{i,t} + \beta_{19} MTB_{i,t} + \beta_{20} Leverage_{i,t} \\ & + \beta_{21} SI_{i,t} + \beta_{22} Size_{i,t} + \beta_{23} Age_{i,t} + \beta_{24} SEO_{i,t} + \beta_{25} MA_{i,t} + \beta_{26} DLW_{i,t} \\ & + \beta_{27} Div_{i,t} + Year\ Dummies + Industry\ Dummy + \varepsilon_{i,t}. \end{aligned} \tag{2}$$

In this model, we expect to find a negative relationship between footnotes (captured by the interaction of current earnings and footnotes) and earnings persistence (one- and two-years ahead of earnings). We expect this because of the argument of the management obfuscation hypothesis that managers try to hide adverse information by adding more footnotes.

3. Sample and sample characteristics

3.1 Sample

In order to collect our sample, we employ the following strategy. We start with all firms in the CRSP-Compustat merged database (2013). We exclude firms from our sample that operate in regulated industries (SIC 4400–5000) and in the financial industries sector (SIC 6000–6999). Then, we only keep those firms with ordinary common shares (with a share code of 10 or 11 from CRSP). From there we calculate the market value of equity for each firm (data25 × data199). Then, we rank the firms based on the market value of equity and randomly select 200 firms (evenly spread across the firm size spectrum). Our final sample has 1,072 firm years for the period 2008–2013.

The main variable in our study is the number of footnotes in the annual statement. We hand collected the number of footnotes for each year from 2008 to 2013 for each firm. In order to collect the number of footnotes we use the 10K filings of the firms in the SEC online Edgar system. From the CRSP-Compustat merged database, we collect the Central Index Key (CIK) for every firm. Using the CIK, we manually collect the number of footnotes and the independent registered public accountant for every firm year and merge these data with our CRSP-Compustat sample firms.

3.2 Sample characteristics

Table I (panel A) presents the summary statistics of the full sample. For the full sample, the mean and median number of footnotes are 17.1 and 17.0, respectively. In our study, 75.65 percent of the observations have at least one of the Big 4 auditing firms as auditor, while the rest (24.35 percent of all firm-year observations) have non-Big 4 auditors. This is consistent with prior studies (e.g. Khurana and Raman, 2004; Francis and Wang, 2008; Lawrence *et al.*, 2011) and clearly shows a market dominance of the Big 4 auditors in the USA. The mean values of the SEO and MA dummies are 0.06 and 0.26, respectively. These are comparable to the means of 0.06 (SEO) and 0.27 (MA) reported by Li (2008). The mean (median) value for earnings is 0.03 (0.08). The average firm in our sample has an MTB of 1.88 and leverage of 0.39.

Table I (panel B) presents the sample firms industry classification based on a four-digit SIC code. From this table, we see that Business Equipment – Computers, Software has the highest representation with 252 observations (23.42 percent of the sample) and Consumer Durables has the least representation with 39 observations (3.62 percent of the sample).

In Table II (panel A), we report the descriptive statistics of the variables separated into subsamples of Big 4 and non-Big 4 auditors. The mean (median) number of footnotes is 16.19 (16.0) if the firm is using a non-Big 4 auditor, whereas the mean (median) number of footnotes is 17.4 (17.0) if the firm is using a Big 4 auditor. The mean (median) value for earnings for non-Big 4 auditor firms is −0.05 (0.03), whereas the mean (median) value of earnings of firms with Big 4 auditors is 0.05 (0.08). The average firm in our sample of non-Big 4 auditors has MTB of 1.96 and leverage of 0.33, whereas these numbers are 1.86 and 1.46 for Big 4 auditor sub-sample. The mean (median) value of size for non-Big 4 firms is 4.41 (4.22) compared to Big 4 sub-sample's 7.09 (7.17).

In Table II (panel B), we divide our sample into four quartiles based on firm size. Most of the firms which are audited by non-Big 4 auditors are in the first and second quartile (i.e. the smallest firms). In the first quartile the mean difference in the footnotes between non-Big 4 auditors and Big 4 auditors is 0.79 and this difference is statistically significant at 10 percent. In the second quartile, the mean difference in the footnotes between non-Big 4 auditors and Big 4 auditors is 1.28, and this difference is statistically significant at 5 percent. Similar pattern of differences also persists in third size quartile although statistically insignificant. Only in the fourth quartile Big 4 auditors have more footnotes than non-Big 4 auditors, but this difference is not significant.

Panel A

Variable	Mean	SD	Min.	25th	Median	75th	Max.	*n*
Footnotes	17.1	4.26	7	14	17	20	30	1,072
Big 4	0.76	0.43	0	1	1	1	1	1,072
ACC	−0.03	0.1	−0.48	−0.07	−0.01	0.02	0.18	1,075
MTB	1.88	1.39	0.57	1.09	1.45	2.03	8.25	1,076
Leverage	0.39	0.21	0.05	0.23	0.36	0.51	1.14	1,076
SI	−0.02	0.05	−0.31	−0.01	0	0	0.09	1,058
Size	6.43	2.1	1.95	4.92	6.6	7.94	11.67	1,076
Earnings	0.03	0.29	−4.97	0	0.08	0.13	0.58	1,076
Age	23.78	18.29	0	11	19	36	88	1,076
SEO	0.06	0.24	0	0	0	0	1	1,076
MA	0.26	0.44	0	0	0	1	1	1,076
DLW	0.62	0.48	0	0	1	1	1	1,076
Div	0.44	0.5	0	0	0	1	1	1,076

Panel B

Fama-French industry (12 industry classification)

	Frequency	Percent
Consumer NonDurables	48	4.46
Consumer Durables	39	3.62
Manufacturing	167	15.52
Oil & Gas Extraction	88	8.18
Chemicals and Allied Products	41	3.81
Business Equipment – Computers, Software	252	23.42
Wholesale, Retail, and Some Services	120	11.15
Healthcare	129	11.99
Other	192	17.84

Notes: Panel A displays descriptive statistics for the variables used in our regressions. *Footnotes* is the number of footnotes in the 10K filings of the firms in the SEC online Edgar system. *Big 4* is equal to 1 if the auditor is one of the reputed auditors (KPMG, Ernst and Young, Deloitte and Price Waterhouse) and 0 otherwise. Accruals (*ACC*) is equal to (data178−data308)/data6. *MTB* is the market value of the firm divided by its book value ((data25×data199 +data181)/data6). *Leverage* is total liabilities (data 181)/total assets. *SI* is equal to special items scaled by total assets (data 6). We use log of total assets (data 6) as a proxy for size. *Earnings* is calculated as operating earnings (data178) scaled by book value of assets (data 6). We proxy for firm age using the number of years since a firm's first appearance in the CRSP monthly stock return files (AGE). *MA* is equal to 1 for a fiscal year in which a firm appears to be acquirer in the SDC Platinum M&A database and 0 otherwise. *SEO* is equal to 1 for a fiscal year in which a firm has common equity offering in the secondary market as per the SDC Global New Issues database and 0 otherwise. Firms that are incorporated in Delaware (DEL) is set to 1 and 0 otherwise. Dividend (DIV) is equal to 1 if a firm pays dividend in the fiscal year and zero otherwise. All accounting values are winsorized at 1 and 99 percent except earnings. Panel B shows the Fama-French 12 industry classification

Table I. Descriptive statistics – full same

Table III reports the correlation matrix of our primary dependent variable (i.e. number of footnotes) and the control variables. All correlations noted in bold are significantly different from zero. The correlation between the number of footnotes and Big 4 dummy is 0.1219, which means that the firms audited by Big 4 auditors have larger number of footnotes. Although this is counter to our hypothesis, but this relationship is merely reflecting that firms audited by big 4 auditors may have a larger number of footnotes without controlling for size, nature and complexity of the business and other control variables. Bushee *et al.* (2018) mention that the complexity of financial statements may reflect the complex information environment. Without controlling for other factors such as size and industry, this bi-variate relationship may not reflect the true nature of the relationship. A multivariate setting can reveal the actual relationship after controlling for other possible factors. The correlation between current earnings and the number of footnotes is 0.1081. *Leverage*, *Size*, *Age*, *SEO*, *MA*, *DLW* and *Div* are all positively correlated with footnotes. However, the correlations among control variables are small in magnitude. Hence, multicollinearity should not be a concern in our study.

Panel A

Variable	Mean	SD	Min.	25th	Median	75th	Max.	*n*
Big 4 = 0								
Footnotes	16.19	4	7	13	16	19	26	261
ACC	−0.05	0.11	−0.48	−0.09	−0.04	0.02	0.18	261
MTB	1.96	1.61	0.57	0.97	1.39	2.23	8.25	261
Leverage	0.33	0.24	0.05	0.15	0.29	0.44	1.14	261
SI	−0.02	0.05	−0.31	−0.01	0	0	0.09	261
Size	4.41	1.63	1.95	3.15	4.22	5.46	9.39	261
Earnings	−0.05	0.42	−4.97	−0.09	0.03	0.11	0.42	261
Age	21.49	16.06	0	10	19	29	84	261
SEO	0.09	0.29	0	0	0	0	1	261
MA	0.15	0.35	0	0	0	0	1	261
DLW	0.54	0.5	0	0	1	1	1	261
Div	0.21	0.41	0	0	0	0	1	261
Big 4 = 1								
Footnotes	17.4	4.31	7	14	17	20	30	811
ACC	−0.02	0.09	−0.48	−0.05	−0.01	0.02	0.18	811
MTB	1.86	1.32	0.57	1.12	1.46	1.99	8.25	811
Leverage	0.41	0.2	0.05	0.26	0.38	0.53	1.14	811
SI	−0.02	0.05	−0.31	−0.01	0	0	0.09	793
Size	7.09	1.8	1.95	5.84	7.17	8.21	11.67	811
Earnings	0.05	0.22	−3.23	0.04	0.08	0.13	0.58	811
Age	24.57	18.93	0	11	19	38	88	811
SEO	0.05	0.22	0	0	0	0	1	811
MA	0.29	0.46	0	0	0	1	1	811
DLW	0.65	0.48	0	0	1	1	1	811
Div	0.51	0.5	0	0	1	1	1	811

Panel B

	First quartile			Second quartile			Third quartile			Fourth quartile		
	Big 4			Big 4			Big 4			Big 4		
	0	1	Diff	0	1	Diff	0	1	Diff	0	1	Diff
Mean	15.17	14.38	0.79 (*1.70**)	18.34	17.05	1.28 (*2.38***)	17.27	17.19	0.08 (*0.05*)	18	19.02	−1.02 (*−1.39*)

Notes: Panel A displays descriptive statistics for the variables by auditor reputation (Big 4). *Footnotes* is the number of footnotes in the 10K filings of the firms in the SEC online Edgar system. *Big 4* is equal to 1 if the auditor is one of the reputed auditors (KPMG, Ernst and Young, Deloitte and Price Waterhouse) and 0 otherwise. Accruals (*ACC*) is equal to (data178−data308)/data6. *MTB* is the market value of the firm divided by its book value ((data25×data199+data181)/data6). *Leverage* is total liabilities (data 181)/total assets. *SI* is equal to special items scaled by total assets (data 6). We use log of total assets (data 6) as a proxy for size. *Earnings* is calculated as operating earnings (data178) scaled by book value of assets (data 6). We proxy for firm age using the number of years since a firm's first appearance in the CRSP monthly stock return files (AGE). *MA* is equal to 1 for a fiscal year in which a firm appears to be acquirer in the SDC Platinum M&A database and 0 otherwise. *SEO* is equal to 1 for a fiscal year in which a firm has common equity offering in the secondary market as per the SDC Global New Issues database and 0 otherwise. Firms that are incorporated in Delaware (DEL) is set to 1 and 0 otherwise. Dividend (DIV) is equal to 1 if a firm pays dividend in the fiscal year and zero otherwise. All accounting values are winsorized at 1 and 99 percent except earnings. Panel B displays the mean difference in the number of footnotes by auditor code (Big 4). We divide our sample into 4 quartiles by size and then calculate the mean difference in the number of footnotes by auditor code. The *t*-statistics reported in parentheses. *,**Significant at the 10 and 5 percent levels, respectively

Table II.
Difference in key variables of two sub-sample based on auditor quality

4. Results and discussion

4.1 Footnotes and auditor reputation

Table IV presents the results of the hypothesis that the firms audited by reputed auditors (i.e. Big 4 auditors) will have fewer footnotes than firms audited by non-Big 4 auditors. Model 2 includes year dummies and industry dummies (based on a two-digit SIC code), although estimates of these dummies are not reported for brevity. We use ordinary least square (OLS) estimation for our regressions. The reported t-statistics are based on standard errors clustered by firm. We expect to find a negative coefficient between number of footnotes in the 10K filings (footnotes) and the auditor reputation (Big 4). From Table IV,

Table III.
Correlation matrix

Variables	*Footnotes*	*Big 4*	*ACC*	*MTB*	*Leverage*	*SI*	*Size*	*Earnings*	*Age*	*SEO*	*MA*	*DLW*	*Div*
Footnotes	1												
Big 4	*0.1219*	1											
ACC	*0.0594*	*0.1046*	1										
MTB	*−0.2317*	−0.0327	−0.0246	1									
Leverage	*0.2752*	*0.1625*	0.0125	−0.0327	1								
SI	*−0.0606*	−0.0162	*0.0732*	*0.065*	*−0.0665*	1							
Size	*0.335*	*0.5485*	*0.2324*	*−0.158*	*0.3338*	0.0434	1						
Earnings	*0.1081*	*0.161*	*0.4654*	*−0.1294*	−0.0161	*0.0844*	*0.365*	1					
Age	0.0319	*0.0721*	*0.1416*	*−0.1889*	0.0231	0.0445	*0.3463*	*0.13*	1				
SEO	0.0129	*−0.0717*	*−0.128*	*0.1437*	−0.0373	0.0045	*−0.1188*	*−0.2954*	*−0.1723*	1			
MA	*0.1537*	*0.1462*	*0.1301*	−0.041	*0.0709*	0.0309	*0.2674*	*0.1194*	*0.0854*	0.0001	1		
DLW	*0.1608*	*0.1016*	−0.0305	−0.0367	*0.0608*	−0.0177	0.0214	−0.033	*−0.1*	*0.1262*	*0.0571*	1	
Div	*0.098*	*0.2657*	*0.2667*	0.0009	*0.0686*	*0.0804*	*0.4953*	*0.2618*	*0.3747*	*−0.1319*	*0.1746*	*−0.0741*	1

Notes: This table displays correlation coefficients for the variables included in our regressions, with Pearson (Spearman) correlation coefficients below the diagonal. *Footnotes* is the number of footnotes in the 10K filings of the firms in the SEC online Edgar system. *Big 4* is equal to 1 if the auditor is one of the reputed auditors (KPMG, Ernst and Young, Deloitte and Price Waterhouse) and 0 otherwise. Accruals (*ACC*) is equal to (data178−data308)/data6. *MTB* is the market value of the firm divided by its book value ((data25×data199+data181)/data6). *Leverage* is total liabilities (data 181)/total assets. *SI* is equal to special items scaled by total assets (data 6). We use log of total assets (data 6) as a proxy for size. *Earnings* is calculated as operating earnings (data178) scaled by book value of assets (data 6). We proxy for firm age using the number of years since a firm's first appearance in the CRSP monthly stock return files (AGE). *MA* is equal to 1 for a fiscal year in which a firm appears to be acquirer in the SDC Platinum M&A database and 0 otherwise. *SEO* is equal to 1 for a fiscal year in which a firm has common equity offering in the secondary market as per the SDC Global New Issues database and 0 otherwise. Firms that are incorporated in Delaware (DEL) is set to 1 and 0 otherwise. Dividend (DIV) is equal to 1 if a firm pays dividend in the fiscal year and zero otherwise. All accounting values are winsorized at 1 and 99 percent except earnings. Correlation coefficients shown in italics are significant at $p < 0.1$ (two-tailed test)

	Dependent variable = *Footnotes* (1)	Dependent variable = *Footnotes* (2)	Dependent variable = (Log) *Footnotes* (3)
Big 4	−0.998*** (*0.002*)	−0.968*** (*0.003*)	−0.063*** (*0.002*)
MTB	−0.572*** (*0.00*)	−0.697*** (*0.00*)	−0.047*** (*0.00*)
Leverage	3.482*** (*0.00*)	3.230*** (*0.00*)	0.201** (*0.03*)
SI	−4.139* (*0.076*)	−4.296** (*0.049*)	−0.275 (*0.13*)
Size	0.648*** (*0.00*)	0.676*** (*0.00*)	0.043*** (*0.00*)
Age	−0.0224*** (*0.002*)	−0.0129 (*0.107*)	−0.001* (*0.07*)
SEO	0.853* (*0.088*)	1.170** (*0.014*)	0.065** (*0.02*)
MA	0.740*** (*0.008*)	0.573** (*0.034*)	0.042** (*0.012*)
DLW	1.149*** (*0.00*)	0.998*** (*0.00*)	0.054*** (*0.00*)
Div	−0.004 (*0.988*)	−0.242 (*0.42*)	−0.024 (*0.19*)
Intercept	12.931*** (*0.00*)	12.385*** (*0.00*)	2.53*** (*0.00*)
Industry dummies	No	Yes	Yes
Year dummies	No	Yes	Yes
Adj. R^2	0.2149	0.3347	0.3707
n	1,054	1,054	1,054

Notes: This table reports coefficients for model:

$$Footnotes_{i,t} = \alpha_0 + \beta_1 Big4_{i,t} + \beta_2 MTB_{i,t} + \beta_3 Leverage_{i,t} + \beta_4 SI_{i,t} + \beta_5 Size_{i,t} + \beta_6 Age_{i,t} + \beta_7 SEO_{i,t} + \beta_8 MA_{i,t} + \beta_9 DLW_{i,t} + \beta_{10} Div_{i,t} + Year\ Dummies + Industry\ Dummy + \varepsilon_{i,t}.$$

Variables measurements are in Table III. The *p*-values are in parentheses. *,**,***Significant at the 10, 5 and 1 percent levels, respectively

Table IV.
The association between footnotes and auditor reputation

we see that the coefficient of the dummy for Big 4 is −0.998 (−0.968) in column 1 (2). Both of these coefficients are statistically significant at 1 percent level. Economically speaking, this simply means that big 4 audited 10Ks have about 1 footnote less than non-big 4 audited firms, holding everything else constant. Clearly, this confirms our hypothesis that firms audited by Big 4 auditors have fewer footnotes. MTB is negatively related to footnotes. The coefficient here is −0.572 for column (1) and −0.697 for column (2) both are significant at the 1 percent level, while leverage is positively related with the number of footnotes and significant at the 1 percent level. Most of the coefficient signs in the regression are in line with those predicted by Li (2008). In Table IV, column (3), we use the log of our dependent variable, i.e. log of number of footnotes, to normalize the variation. The coefficient on the dummy for Big 4 is negative and significant at the 1 percent level.

4.2 Earnings persistence and footnotes

Prior research has shown that lengthy 10Ks may be a red flag with regards to reporting quality. Similarly, we hypothesize (*H2*) that the number of footnotes may be related to reporting quality. In order to investigate this hypothesis, we follow Li (2008). Li (2008) uses earnings in the next periods as a proxy for future performance. In Table V (panel A), we report the regression results. In this table we use earnings in the two consecutive succeeding periods (i.e. earnings in t+1 and t+2) as our dependent variables. We regress earning from one- and two-years ahead on the current year's earnings, the number of footnotes, auditor reputation (Big 4), and their interaction using firm year with positive earnings[5]. The interaction term is used to capture the change in earning persistence as the number of footnotes changes. In both models we also use all control variables from Table IV, as well as accruals (*ACC*).

Panel A: earnings persistence (for years with positive earnings)

	For profit year	
	Dependent variable = $Earnings_{t+1}$	Dependent variable = $Earnings_{t+2}$
$Earnings_t$	1.614*** (*0.00*)	1.278*** (*0.005*)
$Footnotes \times Big\ 4$	−0.013*** (*0.00*)	−0.013*** (*0.005*)
$Earnings_t \times Footnotes \times Big\ 4$	*0.077*** (*0.00*)	*0.089*** (*0.003*)
$Earnings_t \times Footnotes$	*−0.065*** (*0.002*)	*−0.049** (*0.085*)
$Earnings_t \times Big\ 4$	−1.529*** (*0.00*)	−1.558*** (*0.003*)
$Earnings_t \times SEO$	−0.630** (*0.019*)	−0.224 (*0.516*)
$Earnings_t \times MA$	−0.065 (*0.451*)	−0.216175* (*0.056*)
$Earnings_t \times Dividends$	−0.241** (*0.024*)	0.124 (*0.383*)
$Earnings_t \times DLW$	0.055 (*0.547*)	−0.136 (*0.271*)
$Earnings_t \times ACC$	−0.083 (*0.881*)	1.759** (*0.015*)
$Earnings_t \times MTB$	0.021 (*0.448*)	−0.021 (*0.61*)
$Earnings_t \times Age$	0.005* (*0.09*)	0.009** (*0.03*)
$Earnings_t \times Leverage$	0.579*** (*0.005*)	0.980*** (*0.00*)
$Earnings_t \times SI$	1.122 (*0.28*)	1.021 (*0.426*)
$Earnings_t \times Size$	0.016 (*0.659*)	−0.051 (*0.271*)
Footnotes	0.011*** (*0.00*)	0.009** (*0.033*)
Big 4	0.245*** (*0.00*)	0.218*** (*0.004*)
ACC	0.068 (*0.409*)	−0.107 (*0.303*)
MTB	0.002 (*0.648*)	0.011 (*0.127*)
Leverage	−0.060* (*0.059*)	−0.097** (*0.02*)
SI	−0.042 (*0.727*)	−0.165 (*0.261*)
Size	0.008* (*0.072*)	0.016*** (*0.005*)
Age	−0.001** (*0.035*)	−0.001*** (*0.003*)
SEO	0.049 (*0.107*)	0.023 (*0.582*)
MA	0.005 (*0.666*)	0.0274* (*0.077*)
DLW	−0.012 (*0.31*)	−0.002 (*0.91*)
Div	0.028* (*0.03*)	0.016 (*0.354*)
Intercept	−0.299*** (*0.00*)	−0.210*** (*0.005*)
Industry dummies	Yes	Yes
Year dummies	Yes	Yes
Adj. R^2	0.5543	0.4459
n	655	515

Panel B: earnings persistence (for years with negative earnings)

	For loss year	
	Dependent variable = $Earnings_{t+1}$	Dependent variable = $Earnings_{t+2}$
$Earnings_t$	1.622*** (*0.001*)	3.063** (*0.04*)
$Footnotes \times Big\ 4$	−0.008 (*0.387*)	−0.044* (*0.071*)
$Earnings_t \times Footnotes \times Big\ 4$	−0.087** (*0.024*)	−0.362*** (*0.001*)
$Earnings_t \times Footnotes$	0.001 (*0.971*)	0.064 (*0.425*)
$Earnings_t \times Big\ 4$	1.196** (*0.018*)	5.733*** (*0.00*)
$Earnings_t \times SEO$	−0.227** (*0.225*)	0.180 (*0.724*)
$Earnings_t \times MA$	0.448** (*0.020*)	−1.298** (*0.014*)
$Earnings_t \times Dividends$	−0.480 (*0.486*)	−2.228 (*0.178*)
$Earnings_t \times DLW$	−0.031 (*0.886*)	−1.528** (*0.015*)
$Earnings_t \times ACC$	−0.815** (*0.032*)	0.292 (*0.809*)
$Earnings_t \times MTB$	−0.118*** (*0.00*)	−0.242*** (*0.006*)
$Earnings_t \times Age$	−0.024*** (*0.004*)	−0.010 (*0.672*)
$Earnings_t \times Leverage$	−0.782*** (*0.00*)	−0.954* (*0.099*)
$Earnings_t \times SI$	−5.865*** (*0.00*)	4.018 (*0.346*)
$Earnings_t \times Size$	0.040 (*0.533*)	−0.266 (*0.179*)
Footnotes	0.004 (*0.659*)	0.018 (*0.401*)
Big 4	0.090 (*0.593*)	0.785* (*0.074*)

(*continued*)

Table V. Earnings persistence

ACC	−0.281 (*0.140*)	0.311 (*0.534*)
MTB	−0.012 (*0.454*	−0.047 (*0.272*)
Leverage	0.039 (*0.702*)	−0.003 (*0.99*)
SI	−0.736*** (*0.004*)	0.244 (*0.756*)
Size	0.016 (*0.425*)	0.002 (*0.962*)
Age	−0.001 (*0.461*)	0.000 (*0.921*)
SEO	−0.006 (*0.930*)	0.054 (*0.77*)
MA	0.044 (*0.411*)	−0.074 (*0.578*)
DLW	−0.007 (*0.882*	−0.106 (*0.379*)
Div	−0.057 (*0.511*)	0.033 (*0.873*)
Intercept	−0.126 (*0.508*)	0.298 (*0.533*)
Industry dummies	Yes	Yes
Year dummies	Yes	Yes
Adj. R^2	0.8760	0.5339
n	204	161

Notes: Panels A and B reports coefficients for model:

$$\begin{aligned} Earnings_{i,t+1} = {} & \alpha_0 + \beta_1 Earnings_{i,t} + \beta_2 Footnotes_{i,t} \times Big4_{i,t} + \beta_3 Earnings_{i,t} \times Footnotes_{i,t} \times Big4_{i,t} \\ & + \beta_4 Earnings_{i,t} \times Footnotes_{i,t} + \beta_4 Earnings_{i,t} \times Big4_{i,t} + \beta_6 Earnings_{i,t} \times SEO_{i,t} \\ & + \beta_7 Earnings_{i,t} \times MA_{i,t} + \beta_8 Earnings_{i,t} \times Dividends_{i,t} + \beta_9 Earnings_{i,t} \times DLW_{i,t} \\ & + \beta_{10} Earnings_{i,t} \times ACC_{i,t} + \beta_{11} Earnings_{i,t} \times MTB_{i,t} + \beta_{12} Earnings_{i,t} \times Age_{i,t} \\ & + \beta_{13} Earnings_{i,t} \times Leverage_{i,t} + \beta_{14} Earnings_{i,t} \times SI_{i,t} + \beta_{15} Earnings_{i,t} \times Size_{i,t} \\ & + \beta_{16} Footnotes_{i,t} + \beta_{17} Big4_{i,t} + \beta_{18} ACC_{i,t} + \beta_{19} MTB_{i,t} + \beta_{20} Leverage_{i,t} \\ & + \beta_{21} SI_{i,t} + \beta_{22} Size_{i,t} + \beta_{23} Age_{i,t} + \beta_{24} SEO_{i,t} + \beta_{25} MA_{i,t} + \beta_{26} DLW_{i,t} + \beta_{27} Div_{i,t} \\ & + Year\ Dummies + Industry\ Dummy + \varepsilon_{i,t\ if} Earnings_{i,t<0}. \end{aligned}$$

Variables measurements are in Table III. All models include an industry (based on a 2-digit SIC code) and year dummies, although estimates for these dummies are not reported for brevity. The *p*-values are in parentheses. *,**,***Significant at the 10, 5 and 1 percent levels, respectively

Table V.

In both periods of earnings (i.e. *t*+1 and *t*+2), the interaction term between earnings in the current period ($Earnings_t$) and the number of footnotes is negative. The coefficient on the interaction between $Earnings_t \times Footnotes$ using one-year ahead earnings as dependent variable is −0.013 (significant at the 1 percent level of significance) and the coefficient on the interaction between $Earnings_t \times Footnotes$ using two-year ahead earnings as dependent variable is −0.049 (significant at the 10 percent level of significance). This suggests that as the number of footnotes increases, earnings persistence becomes smaller. This is consistent with the idea that a larger number of footnotes do not increase the reporting quality.

Our results are also economically significant. If we increase the number of footnotes from 25th percentile to 75th percentile (an increase from 14 to 20 footnotes) earnings persistence one-year ahead goes down by 0.078 [−0.013 × (20−14)] and earnings persistence two-year ahead goes down by 0.294 [−0.049 × (20−14)]. In order to investigate the role of auditor reputation, with respect to footnotes and earnings persistence, we create a three-way interaction between footnotes, auditor reputation, and earnings in the current period. In the three-way interaction, we find that if a firm uses a Big 4 auditor and has more footnotes, earning persistence increases. The coefficient for the three-way interaction between $Earnings_t \times Footnotes \times Big\ 4$, using one-year ahead earnings as the dependent variable, is 0.077 (significant at the 1 percent level of significance) and the coefficient for the three-way interaction between $Earnings_t \times Footnotes \times Big\ 4$, using two-year ahead earnings as the dependent variable, is 0.089 (significant at the 1 percent level of significance). So, with the use of reputed auditors, firms can have more footnotes without affecting their earning persistence.

Panel A

	Dependent variable = *Footnotes*
	(1)
Auditor Code	−1.035** (*0.029*)
MTB	−0.627*** (*0.00*)
Leverage	3.769*** (*0.00*)
SI	−3.569 (*0.102*)
Size	0.618*** (*0.00*)
Age	−0.023*** (*0.001*)
SEO	0.760*** (*0.008*)
MA	1.037 (*0.101*)
DLW	1.162*** (*0.00*)
Div	0.135 (*0.589*)
Intercept	13.055*** (*0.00*)
Number of time periods	5
Avg. R^2	0.2149
n	1,054

Panel B

	For profit year	
	Dependent variable = $Earnings_{t+1}$	Dependent variable = $Earnings_{t+2}$
$Earnings_t$	1.456*** (*0.002*)	0.664 (*0.218*)
Footnotes×*Big 4*	−0.010* (*0.061*)	−0.008* (*0.077*)
$Earnings_t$×*Footnotes*×*Big 4*	0.059** (*0.02*)	0.053 (*0.108*)
$Earnings_t$×*Footnotes*	−0.052 (*0.115*)	−0.014 (*0.671*)
$Earnings_t$×*Big 4*	−1.125** (*0.044*)	−0.972** (*0.021*)
Footnotes	0.010* (*0.062*)	0.005 (*0.31*)
Big 4	0.192* (*0.055*)	0.142** (*0.072*)
Controls	Yes	Yes
Number of time periods	5	4
Averaged R^2	0.6999	0.5914
n	655	515

Notes: Panel A reports coefficients for Fama–Macbeth regression estimates using model 1. Panel B reports coefficients for Fama–Macbeth regression estimates using model 2 for years with positive earnings. Variables measurements are in Table III. The *p*-values are in parentheses. *,**,***Significant at the 10, 5 and 1 percent levels, respectively

Table VI. Fama–Macbeth regression

In Table V (panel B), we replicate Table V (panel A) using loss years. For these observations, the number of footnotes has no impact on the persistence of losses for one-year ahead and wo-years ahead.

4.3 Additional analysis

The residuals in our regressions may be correlated across time or across firms (Petersen, 2009). In this case, OLS estimates are not independent and identically distributed (i.i.d) and hence biased. In order to address such bias, we re-run model 1 and 2 using Fama–Macbeth (FM) regressions. In FM regressions, *t*-statistics are constructed using averages of coefficient estimators and are robust to correlation within groups. Skoulakis (2006) states that researchers can use both estimation techniques (i.e. OLS and FM) and use both approaches to validate the results.

We reported our FM regression results in Table VI (panel A). In Table VI (panel A), we find similar results as those obtained from our OLS estimates. We find a negative coefficient on Big 4 auditors (significant at the 5 percent level of significance) when regressed on the number of footnotes. In Table VI (panel B), we use FM estimates for our model 2. Here we also find a positive relation between the number of footnotes and earnings persistence only when firms use Big 4 auditors (significant at the 5 percent level).

5. Conclusion

This is the first paper to our knowledge that uses the number of footnotes in the 10K annual filings as a proxy for reporting quality. Obviously, this is a very simple proxy which does not rely on relatively difficult constructs such as fog index. In particular, we investigate whether auditor reputation is related to the number of footnotes. We then explore whether the number of footnotes affects earning persistence. We find that firms audited by Big 4 auditors have fewer footnotes than firms audited by non-Big 4 auditors. We also find that more footnotes reduce earnings persistence in one-year ahead and two-years ahead. Although, with the use of Big 4 auditors, a larger number of footnotes do not reduce earning persistence. Overall, firms that use non-Big 4 auditors can obfuscate the annual report by using more footnotes and, in turn, reduce earnings persistence.

Notes

1. Available at: www.sec.gov/investor/pubs/begfinstmtguide.htm
2. Available at: www.forbes.com/sites/greatspeculations/2011/09/09/devilish-details-lurk-in-footnotes-to-financialstatements/. In the same article IP's director of corporate accounting, Kevin Ferguson, states that "investors know that 10-K footnotes contain important information. He says not reading them is like 'hiding' the data from themselves."
3. Palmorse (1988) finds that big audit firms are less likely to be sued than other audit firms because of higher quality audits. Khurana and Raman (2004) also show that litigation exposure is the main concern that leads to higher quality audits. Other studies use different proxies of audit quality instead of Big N auditors, such as auditor specialization (Krishnan, 2003; Balsam *et al.*, 2003), auditor tenure (Myers *et al.*, 2003) and audit office size (Francis and Yu, 2009).
4. One of the common ways to measure audit quality is by using earnings quality. In general, there exists a negative relationship between the level of discretionary accruals and big auditors (Francis *et al.*, 1999; Kim *et al.*, 2003).
5. Note that, consistent with Li (2008), we only include firm years with positive earnings.

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Considering production time in allocating costs and estimating profits at a Fortune 500 manufacturing corporation

A case study

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Abstract

Purpose – Prior research has used computer-generated data to illustrate the benefits of the recently developed duration-based costing (DBC) and its affiliate modified duration-based costing (MDBC). The purpose of this paper is to use data from a Fortune 500 corporation to compare its traditional, or functional-based, cost allocation method with that of the recently developed DBC and MDBC models.
Design/methodology/approach – A Fortune 500 company provided one month of production data for a particular, key machine within its manufacturing process. The data were used to apply DBC and MDBC.
Findings – Variations arising from differences in the models' cost allocation reveal the advantages of using time-based cost allocation over the traditional, mostly non-time-based allocation to estimate profit.
Research limitations/implications – By using actual data, this case study enhances prior theoretical research concerning the benefits of utilizing DBC and MDBC over the traditional costing method.
Practical implications – This case study is of benefit to practitioners who use traditional costing since it will encourage them to explore DBC and/or MDBC that tend to be more accurate in situations where the old adage of "time is money" applies. Implementing DBC and MDBC was not difficult to do for the Fortune 500 company as all of the components to run the models were readily available.
Originality/value – This is the first study to utilize actual company data to illustrate DBC and MDBC, and thus, adding to the literature concerning DBC and MDBC.

Keywords Time, Cost allocation, Case study, Activity-based costing, Duration based, Modified

Paper type Case study

1. Introduction

For over a decade, increasingly rigorous international competition, improving manufacturing technologies, and more precise information systems have forced companies to identify and use new business management techniques (Baykasoglu and Kaplanoglu, 2006). To gain and retain a competitive advantage, companies need to produce high-quality goods and services in a short period of time at the lowest possible cost. Accurate cost information is necessary for a company to provide goods and services at the lowest possible cost. In an environment where revenues are constrained, the role of accurate cost estimation has become even more critical, impacting decisions ranging from pricing policies to performance reviews (Gupta and Gallaway, 2003). This case study examines the improvement in cost estimation arising from two legal cost models that are beginning to enter the mainstream of cost accounting: duration-based cost (DBC) and modified duration-based cost (MDBC). These models are developed from the stream of research originating from Lelkes (2009) and continued with Lelkes and Deis (2013) and Lelkes (2014, 2015, 2017). The DBC model has also been cited in a college-level textbook in Chapter 4 of *Cornerstones of Cost Management*, 4th edition (Hansen and Mowen, 2018).

John Deere & Company's coinage of the "activities-based costing" (ABC) was viewed as a means to improve pricing, scheduling and machine configuration (MacArthur, 1992).

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The ABC methodology was developed by Cooper and Kaplan (1988a, b) as a more accurate a way to properly assign indirect costs, which have been an increasing proportion of total costs as a result of industrialization and automation of the production process. ABC is a two-step process, where in the first stage, resource costs are assigned to activities, and in the second stage, activity costs are assigned to products. An example of an activity is setting up equipment. In the first stage, the cost of the resources that setting up equipment consumes is assigned to determine the cost of setting up equipment. Resources that the activity consumes can be labor, supplies to operate the machinery, etc. In the second stage, the cost of setting up equipment is assigned to various product lines based on how much time (i.e. set-up hours) or on how many setups the product lines use (i.e. number of setups).

Accurate measurement of the benefits of ABC among adopting firms has been the focus of many studies. Two decades ago, Innes and Norris (1997) pointed out the need for training in how to use ABC information but found very limited post-implementation auditing of ABC systems. In the UK, Friedman and Lyne (1999) found that ABC adoption success was associated with a clearly recognized need for ABC at the outset, broad-based support for ABC beyond employee accountants and adequate resourcing. Based on work in the USA, Shields (1995) revealed the difficulty in defining ABC success, pointing to vagueness in the literature and a failure to achieve consensus regarding how to measure success, even among ABC consultants. Based upon data collected at four sites using ABC, McGowan and Klammer (1997) found support for three factors originally identified by Shields (1995) as significantly associated with ABC success (i.e. top management support, linkage to performance evaluation and adequacy of training). Foster and Swenson (1997) found that the perception of cost measurement accuracy was a key component guiding perceptions of ABC success.

The importance of accurate cost estimation and cost information came into focus with the advent of modern costing methods that highlighted the shortcomings of the traditional, or functional-based, cost accounting systems. ABC inadequacies have many origins, not the least of which is the traditional cost accounting system's tendency to distort cost information (Qian and Ben-Arieh, 2008). Most cost estimation methods do not entirely consider the time required to produce goods and services. Costs are assumed to be tied to transaction-based drivers and not to time-based drivers. Nonetheless, it has been argued that time-based drivers are more effective than transaction-based drivers for over three decades (i.e. Cooper, 1987).

Many attempts have been made to improve ABC. However, some improvements, such as Resource Consumption Accounting and the German Grenzplankostenrechnung, have revealed that incremental information collection costs can exceed incremental benefits (Balakrishnan *et al.*, 2012). To the extent that the adage "time is money" applies, ABC as well as the traditional costing methods may be providing inaccurate cost estimates. Kaplan and Anderson (2007a, b) argue that duration-based drivers assign cost more accurately, and thus they developed time-driven ABC as a simpler alternative to ABC. Employees do not have to be interviewed to develop the activity dictionary (Kaplan and Anderson, 2007a, b). However, time equations must be developed for all the activities, and identifying all activities and their associated time-based equations can be just as cumbersome as ABC (Lelkes, 2017; Balakrishnan *et al.*, 2012; Kaplan and Anderson, 2007a, b). As a result, DBC and MDBC were developed (Lelkes, 2009, 2015, 2017; Lelkes and Deis, 2013). To date, in these studies, DBC and MDBC are compared to ABC using hypothetical, computer-generated data.

This case study compares DBC and MDBC with a traditional costing method using data supplied by a Fortune 500 company. This company currently assigns costs using the traditional costing system wherein labor hours are the only time-based production measure. However, a more accurate duration driver is the manufacturing cycle time, which is the time

it takes to manufacture the product from start to finish (Lelkes, 2009, 2015, 2017; Lelkes and Deis, 2013). DBC and MDBC are based on time, and thus, should be more accurate given the fact that the more time that is spent in production, the higher the costs.

2. Company background, data and conditions as currently measured using the traditional method

Management from a global, publicly held manufacturing company provided data for one month from one key machine within one of its manufacturing divisions under the traditional costing system[1]. This business unit uses one machine to manufacture the units. Data provided are for 27 different part numbers that are manufactured by this one machine for the month of August 2018. Management provided data that included the date, number of units in each run, material cost, inbound freight, manufacturing labor cost per run, additional internal markup (within the cost of product as a transfer cost), manufacturing fixed overhead, manufacturing variable overhead, direct manufacturing overhead (treated as direct cost to the manufacturing run) and the markup on cost, or profit. The total product cost consists of material cost, inbound freight, manufacturing labor, additional markup supported, manufacturing fixed indirect overhead, manufacturing variable indirect overhead and any other directly traced manufacturing overhead.

From the information provided by the manager, the machine results in approximately 10 percent of the company's revenue as tested over time. This machine is a key profit center; thus, it needs to cover at least 10 percent of the fixed overhead cost. Daily revenue of the machine averages $10,000 and is in operation during two 8 h shifts six days per week. Hence, weekly revenue averages $60,000 and monthly averages $240,000. The machine needs to contribute approximately $1,000 a day to cover fixed overhead costs and contribute approximately $750 a day to cover variable overhead costs. Targeted daily profit requirement is $2,000. For any special orders, the company follows the above parameters in its price quotes.

Setting up the machine for a particular run requires a fixed period of time. The first run of 1,000 units takes 8 h and 20 min (8.333 h). After that, it produces 3,000 units per hour, or 0.333 h for each 1,000 units after the first 1,000 units. For example, a run of 9,000 units takes 11 h to manufacture (8.333 h for first 1,000 + 8 sets of 1,000 $\times$ 0.333 = 11 h). Based on this model, if a customer came with a special order of 1,000 units, then it would take slightly over a day to run, considering 8 h is generally the normal length of a shift. If the company needs to make revenue of approximately $10,000 a day, then that would mean each unit would cost $10.

Time is a valuable resource; and thus, a popular proverb is "time is money." Hence, the DBC and MDBC models discussed in the next sections incorporate time to assign the indirect overhead costs. Using the data and information provided, DBC and MDBC are applied to determine whether the company is actually losing money on some of its manufacturing runs and the extent of these losses when time is taken into consideration. Of course, when costs assigned to production runs using the traditional method are overstated, proper cost assignment with DBC and MDBC results in higher profit estimates.

3. Time-based analysis of current manufacturing conditions

3.1 DBC model definition

DBC uses the manufacturing cycle time to assign resource (indirect overhead) costs to product lines. This manufacturing cycle time is found by observing the duration of a manufacturing run from start to finish: from the time the materials leave inventory to the completion of the run, which in this case study, consists of a batch of parts. As per Lelkes (2009, 2017) and Lelkes and Deis (2013), the DBC model to assign the indirect overhead

cost to part numbers $i = 1, \ldots, k$ is as follows:

$$D_i = c\beta_i\theta_i, i = 1, \ldots, k, \tag{1}$$

where D_i is the indirect overhead assigned to part number i using DBC; c the indirect overhead cost per unit of time; β_i the manufacturing cycle time for part number i; and θ_i the number of manufacturing runs for part number i.

Time in this case study is based on hours, including fractions thereof. The indirect overhead cost per hour, c, is the total indirect overhead cost divided by the total hours across all batches of parts. The manufacturing cycle time is the time it takes to manufacture the batch of parts from start to finish. In simpler terms, the overhead cost assigned to the particular part number is the manufacturing cycle time for that run multiplied by the number of manufacturing runs for that part number, which is then multiplied by the indirect overhead cost per hour.

3.2 Application of DBC

DBC applies the indirect overhead in total and does not distinguish between fixed and variable components. Table I provides a summary of the cost information under the company's traditional costing method as well as the application of DBC[2]. The total direct costs consist of material cost, inbound freight, manufacturing labor cost per run, additional internal markup and direct manufacturing overhead. Fixed indirect overhead (OH) cost and variable indirect OH cost consist of the allocation the company provided using the traditional costing method. Total cost is the total cost of the manufacturing run, which is the sum of the total direct costs, fixed indirect OH cost and variable indirect OH cost. Revenue for the run is calculated by taking the total cost and applying the markup on cost. Profit for each manufacturing run is revenue minus total cost.

As shown in the third to last column of the bottom row of Table I, total revenue is $203,505.29 for August 2018. This averages to $50,876.32 per week (four weeks per month) and $8,479.39 per day (six days per week). Hence, the company fell short of its goal of $10,000 a day. Of the total indirect OH of $40,170.30 as shown at the bottom of Table I, $22,531.47 is fixed indirect OH cost (shown later in Table II). This averages to $5,632.87 per week ($5,632.87/4 weeks) and $938.81 per day ($5,632.87/6 days). This fixed indirect OH cost of $938.81 is less than the $1,000 a day that the machine needs to contribute to cover fixed overhead, which is good since any cost or expense should be lower than budget. Total variable indirect OH cost is $17,638.82, which averages to $4,409.71 per week ($17,638.82/4 weeks) and $734.95 per day ($4,409.71/6 days). This variable indirect OH cost of $734.95 is less than $750 per day, which again is good since any cost should be lower than budget.

As shown in the profit column of Table I, each part is run currently using a costing technique allowing the firm to break even. Stated another way, the traditional costing system shows no loss in the manufacture of any part. However, the company stated that it needs profit to be around $2,000 a day. From Table I, total profit is $34,183.37. This averages to $8,545.84 per week and $1,424.31 per day, meaning that the company did not reach its goal for total profit, most likely due to either experiencing costs that are too high to generate desired profits or not pricing production high enough to generate sufficient revenue.

The manufacturing cycle time for this company is a step function since it takes 8.333 h for the first run of 1,000 units and 0.333 h for each run of 1,000 units afterwards. For instance, to apply DBC, for the very last run for Part27 of 2,800 units, the time of 8.933 h is calculated as 8.333 for first set of 1,000 units plus the hours for unit above 1,000, or $8.333 + (1{,}800/1{,}000) \times 0.333 = 8.933$ (difference due to rounding).

Each run (by part)	No. of units	Hours	Total direct costs	Indirect OH (DBC model)	Indirect OH (traditional model)	Revenue	Profit under DBC model	Profit under traditional model
Part01	23	8.333	$30.73	$795.34	$5.25	$36.74	–$789.33	$0.76
Part02	7	8.333	$7.73	$795.34	$1.32	$9.24	–$793.83	$0.19
Part03	25	8.333	$28.66	$795.34	$4.90	$34.26	–$789.74	$0.70
Part04	700	8.333	$867.75	$795.34	$148.23	$1,037.32	–$625.78	$21.33
Part05	700	8.333	$931.85	$795.34	$159.18	$1,113.94	–$613.25	$22.91
Part05	2,300	8.767	$3,061.81	$836.70	$523.01	$3,660.09	–$238.41	$75.28
Part06	4,000	9.333	$5,533.96	$890.78	$945.99	$6,479.94	$55.21	$0.00
Part07	1,000	8.333	$2,066.86	$795.34	$353.05	$2,470.73	–$391.47	$50.82
Part08	1,100	8.367	$1,554.87	$798.52	$265.60	$1,858.69	–$494.69	$38.23
Part09	4,600	9.533	$9,958.29	$909.87	$1,701.04	$11,904.17	$1,036.01	$244.84
Part10	1,000	8.333	$1,892.83	$795.34	$323.33	$2,262.70	–$425.47	$46.54
Part10	13	8.333	$24.61	$795.34	$4.20	$29.42	–$790.53	$0.60
Part11	2,000	8.667	$4,981.21	$827.15	$851.50	$5,832.71	$24.35	$0.00
Part12	1,000	8.333	$2,552.28	$795.34	$436.29	$2,988.57	–$359.05	$0.00
Part13	600	8.333	$1,082.94	$795.34	$242.33	$1,325.27	–$553.01	$0.00
Part14	780	8.333	$2,254.40	$795.34	$272.51	$3,734.97	$685.23	$1,208.06
Part15	4,500	9.500	$5,819.63	$906.69	$808.59	$9,858.11	$3,131.79	$3,229.89
Part15	5,900	9.967	$7,630.19	$951.22	$1,060.15	$12,925.08	$4,343.67	$4,234.74
Part16	2,000	8.667	$2,070.65	$827.15	$334.15	$2,767.78	–$130.02	$362.98
Part16	1,500	8.500	$1,552.98	$811.24	$250.61	$2,075.83	–$288.40	$272.24
Part16	3,300	9.100	$3,416.57	$868.51	$551.35	$4,566.83	$281.76	$598.92
Part16	4,000	9.333	$4,141.29	$890.78	$668.30	$5,535.56	$503.49	$725.96
Part16	5,000	9.667	$5,176.62	$922.59	$835.38	$6,919.45	$820.24	$907.45
Part16	133	8.333	$137.70	$795.34	$22.22	$184.06	–$748.98	$24.14
Part16	406	8.333	$420.34	$795.34	$67.83	$561.86	–$653.82	$73.68
Part17	500	8.333	$636.68	$795.34	$117.29	$1,266.15	–$165.87	$512.19
Part17	700	8.333	$891.35	$795.34	$164.20	$1,772.61	$85.92	$717.06
Part17	2,250	8.750	$2,865.07	$835.10	$527.79	$5,697.69	$1,997.52	$2,304.84
Part17	2,600	8.867	$3,310.74	$846.24	$609.89	$6,584.00	$2,427.01	$2,663.37
Part17	585	8.333	$744.92	$795.34	$137.22	$1,481.40	–$58.86	$599.26
Part17	6,000	10.000	$7,640.18	$954.41	$1,407.43	$15,193.84	$6,599.26	$6,146.23
Part18	5,100	9.700	$5,160.29	$925.77	$685.16	$9,439.68	$3,353.62	$3,594.23
Part19	2,000	8.667	$1,904.99	$827.15	$313.89	$4,510.17	$1,778.03	$2,291.28
Part20	1,000	8.333	$2,773.06	$795.34	$474.03	$3,247.09	–$321.31	$0.00
Part21	1,000	8.333	$2,193.94	$795.34	$374.76	$2,622.64	–$366.64	$53.94
Part22	7,030	10.343	$15,636.04	$987.17	$2,670.89	$18,691.37	$2,068.15	$384.44
Part23	2,600	8.867	$3,903.21	$846.24	$666.73	$4,665.90	–$83.54	$95.97
Part24	2,600	8.867	$5,366.29	$846.24	$916.99	$6,349.27	$136.74	$65.99
Part25	2,000	8.667	$757.69	$827.15	$1,711.92	$4,762.09	$3,177.24	$2,292.48
Part26	3,000	9.000	$1,041.71	$858.97	$2,560.92	$3,602.62	$1,701.95	$0.00
Part26	3,000	9.000	$1,041.71	$858.97	$2,560.92	$3,602.62	$1,701.95	$0.00
Part26	1,600	8.533	$555.58	$814.43	$1,365.82	$1,921.40	$551.40	$0.00
Part26	1,400	8.467	$486.13	$808.06	$1,195.09	$1,681.22	$387.03	$0.00
Part26	3,000	9.000	$1,041.71	$858.97	$2,560.92	$3,602.62	$1,701.95	$0.00
Part27	2,500	8.833	$1,283.21	$843.06	$2,664.15	$4,050.51	$1,924.24	$103.16
Part27	2,000	8.667	$1,026.57	$827.15	$2,131.32	$3,240.41	$1,386.69	$82.53
Part27	500	8.333	$256.64	$795.34	$532.83	$810.10	–$241.88	$20.63
Part27	2,800	8.933	$1,437.19	$852.60	$2,983.84	$4,536.57	$2,246.78	$115.54
Total	102,352	420.893	$129,151.63	$40,170.30	$40,170.30	$203,505.29	$34,183.37	$34,183.37

Notes: [a]In DBC, c = Total indirect OH cost/total hours = $40,170.30/420.893 = $95.44 per hour (any difference due to rounding). The hours are calculated for a particular run as 8.333 h for the first 1,000 units in the run and 0.333 h for each next 1,000 units in the run

Table I. Application and comparison using DBC model[a]

Table II.
Application and comparison using MDBC model[b]

Each run (by part)	No. of units	Hours	Total direct costs	MDBC Indirect variable OH cost	MDBC indirect fixed OH cost	Traditional model indirect variable OH cost	Traditional model indirect fixed OH cost	Revenue	Profit under MDBC model	Profit under traditional model
Part01	23	8.333	$30.73	$349.23	$469.41	$2.35	$2.90	$36.74	−$812.63	$0.76
Part02	7	8.333	$7.73	$349.23	$469.41	$0.59	$0.73	$9.24	−$817.13	$0.19
Part03	25	8.333	$28.66	$349.23	$469.41	$2.19	$2.70	$34.26	−$813.04	$0.70
Part04	700	8.333	$867.75	$349.23	$469.41	$66.36	$81.86	$1,037.32	−$649.08	$21.33
Part05	700	8.333	$931.85	$349.23	$469.41	$71.26	$87.91	$1,113.94	−$636.55	$22.91
Part05	2,300	8.767	$3,061.81	$367.39	$469.41	$234.15	$288.85	$3,660.09	−$238.51	$75.28
Part06	4,000	9.333	$5,533.96	$391.14	$469.41	$423.52	$522.46	$6,479.94	$85.44	$0.00
Part07	1,000	8.333	$2,066.86	$349.23	$469.41	$158.06	$194.99	$2,470.73	−$414.77	$50.82
Part08	1,100	8.367	$1,554.87	$350.63	$469.41	$118.91	$146.69	$1,858.69	−$516.21	$38.23
Part09	4,600	9.533	$9,958.29	$399.52	$469.41	$761.57	$939.47	$11,904.17	$1,076.95	$244.84
Part10	1,000	8.333	$1,892.83	$349.23	$469.41	$144.76	$178.57	$2,262.70	−$448.78	$46.54
Part10	13	8.333	$24.61	$349.23	$469.41	$1.88	$2.32	$29.42	−$813.83	$0.60
Part11	2,000	8.667	$4,981.21	$363.20	$469.41	$381.22	$470.28	$5,832.71	$18.89	$0.00
Part12	1,000	8.333	$2,552.28	$349.23	$469.41	$195.33	$240.96	$2,988.57	−$382.35	$0.00
Part13	600	8.333	$1,082.94	$349.23	$469.41	$105.14	$137.19	$1,325.27	−$576.31	$0.00
Part14	780	8.333	$2,254.40	$349.23	$469.41	$118.23	$154.28	$3,734.97	$661.93	$1,208.06
Part15	4,500	9.500	$5,819.63	$398.13	$469.41	$357.99	$450.60	$9,858.11	$3,170.95	$3,229.89
Part15	5,900	9.967	$7,630.19	$417.68	$469.41	$469.37	$590.78	$12,925.08	$4,407.81	$4,234.74
Part16	2,000	8.667	$2,070.65	$363.20	$469.41	$149.60	$184.55	$2,767.78	−$135.48	$362.98
Part16	1,500	8.500	$1,552.98	$356.22	$469.41	$112.20	$138.41	$2,075.83	−$302.78	$272.24
Part16	3,300	9.100	$3,416.57	$381.36	$469.41	$246.84	$304.51	$4,566.83	$299.50	$598.92
Part16	4,000	9.333	$4,141.29	$391.14	$469.41	$299.20	$369.10	$5,535.56	$533.72	$725.96
Part16	5,000	9.667	$5,176.62	$405.11	$469.41	$374.01	$461.38	$6,919.45	$868.31	$907.45
Part16	133	8.333	$137.70	$349.23	$469.41	$9.95	$12.27	$184.06	−$772.28	$24.14
Part16	406	8.333	$420.34	$349.23	$469.41	$30.37	$37.46	$561.86	−$677.12	$73.68
Part17	500	8.333	$636.68	$349.23	$469.41	$54.16	$63.13	$1,266.15	−$189.17	$512.19
Part17	700	8.333	$891.35	$349.23	$469.41	$75.82	$88.38	$1,772.61	$62.62	$717.06
Part17	2,250	8.750	$2,865.07	$366.70	$469.41	$243.71	$284.08	$5,697.69	$1,996.52	$2,304.84
Part17	2,600	8.867	$3,310.74	$371.58	$469.41	$281.62	$328.27	$6,584.00	$2,432.26	$2,663.37
Part17	585	8.333	$744.92	$349.23	$469.41	$63.36	$73.86	$1,481.40	−$82.16	$599.26

(*continued*)

Each run (by part)	No. of units	Hours	Total direct costs	MDBC Indirect variable OH cost	MDBC indirect fixed OH cost	Traditional model indirect variable OH cost	Traditional model indirect fixed OH cost	Revenue	Profit under MDBC model	Profit under traditional model
Part17	6,000	10.000	$7,640.18	$419.08	$469.41	$649.88	$757.55	$15,193.84	$6,665.18	$6,146.23
Part18	5,100	9.700	$5,160.29	$406.51	$469.41	$306.75	$378.41	$9,439.68	$3,403.48	$3,594.23
Part19	2,000	8.667	$1,904.99	$363.20	$469.41	$140.53	$173.36	$4,510.17	$1,772.57	$2,291.28
Part20	1,000	8.333	$2,773.06	$349.23	$469.41	$212.23	$261.81	$3,247.09	−$344.61	$0.00
Part21	1,000	8.333	$2,193.94	$349.23	$469.41	$167.78	$206.98	$2,622.64	−$389.94	$53.94
Part22	7,030	10.343	$15,636.04	$433.47	$469.41	$1,195.77	$1,475.11	$18,691.37	$2,152.45	$384.44
Part23	2,600	8.867	$3,903.21	$371.58	$469.41	$298.50	$368.23	$4,665.90	−$78.29	$95.97
Part24	2,600	8.867	$5,366.29	$371.58	$469.41	$410.54	$506.45	$6,349.27	$141.99	$65.99
Part25	2,000	8.667	$757.69	$363.20	$469.41	$736.39	$975.53	$4,762.09	$3,171.79	$2,292.48
Part26	3,000	9.000	$1,041.71	$377.17	$469.41	$1,101.96	$1,458.96	$3,602.62	$1,714.34	$0.00
Part26	3,000	9.000	$1,041.71	$377.17	$469.41	$1,101.96	$1,458.96	$3,602.62	$1,714.34	$0.00
Part26	1,600	8.533	$555.58	$357.62	$469.41	$587.71	$778.11	$1,921.40	$538.80	$0.00
Part26	1,400	8.467	$486.13	$354.82	$469.41	$514.25	$680.85	$1,681.22	$370.87	$0.00
Part26	3,000	9.000	$1,041.71	$377.17	$469.41	$1,101.96	$1,458.96	$3,602.62	$1,714.34	$0.00
Part27	2,500	8.833	$1,283.21	$370.19	$469.41	$1,140.67	$1,523.48	$4,050.51	$1,927.71	$103.16
Part27	2,000	8.667	$1,026.57	$363.20	$469.41	$912.53	$1,218.78	$3,240.41	$1,381.23	$82.53
Part27	500	8.333	$256.64	$349.23	$469.41	$228.13	$304.70	$810.10	−$265.18	$20.63
Part27	2,800	8.933	$1,437.19	$374.38	$469.41	$1,277.55	$1,706.29	$4,536.57	$2,255.59	$115.54
Total	102,352	420.893	$129,151.63	$17,638.82	$22,531.47	$17,638.82	$22,531.47	$203,505.29	$34,183.37	$34,183.37

Notes: [b]In MDBC, c^{v} = Total indirect variable OH cost/total hours = $17,638.82/420.893 = $41.91 per hour (any difference due to rounding), and c^{F} = Total indirect fixed OH cost/No. of manufacturing runs = $22,531.47/48 = $469.41 per run

Table II.

The cost per unit of time in hours, c, is the total indirect OH cost for August of \$40,170.30 divided by the total hours for August of 420.893 h, which provides \$95.44 per hour (\$40,170.30/420.893 h = \$95.44 per hour). This cost per hour is multiplied by the number of hours for each run to determine the indirect OH cost assignment using the DBC Model. In other words, for the last run in Table I, Part27, the indirect OH cost assignment, DBC Model, is \$852.60, which is the number of hours for that run of 8.933 multiplied by \$95.44 per hour. The profit under the DBC model is shown in the right column of Table I.

In Table I, the total indirect OH cost for August under both models sums to \$40,170.30. The total profit for August under both models sums to \$34,183.37. The differences lie in how each cost is assigned to each run. For instance, for the last run for Part01, the profit under the traditional model is \$0.76 but DBC shows a loss of \$789.33. From looking at each individual run and comparing DBC profit with the traditional model profit, there is greater profit on some runs and losses on others. Specifically, smaller runs now have to carry a greater time-based proportion of overhead cost. Hence, their costs rise and profitability falls. By contrast, longer runs spread out the set-up time overhead cost and become more profitable.

DBC does not separate overhead cost into its fixed and variable components. Variable and fixed costs behave differently, with variable costs varying with production and fixed costs remaining stationary. The next two sections describe and apply MDBC in which the variable and fixed indirect overhead costs are assigned separately.

3.3 MDBC model definition

Based on Lelkes (2015), in MDBC, the indirect fixed and variable overhead costs are assigned separately to the parts being manufactured. Variable costs are assigned using the manufacturing cycle time for each manufacturing run for each part number whereas the fixed costs are assigned based on the number of manufacturing runs for each part number. Consequently, as indirect fixed overhead costs rise as a proportion of overhead costs, DBC and MDBC cost estimates will diverge. However, for the company in this case study, each row in the tables is one manufacturing run since the manufacturing cycle time is a step function. Thus, the MDBC cost assignment model from Lelkes (2015) is as follows:

$$D_i^M = c^V \beta_i \theta_i + c^F \theta_i \text{ for } i = 1, \ldots, k. \tag{2}$$

where D_i^M is the cost of part number i under MDBC; c^V the indirect variable overhead cost per unit of time; β_i the manufacturing cycle time for part number i; θ_i the number of manufacturing runs for part number i; c^F the fixed overhead cost per manufacturing run.

The variable overhead cost per unit of time, c^V, is found by taking the total indirect variable overhead cost and dividing by the total time. In this study, time is in hours. The fixed overhead cost per manufacturing run, c^F, is found by taking the total indirect fixed overhead cost and dividing it by the total manufacturing runs, θ_i.

In other words, the total variable indirect overhead cost assigned to part number i is the manufacturing cycle time multiplied by the number of manufacturing runs, which is then multiplied by the variable overhead cost per unit of time. The total fixed indirect overhead cost assigned to part number i is the fixed indirect overhead cost per manufacturing run multiplied by the number of manufacturing runs.

3.4 Application of MDBC

Under MDBC, indirect variable overhead costs are applied based on time and the fixed overhead is applied based on the number of manufacturing runs. For each manufacturing run, Table II provides the summary comparing MDBC indirect overhead cost assignments and profit with the current, traditional model indirect overhead cost assignments and profit.

The MDBC variable cost per hour, c^V, is the total indirect variable OH cost for August of \$17,638.82 divided by the total hours for August of 420.893 h, which provides \$41.91 variable cost per hour. The MDBC fixed cost per manufacturing run, c^F, is the total indirect fixed OH cost for August of \$22,531.47 divided by the number of manufacturing runs of 48 (note that this value is the number of rows since each row represents one manufacturing run), which provides a cost estimate of \$469.41 per run. Since each row in Table II represents one run, the fixed indirect overhead assigned is the same for each row.

Similar to Table I, in Table II, the total variable indirect OH cost for August under both models sums to \$17,638.82, the total fixed indirect OH cost for August sums to \$22,531.47 and the total profit for August under both models sums to \$34,183.37. The differences lie in how the indirect variable and fixed overhead costs are assigned to each run. For instance, for the first run for Part01, the profit under the traditional model is \$0.76 but MDBC shows a loss of \$812.63, which is higher than the loss of \$789.33 under DBC in Table I. By comparing Tables I and II, the runs with losses are greater in Table II than in Table I, but the runs with profits are greater in Table II than in Table I.

The magnitude of differences that exist between DBC and MDBC depends on the magnitude of fixed costs as opposed to variable costs. Lelkes (2015) theoretically compared MDBC with DBC at varying levels of fixed costs. If a company produces multiple products that exhibit economies of scope, then fixed costs should be less because of more efficient capacity utilization (Charles and Hansen, 2008; Panzar and Willig, 1981). At this manufacturing company, runs are assessed a fixed cost of \$469.41 regardless of units produced, which leverages up the losses for small runs.

4. Comparison of DBC, MDBC and the company's traditional cost allocation effect on profit

4.1 The company's traditional costing allocation effect on profit vs DBC

The first column of Table III presents a comparison of profit estimates across production runs using DBC and the company's current, traditional costing method. Analysis across production runs is presented in Panel A, while profit is presented in terms of production runs adjusted for the actual number of units produced is exhibited in Panel B. As shown in

	Traditional vs DBC	Traditional vs MDBC	MDBC vs DBC
Panel A: differences in profit values across runs			
Range	−\$2,131.24 to \$794.02	−\$2,140.06 to \$817.32	−\$23.30 to \$84.30
SD	\$825.21	\$839.24	\$28.40
Frequency of positive values	32	32	18
Frequency of negative values	16	16	30
Mean difference	\$640.53	\$652.82	\$22.32
Median difference	\$527.87	\$542.46	\$23.30
Smallest difference	\$24.35	\$18.89	\$0.10
Largest difference	\$2,131.24	\$2,140.06	\$84.30
Panel B: differences in profit values per unit			
Range	−\$0.76 to \$113.43	−\$0.76 to \$116.76	−\$3.33 to \$0.01
SD	\$19.27	\$19.84	\$0.57
Frequency of positive values	32	32	18
Frequency of negative values	16	16	30
Mean difference	\$5.51	\$5.68	\$0.16
Median difference	\$0.43	\$0.44	\$0.01
Smallest difference	\$0.01	\$0.01	\$0.00
Largest difference	\$113.43	\$116.76	\$3.33

Table III. Comparison of cost model estimates of profit for all 48 production runs

the first row of Table III in Panel A, estimated profit differences range from −$2,131.24 to $794.02 (traditional profit minus DBC profit for each run). A negative value means that the traditional profit estimate is lower than the DBC estimate (meaning DBC is showing that the profit should be higher). For the lowest extreme instance, the traditional allocation of overhead costs was $2,131.24 higher than the DBC allocation, which caused the traditional profit estimate to be $2,131.24 lower than the DBC estimate. Thus, the traditional profit estimate is understated by $2,131.24. Additionally, in the instance with the lowest number of units produced (i.e. Part02), the traditional allocation of overhead cost is $794.02 lower than the DBC allocation, causing the traditional profit estimate to be $794.02 higher than the DBC estimate. This value indicates that the traditional profit is overstated by $794.02. Typically, smaller production runs will end up with relatively higher overhead costs under DBC, and thus, lower profit.

The standard deviation of the difference between the two cost measures is $825.21. There were 16 production runs in which the traditional model provided a lower profit level than DBC and 32 production runs for which the traditional model provided a higher profit estimate than DBC. The mean difference was $640.53, with a lower median difference of $527.87. It is logical that a large difference exists between the mean and median values, given the fact that the differences are not evenly spread across the origin. One difference is under $25, while at the other extreme one difference exceeds $2,000.

This case study shows that the traditional model is not accounting for the fact that time affects the costs of production. The smaller production runs should cost more than the larger production runs given that it takes 8.333 h to produce the first 1,000 units regardless of the number of units in the run, meaning it takes the same 8.333 h to produce 7 units as it does to produce 1,000 units.

4.2 The company's traditional costing allocation effect on profit vs MDBC

The second column of Table III's Panel A exhibits a comparison of production run profit estimates using the MDBC and the current, traditional cost method being used by the company. The profit estimate range is slightly wider, running from −$2,140.06 to $817.13, with a slightly higher standard deviation of $839.24. As in the comparison with DBC, there are 16 instances where the traditional model provides higher cost allocations than MDBC, resulting in lower profit estimates than MDBC. The average difference error is $652.82, meaning that for the typical run costs are misspecified by over $650. The median is lower, implying that presence of outliers, which as can be seen in the bottom row of Table III's Panel A, can be as far off as $2,140.06 in one instance.

4.3 MDBC vs DBC

The third column of Table III reveals the differences of DBC and MDBC profit estimates. There is much less variation between the DBC and MDBC cost allocation. As shown the last column of the first row of Panel A, in one instance the profit arising from using MDBC cost allocation was $84.30 higher. At the other extreme, in one instance DBC resulted in as much as $23.31 in additional profit. The standard deviation is much lower, while the number of positive and negative differences is similar but not identical to the positive and negative frequencies when DBC and MDBC are compared to the traditional cost allocation. The mean difference is only $22.32, with a similar median. Underlying the similarity of these allocation models, the profit estimate difference is as low as $0.10 in one instance.

4.4 Per unit profit estimate differences

4.4.1 Traditional vs DBC. The units produced within each run ranged from 7 to 7,030, which has the potential to confound the findings presented in Panel A of Table III.

Consequently, profit estimates on a per unit basis for each production run were computed and analyzed using the same statistics for considering machine profitability as presented in Panel A of Table III. For instance, indirect costs for the 7-unit, Part02 production run resulted in a difference of $794.02, or $113.43 on a per unit basis. At the other end of the production size spectrum, the 2,800-unit production run of Part27, results in a $2,131.24 gross loss, but only $0.76 on a per unit basis. On a per unit basis, the errors range from –$0.76 to $113.43, with the median error being $0.43. The variation in profit estimate differences across runs adjusted for units produced was $19.27, with the average error in the estimate of profit being a meaningful $5.51. The $5.51 value should be viewed with caution, however, because the average is greatly impacted by the outliers.

4.4.2 Traditional vs MDBC. As with profit values across runs shown in Panel A, MDBC suggests the traditional cost allocation error is even larger. The mean difference rises from $5.51 to $5.68 per unit, while the extreme rises to $116.76. The median difference is registered by Part21 with a production of 1,000 units and Part25 with a production of 2,000 units. On average, use of the traditional cost system results in an error in estimated profits of $660 (i.e. ((1000 + 2000)/2) × $0.44).

4.4.3 MDBC vs DBC. The difference between MDBC and DBC estimates of profit range from –$ 3.33 to $0.01, as shown in the right column of Table III's Panel B. The number of times MDBC exceeds DBC (i.e. 18 times) matches the frequency of difference found in Panel A. While some run-size adjusted differences between DBC and MDBC are under a penny, the 7-unit production run of Part02 has a per unit difference of $3.33. This outlier led to the analysis of production runs at the extreme size levels.

5. Comparison of short and long production runs

5.1 Aggregate run cost and profitability

Analysis of profit at the extreme levels of units per run allows better understanding of the three cost measures. As with Table III, Table IV has two panels with Panel A statistics based on aggregate profit per run and Panel B values stated in terms of profit and cost per unit produced. As shown in the first column of Table IV, the number of units per run ranged from 7 to 7,030, with a median of 2,000, across the 48 separate runs during the sample period. Both the 24th largest and 25th largest runs were of 2,000 units, and are consequently both included in Table IV to serve as benchmarks for the extreme production size runs. The part number column is provided so one can find these runs in the first two tables exhibited above. Most of the runs required only slightly over the 8.333 minimum number of hours, with the largest run requiring only 10.343 h.

Units in run	Part number	Hours	Total direct cost	Total indirect costs			Profit		
				Traditional	DBC	MDBC	Traditional	DBC	MDBC
Panel A: aggregate cost and profit values									
7	Part02	8.333	$7.73	$1.32	$795.34	$818.64	$0.19	–$793.83	–$817.13
2,000	Part11	8.667	$4,981.21	$851.50	$827.15	$832.61	$0.00	$24.35	$18.89
2,000	Part16	8.667	$2,070.65	$334.15	$827.15	$832.61	$362.98	–$130.02	–$135.48
7,030	Part22	10.343	$15,636.04	$2,670.89	$987.17	$902.87	$384.44	$2,068.15	$2,152.45
Panel B: per unit cost and profit values									
7	Part02	8.333	$1.10	$0.19	$113.62	$116.95	$0.03	–$113.40	–$116.73
2,000	Part11	8.667	$2.49	$0.43	$0.41	$0.42	$0.00	$0.01	$0.01
2,000	Part16	8.667	$1.04	$0.17	$0.41	$0.42	$0.18	–$0.07	–$0.07
7,030	Part22	10.343	$2.22	$0.38	$0.14	$0.13	$0.05	$0.29	$0.31

Table IV. Comparison of traditional, DBC and MDBC models for production run outliers

The value of including both 2,000-unit runs at the median provides additional insight regarding the impact of varying direct cost, which is $2.49 for Part11 and $1.04 for Part16. This difference highlights the sensitivity of the traditional model's total indirect cost application to total direct costs, which are $851.50 for Part11 and $334.15 for Part16. Specifically, traditional model total indirect costs are $0.43 per dollar of total direct costs for Part11 and $0.17 per dollar of total direct cost for Part16. Under DBC and MDBC, the total indirect costs are an equal amount for each part number since the production time is identical. The shortest production time is only slightly less costly, being $31.81 (i.e. $827.15−$795.34) lower using DBC and $13.97 (i.e. $832.61−$818.64) using MDBC. Likewise, the longest production run is only slightly costlier, rising $160.02 (i.e. $987.17−$827.15) under DBC and $70.27 (i.e. $902.87−$832.61) under MDBC. Across all production runs, there would be more divergence between DBC and MDBC costs estimates if indirect fixed overhead costs were a larger proportion of total overhead costs.

Because of the similarity of indirect costs across production runs that can be as high as 1,000 times the shortest production runs, there is a very noticeable change in the profit measurement. The short run has a loss of $793.83 under DBC and a greater loss $817.13 under MDBC, which essentially penalizes short production runs. At the other extreme, the longest production run has a profit that is $1,683.71 and $1,768.01 higher using DBC and MDBC, respectively, providing evidence in favor of spreading out set-up time across large volume runs.

Perhaps the most interesting finding in Table IV is the counter-intuitive result for the two 2,000-level production runs, where the production run with the highest direct cost is the profitable one using DBC and MDBC. This result occurs because revenues are a function of a fixed markup, which generates more revenue for the Part11 than Part16. As a consequence, though they have the same production time, and hence the same indirect costs with DBC and MDBC, Part11 with the higher direct cost earns $154.37 more whether contrasting this run with Part16 using DBC (i.e. $24.35 − (−$130.02)) or MDBC (i.e. $18.89 − (−$135.48)). Given that more information is included in MDBC cost allocation and the resulting profit estimation, the $18.89 and −$135.48 values are better estimates of profit arising from running Part11 vs Part16 over the next 8.667 h.

5.2 Per unit cost and profitability

Due to the thousand-fold difference in units produced, Panel B of Table IV presents costs and profits on a per unit basis. Consequently, reported total direct costs drop dramatically to $2.22, which is under the total direct cost found on the Part22 row. Part11 also has the highest total indirect cost under the traditional cost method, which is over twice that found for Part16. The similarity of DBC and MDBC when production levels are similar is witnessed by the $0.41 and $0.42 for the Part11 and Part16 2,000-unit runs. In contrast, the indirect cost per unit for Part02 is over $100 higher. When it comes to profitability, the ability to avoid losses using the traditional model is represented by the positive values in the traditional column. Spreading the $135.48 aggregate loss arising from using the more accurate MDBC method out across the 2,000 units, results in a per unit loss of $0.07 for Part16. In other words, the $0.31 improvement in profit estimates arising from using MDBC when estimating the profitability of Part22's 7,030 unit-size production sums to a gain of $2,152.45.

6. Analysis of relative profit levels in percentage format

Another way to examine the difference between the cost allocation systems is in percentage terms. Given the greater volatility in the DBC and MDBC estimates of profitability, and especially the relatively low (though consistently profitable) level of profitability for several runs on the basis of the current, traditional cost method, the absolute value of the profit

estimate using the DBC or MDBC methods was used in the denominator. Specifically, to measure the relative difference in profit (P) between DBC and the Traditional method, the following equation is used:

$$\text{Relative profit difference between DBC and Traditional} = (P_{\text{Traditional}} - P_{\text{DBC}})/|P_{\text{DBC}}|.$$

Absolute values are used for denominators because across the sample of runs or units the differences will cancel out. Relative profit is estimated with the time-based measure in the denominator, because in several instances the profit using the current, traditional cost method is 0. Dividing the profit difference by 0, results in an infinite value.

Likewise, the relative difference in profit using MDBC is computed using the following equation:

$$\text{Relative profit difference MDBC vs Traditional} = (P_{\text{Traditional}} - P_{\text{MDBC}})/|P_{\text{MDBC}}|.$$

Finally, the relative difference between the two duration-based measures is estimated using the following equation:

$$\text{Relative profit difference DBC and MDBC} = (P_{\text{MDBC}} - P_{\text{DBC}})/|P_{\text{DBC}}|.$$

Differences in profitability are the same whether one is dealing with all runs in aggregate (i.e. Panel A in both Tables III and IV) or profit values per unit produced (i.e. Panel B in both Tables III and IV). Hence, only the analysis across all 48 production runs is presented in Table V. As shown in the first column of the first row in Table V, the difference between the DBC and the traditional cost methods ranges from 100 percent to over 1,000 percent of the DBC estimate. A difference of 100 percent occurs when the profit estimate using the traditional cost method is \$0.00. The standard deviation is over 215 percent of the DBC difference, and larger than the 133 percent mean. Interestingly, the median is right at 100 percent, which one would expect because the difference over time would be 100 percent reflected in the numerator. At the low end, the difference is only 2.5 percent of the DBC estimate, while it can reach as high as 1,118.18 percent of the DBC estimate, which occurs for 585-unit run of Part17. In this case, the traditional profit estimate is \$599.26, while the DBC estimate is a loss of \$58.86 (i.e. $1{,}118.18\% = 100 \times (\$599.26 - (-\$58.86))/|\$58.86|$).

MDBC has a slightly lower relative difference, with an average difference as a percentage of the MDBC profit level of 132.3 percent. In fact, all of the values in the second column of Table V are slightly lower than those found in the first column. At the extreme for the 700-unit run of Part17, the traditional model estimates a profit of \$717.06 while the MDBC method estimates the profit to be \$62.62 (i.e. $1{,}045.07\% = 100 \times (\$717.06 - \$62.62)/|\$62.62|$).

As a percentage of the DBC profit estimate, the difference between the DBC and MDBC estimates is 6.21 percent as shown in the right column of Table V. With the 545-unit Part17 run, the DBC profit estimate is about 40 percent more than the MBDC estimate, with the difference being adjusted for the size the DBC estimate. This run is the one for which the DBC method reported its largest loss, suggesting that had it not been for a larger

	Traditional vs DBC (%)	Traditional vs MDBC (%)	MDBC vs DBC (%)
Percentage differences in profit values across runs			
Range	−100.00 to 1,118.18	−100.00 to 1,045.07	−39.59 to 54.76
SD	215.86	213.89	11.75
Mean difference	133.26	132.30	6.21
Median difference	100.00	100.00	3.76
Smallest difference	2.51	1.86	0.04
Largest difference	1,118.18	1,045.07	54.76

Table V.
Relative cost model estimates of profit

denominator, the MDBC would have estimated an even worse relative performance during this run. With the 4,000-unit Part16 run, the DBC profit estimate is about 55 percent more than the MBDC estimate, with the difference being adjusted for the size the DBC estimate.

7. Implications for the company

Which duration-based model is better depends on the company's needs and ability to separate fixed and variable costs. However, as mentioned in prior research, DBC, like ABC, treats fixed costs as though they are variable (Lelkes, 2014; Balakrishnan and Sivaramakrishnan, 2002; Noreen, 1991; Cooper and Kaplan, 1988a; Cooper, 1987). In other words, DBC assumes that fixed costs are driven by the manufacturing cycle time, which is not necessarily the case. Thus, from that standpoint, MDBC may be the better model since it assigns fixed costs in a different manner based on the number of manufacturing runs. In this case, MDBC provides the most accurate cost assignment and therefore the best profit estimate of the individual production runs.

It seems from a numerical standpoint that the company needs either to increase efficiency and manufacture more parts in each run or adjust the selling price or both. When the results of the analysis were given to the manager, he overall agreed with the calculations. However, he said that because of market reality, they cannot increase the selling prices to ensure no loss on some of the manufacturing runs. With a locked selling price, the best way to create profits is to manufacture a larger quantity of parts in each run. They are continually trying to leverage volume orders and in some cases are able to do this; however, on other manufacturing runs, in order to keep a good customer, they have to do some manufacturing runs at a loss. He said that, across long periods of time and across their five largest machines, one of which is the focus of this case study, they average over 20 percent profit.

This case study provides insight to financial management at a large Fortune 500 firm. Better cost estimation improves profit estimation on both per run and per unit basis. While management acknowledges that it is experiencing losses on some runs, the company has decided to incur some losses in order to continue serving its customers. Thus, cost analysis does not entail just calculations. It entails looking at the overall picture on what the company is able to do and what the consequences are of particular actions. One consequence could be losing more money if the company were not to accept unprofitable orders from certain customers. This case study would be good for students to show that more accurate costing methods are good to have in decision making, but that there are more factors to consider other than cost in the decision-making process.

This case study can be extended in many ways. One could look at the relative advantages of DBC and MDBC over multiple periods, to ascertain the consistency of the findings presented here. Other case studies may consider DBC and MDBC at alternative firms, industries, and even nations to evaluate the robustness of these findings. Examining results in a situation where fixed costs are a higher proportion of overhead costs would also provide evidence regarding the utility of MDBC vs DBC, and both relative to ABC. While including set-up and production time factors in the consideration of production costs and profits makes sense, the improvement in cost allocation and profit estimation will continue to be an important arena of investigation.

Notes

1. Company name and product names are withheld due to confidentiality.
2. Due to the amount of data and for ease of reading, much of the data are summarized. The data in each table are listed by manufacturing run so that the reader can compare each run across each table. The runs could not be summarized by part numbers because some runs are less than 1,000 each for a particular part, and thus, would make it difficult for the reader to verify the total time for the particular part. Actual part production did not follow the chronological ordering reported here.

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