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Common Auditors in the Supply Chain and the Supplier's Performance

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ABSTRACT: We examine the effect of a common auditor within a supply chain, where the auditor serves both the supplier and its customer(s). This dual role allows auditors to leverage and disseminate crucial chain-specific knowledge. Considering that supplier firms are relatively smaller and at a disadvantage compared with their customers, such supply-chain knowledge is valuable for suppliers to make better demand forecasts and business plans. Consistent with this argument, we find that a supplier sharing a common auditor with its customer(s) has a higher ROA, a higher profit margin, a shorter receivable conversion period, and a smaller demand distortion from the bullwhip effect. Performance enhancement is more pronounced when the common auditor has more opportunities to collect and transfer information and when such information transfer is more valuable to the supplier. Our results are robust to alternative measures of common-auditor presence, alternative explanations, and potential endogeneity concerns.

Data Availability: The data that support the findings of this study are openly available.

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Keywords: common auditor; supply chain; information spillover; ROA.

I. INTRODUCTION

Information asymmetry between customers and supplier firms is an inherent issue that can lead to demand distortion, opportunistic behavior, and holdup problems in the supply chain. This asymmetry has intrigued a large number of researchers in economics, finance, and accounting (Chang, Chen, Hsu, and Mashruwala 2018; Grossman and Hart 1986; Hart and Moore 1990; Klein, Crawford, and Alchian 1978; Tirole 1999; Williamson 1975, 1979). In this study, we examine the effect of common auditors in the supply chain, specifically whether common auditors improve the performance of supplier firms through information spillovers from customer firms to supplier firms.

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Auditors learn valuable information about their clients in the course of providing audit services. Prior studies have found that common auditors improve the outcomes of mergers and acquisitions (M&A hereafter) by sharing information between targets and acquirers (Cai, Kim, Park, and White 2016; Dhaliwal, Lamoreaux, Litov, and Neyland 2016). Common auditors can also reduce information asymmetry in the lending decision making of banks (Francis and Wang 2021), facilitate supply chain audits (J. Chen, Chang, H. Chen, and Kim 2014; Johnstone, Li, and Luo 2014), enhance relationship-specific investment (RSI hereafter) (Dhaliwal, Shenoy, and Williams 2017; Hu, Yang, and Zhang 2022), reduce corporate cost stickiness (Cai, Zheng, and Zhu 2019), and improve investment efficiency (Chen, Liao, and Lin 2022). However, little is known about whether the information shared by auditors can enhance firms' performance by improving operating efficiency. Assessing the influence of common auditors on suppliers' operational efficiency is vital, as it enhances our comprehension of production cost management and operational process improvements driven by the information these auditors share.

Common auditors that serve both the supplier and customer can gain valuable chain-specific knowledge, which is essential for suppliers to generate reliable and timely forecasts of downstream demand and to improve their production plans.[1] In general, suppliers are smaller firms than their customers, resulting in a power imbalance in their contractual relationships (Li and Tang 2016). Thus, suppliers may have a pressing need for an efficient information flow facilitated by the supply-chain knowledge of a common auditor. Specifically, supplier firms can learn about demand, financial, and other useful information relative to their customers through common auditors. Such information empowers suppliers to generate more accurate forecasts of customer demand and to develop better production plans, leading to a higher profit margin. Better informed suppliers are in a more favorable position to negotiate better trading terms—such as faster receivable collections—with their customers, which in turn can help reduce bad debts and improve the supplier's financial condition. Collectively, these benefits are expected to translate into better operational and financial performance for the supplier.

Using the segment filing data, in which firms are mandated to report customers whose sales account for more than 10 percent of the firm's total sales, we empirically test the relationship between common auditors and the performance of supplier firms of 39,037 supplier-year observations for the years 1980–2016. We test and find that the presence of common auditors working for both a supplier firm and its customers is positively associated with the supplier's performance. Specifically, a one-standard-deviation increase of *Pct_Common_Auditor* (i.e., the percentage of sales to major customers sharing the same auditor as the supplier) leads to a 20 percent increase in the supplier's *ROA* based on the sample median. We further decompose operating performance—that is, the *ROA*—into asset turnover (*ATO*) and profit margin (*PM*) and find that the benefits of information spillovers through common auditors mostly result in greater *PM* and especially in improvement in the gross margin (*GM*).

We then explore whether common auditors can improve suppliers' business processes. One major friction in the supply-chain relationship is the demand distortion from downstream demand to upstream supply. As the cost of excessive capacity is borne by the supplier, the customer prefers the supplier to maintain a greater capacity to prevent a shortage of stock when unanticipated demand arises (Cachon and Terwiesch 2012; Metters 1997; Porter 1974). Consequently, the customer tends to inflate nonbinding orders to make its supplier invest more, and such demand distortion usually increases as orders move upstream (i.e., the bullwhip effect). We find that suppliers with common auditors are associated with less demand distortion from the bullwhip effect as measured by fewer mismatches between productions and sales; this supports the transfer of demand information from customers to suppliers. We also find receivable collections to be faster with common auditors, suggesting that the information spillover of customers' financial conditions allows suppliers to negotiate for better terms.

Our further analysis shows that the common auditor effect is more pronounced when a common auditor has more opportunities to transfer information, such as prior to the enactment of the Sarbanes-Oxley Act or when the auditors are from the same office. In addition, we find that the performance enhancement is more pronounced when the information transferred by a common auditor is more valuable to the supplier, such as when the information asymmetry of the customer is high, when the supplier is more dependent on its customers, or when the customers' auditor tenure is longer.

Since hiring common auditors is an endogenous decision made by both the supplier and the customer, such a decision likely reflects the characteristics of the supplier and the customer firms. To address this concern, we conduct a difference-in-differences (DiD) test based on three mergers of audit firms in 1989 and 1998.[2] An audit-firm merger is not likely decided by the supplier or its customer. We find that the treatment group (i.e., suppliers that did not share the

[1] Although professional auditing standards prohibit auditors from communicating confidential client information to entities outside the audit firm, such as investors or other audit clients (Demski, Lewis, Yao, and Yildirim 1999; McAllister and Cripe 2008), both anecdotal and empirical evidence suggest information spillovers can and do occur (Cohn 2017; Gaetano 2018; Heller 2017; Pfeifer 2014).

[2] In 1989, Touche Ross merged with Deloitte, Haskins, and Sells to form Deloitte and Touche, and Arthur Young merged with Ernst and Whinney to form Ernst & Young. In 1998, Coopers & Lybrand merged with Price Waterhouse to form PricewaterhouseCoopers.

same auditor with their customers before the merger but did so afterward as a result of the merger) showed significant improvement in *ROA* after the merger, compared with the propensity score-matched control group (i.e., suppliers that had no common auditor with their customers during the four-year window around each merger event). As a robustness test, we also show that the common auditor effect on suppliers' performance is not entirely driven by the increased RSI of suppliers, as found by Dhaliwal et al. (2017).

This study makes several contributions. First, it contributes to the information intermediary role of auditors. Extant studies that document the impact of auditors on information asymmetry mainly investigate improved corporate investment and financing. For example, local non-Big 4 auditors draw upon the information advantage obtained via their local network to help improve M&A performance (Louis 2005). Auditors also gain valuable industry expertise, enabling them to assist clients in improving capital investment efficiency (Bae, Choi, Dhaliwal, and Lamoreaux 2017; Chen et al. 2022). The supply-chain knowledge obtained by common auditors can influence M&A decisions and performance (Cai et al. 2016), RSI along supply chains (Dhaliwal et al. 2017), and bank loan interest rates (Francis and Wang 2021). We add to this literature by identifying the intermediary role of auditors' information in the supply chain, with a focus on corporate operational and financial performance. Our results suggest that common auditors enhance suppliers' performance through improved profitability, operating efficiency, and reduced demand distortions from their downstream customers.

Second, we contribute to the large volume of literature on information asymmetry in the supply chain (e.g., Williamson 1975, 1979, 1985). Prior studies propose various ways to mitigate information asymmetry and the resultant misaligned interest problem between customers and suppliers by designing relational contracts (Plambeck and Taylor 2006) or by financial reporting to change the trading partner's perceptions (Dou, Hope, and Thomas 2013; Raman and Shahrur 2008). Building upon the prior work, our study reveals that suppliers can derive significant benefits from the sharing of auditors and the subsequent reduction in information asymmetry, which in turn can enhance their operational and financial performance. Other common intermediaries, such as institutional investors, can also reduce information asymmetry in the supply chain (Cheung, Haw, Hu, Swink, and Zhang 2020). However, the information sets of different common intermediaries may have different advantages and thus could generate different impacts on the supplier's performance. Our paper documents the additional contribution of common auditors on suppliers' performance after controlling for the presence of other common intermediaries.

It is important to note that our findings differ from those of Aobdia (2015) and Kang, Lennox, and Pandey (2022), who suggest that information leakage resulting from product market competitors sharing common auditors may be detrimental to firms' competitive advantage. In contrast, our study shows the positive implications of information dissemination throughout the supply chain are particularly beneficial for suppliers with lower bargaining power and in circumstances where the information holds greater value. The discrepancy in our findings suggests that the effect of information sharing through common auditors may be different in the *competitive* versus *cooperative* contexts. Overall, our study sheds light on the benefits of information sharing facilitated by common auditors within the supply chain and provides insights that contribute to the existing literature on information asymmetry and its implications for firms operating in various market contexts.

The remainder of the paper is organized as follows. Section II discusses the literature on the intermediary role of the auditor's information. Section III develops our hypotheses. The sample and research design are discussed in Section IV. Section V reports the empirical results, and Section VI offers the conclusion.

II. LITERATURE REVIEW

Information Intermediary Role of Common Auditors

Auditors gain a sound understanding of their clients' financial situation and operating performance by providing services to their clients. Previous research indicates that accessing information along the supply chain can greatly benefit auditors in making informed judgments and can enhance the overall quality of audits (Dhaliwal, Michas, Naiker, and Sharma 2020; Johnstone et al. 2014). Previous literature also suggests that auditors transfer information among their clients. Notably, Bianchi, Falsetta, Minutti-Meza, and Weisbrod (2014); Hu, Yang, Zhang, and Wang (2023); and Lim, Shevlin, Wang, and Xu (2018) have found that auditors spread information concerning tax savings strategies among their clients.

In the context of M&A, common auditors involved with both the acquirer and the target firms can facilitate information sharing and improve the overall transfer of knowledge during the transaction. Consequently, this can positively impact the quality of the merger deal and the subsequent stock market performance (Cai et al. 2016). However,

Dhaliwal et al. (2016) have observed that common auditors in M&A situations might transfer more information from the target firm to the acquirer, potentially benefiting the acquirer but hurting the target firm.

The information shared by common auditors may help firms to improve their business processes. For example, Dhaliwal et al. (2017) find that the common auditor who audits both the supplier and the customer reduces information asymmetry by increasing financial statement comparability between the supplier and the customer; this reduced information asymmetry results in more RSI in the supply chain. J. Chen, M. Chen, Chin, and Lobo (2020) find that Chinese firms audited by the same individual auditor report more comparable earnings.

In addition to supply chain dynamics, the influence of common auditors extends to other contexts. Hope, Rao, Xu, and Yue (2023) have researched the information transfer from common auditors to mutual funds. Their findings reveal that Chinese mutual funds, which share common auditors with firms in their stock holdings, have achieved higher profits. This suggests that the knowledge and insights conveyed by common auditors can positively impact the investment decisions and performance of mutual funds in the Chinese market.

Supply Chain Information Transfer

Information transfer between suppliers and customers is crucial to their operational and financial performance, as suppliers and customers are closely related through business transactions. Suppliers and customers could directly share information, for example, through placing orders and negotiating deals. Prior literature shows that information shared between suppliers and customers affects their performance. Specifically, Lee, So, and Tang (2000) and Yan and Pei (2011) find that sharing demand information can benefit suppliers, for example, by reducing suppliers' inventory-holding and shortage costs. Corbett, Zhou, and Tang (2004) and Cao, Ma, Wan, and Lai (2013) show that information on customers' cost structure helps improve suppliers' performance, such as profit. Terlaak and King (2006) and Wang, Cai, and Tang (2006) find that quality information sharing can increase suppliers' sales growth and profit. Jain and Moinzadeh (2005) and Budde and Minner (2015) find that supply-information sharing improves supply-chain performance, for example, by increasing order rate.

In addition to direct information sharing between suppliers and customers, other sources of supply-chain information supplement the information set; for example, information intermediaries provide supply-chain information beyond the direct information sharing between suppliers and customers, especially when direct sharing contains incomplete or even distorted information (e.g., Cachon and Lariviere 1999). Radhakrishnan, Wang, and Zhang (2014) find that the quality of customers' public information is positively associated with their suppliers' operating performance. They argue that customers' public information might help their suppliers' management plan production and accordingly improve profitability. The measure of customers' public information quality used by Radhakrishnan et al. (2014) includes management earnings forecasts, earnings quality, and coverage by financial analysts and credit rating agencies. In addition to financial analysts and credit rating agencies, auditors are an important information intermediary. Rule 301 of the AICPA Code of Professional Conduct prohibits auditors from revealing confidential information without the specific consent of their clients, and the Chinese walls established within the audit office disallow auditors from sharing confidential information with colleagues who are not directly involved with the clients (Kang et al. 2022). However, prior studies show both anecdotally and empirically that information sharing by common auditors does occur. Kang et al. (2022) find that firms in the same product market tend to avoid sharing the same audit partner when they have significant concerns about information spillovers. Whether information is transferred by the auditor from customers to suppliers, or how such information transfer affects firms' performance, remains unexplored. Our study attempts to address this question.

III. HYPOTHESIS DEVELOPMENT

Information Spillover by Common Auditors

Customer information can be very important for a firm's entire value chain and can affect the firm's operational and financial performance. First, a firm's management needs customer demand information to forecast sales and plan production and procurement (Lee et al. 2000). The information shared by common auditors can potentially reduce the demand distortion raised by downstream customers. Second, improvements in production planning result in less idle time or overtime and hence reduce production costs and improve profit margins. Finally, knowing the customer's cash flow information might help the supplier to ask for faster collection of its accounts receivable, releasing its financial burden and broadening its opportunity to make profitable investments. In sum, by transferring knowledge of a firm's

customers, a common auditor could increase the firm's profit, leading to a positive association between the presence of a common auditor and the firm's performance. We propose the first hypothesis as follows:

H1: Common auditors in the supply chain have a positive effect on the supplier's performance.

Our first hypothesis is not without tension. Auditors are prohibited from disclosing confidential information without the consent of their clients (Rule 301 of the AICPA Code of Professional Conduct). Even if it were permissible for common auditors to transmit information to suppliers, this information may be of limited value to suppliers in an established supply chain relationship. Suppliers already have direct access to relevant information, particularly in long-term supply chain relationships. Therefore, the transmission of information may not significantly enhance suppliers' performance. Furthermore, previous studies have indicated that information leakage resulting from product market competitors who share common auditors can be detrimental to firms' competitive advantage (Aobdia 2015; Kang et al. 2022). In the supply chain context, it is plausible that the presence of common auditors may also have negative implications for performance. Therefore, whether and in which direction common auditors affect the supplier's performance remain empirical questions.

Opportunity for the Common Auditors to Collect and Transfer Supply Chain-Specific Information

Large audit firms have offices located in different regions, and they operate on a semiautonomous basis (Chen, Martin, and Sun 2012). Information sharing between different audit teams is easier if they work within the same geographic location than from different locations. We expect auditors from the same local office to have more opportunities to share their clients' information. Accordingly, we predict that the positive effect of common auditors on the supplier's performance is stronger at the audit-office level than at the audit-firm level and propose the following hypothesis:

H2a: The positive effect of common auditors on the supplier's performance is more pronounced when the auditors are from the same office than when they are only from the same audit firm.

The Sarbanes-Oxley Act (SOX) was enacted in 2002 to enhance auditor independence. Section 201 of SOX prohibits auditors from providing certain nonauditing services to their clients. This enactment may reduce opportunities for common auditors to gain information about customers or to transfer customer information to suppliers. Before SOX, a common auditor could also gain knowledge by providing nonauditing services to the customer client. Moreover, the common auditor might have transferred customers' information to the supplier through the consulting service provided to the supplier client. However, SOX prohibited such activities. Accordingly, we predict that the positive effect of common auditors on the supplier's performance is smaller after SOX and propose our next hypothesis.

H2b: The positive effect of common auditors on the supplier's performance was more pronounced before SOX.

The Importance and Value of the Information Transfer by Common Auditors

Suppliers' demand for customer information is high when they know little about their customers. In other words, the marginal effect of a common auditor's presence on a supplier client should be greater if the information asymmetry of the customer is higher. Accordingly, we predict that the positive effect of common auditors on the supplier's performance is stronger when the supplier knows little about its customers. We propose our next hypothesis as follows:

H3a: The positive effect of common auditors on the supplier's performance is more pronounced when the information asymmetry of the customer is higher.

Major customers dominate a supplier's sales. When a supplier is more dependent on a customer, information about that customer is more important to the supplier's performance. Further, when common auditors have a longer working tenure with customer firms, they will better understand the customers' operating and financial conditions and can transfer more valuable information to the supplier. However, information obtained through common auditors would be less valuable to a supplier who already has a long supply chain-pair relationship with a customer, because repeated interactions throughout a long trading relationship provide the supplier with a sound understanding of its customer, leaving less room for a common auditor to contribute. Therefore, we also propose the following two hypotheses:

H3b: The positive effect of common auditors on the supplier's performance is more pronounced when suppliers are more dependent on their major customers.

H3c: The positive effect of common auditors on the supplier's performance is more pronounced when the customer's auditor tenure is longer and when the supply chain relationship is shorter.

IV. SAMPLE AND DESCRIPTIVE ANALYSIS

We obtain customer information from the Compustat Segments-Customer database and require each customer to have its purchase amount from the supplier. We require all suppliers to have auditor information and regard customers without auditor information as not having common auditors with their suppliers.[3] We obtain audit-office information from Audit Analytics, financial statement information from Compustat Fundamentals Files, and stock transaction information from the CRSP database. We require our sample to have available data for all variables in the baseline test but allow for different sample sizes in other tests based on data availability. Finally, our sample for the baseline test includes 67,348 supplier-customer-year observations, for a total of 39,307 supplier-year observations spanning 1980–2016. In our sample, the number of unique customer-supplier pairs is 22,389, and the average duration of a supply chain-pair relationship is around 3.3 years. We use the supplier-year observations as the basic unit of analysis.

As most suppliers have more than one customer, we follow Dhaliwal et al. (2017) and measure the common auditor presence of a supplier by using the percentage of its sales to its major customers who use the same auditor as the supplier. We show the calculation below:

$$Pct\_Common\_Auditor = \sum_{j=1}^{J}\left(\frac{Sales_{ijt}}{Sales_{it}} \times Common\_Auditor_{ijt}\right) \quad (1)$$

where $Sales_{ijt}$ is supplier i's sales to customer j in year t and $Sales_{it}$ is supplier i's total sales in year t. The variable $Common\_Auditor_{ijt}$ is an indicator that equals 1 if the supplier i uses the same auditor as the customer j in year t.

The definitions of all variables used in this study are listed in Appendix A. Table 1 gives the summary statistics of the main variables. All continuous variables are Winsorized at the 1 percent and 99 percent levels. Some variables' summary statistics are noteworthy. First, the mean value of *Dum_Common_Auditor*, which is a dummy for the presence of a common auditor, is 23.6 percent. This could be due to the potential tradeoffs associated with switching to common auditors.[4] Second, the average size of suppliers (*SIZE*) is much smaller than the average size of customers (*CSIZE*), suggesting that suppliers' dependence on their customers might be higher than *vice versa*. In addition, suppliers are younger than their major customers (*AGE* versus *CAGE*) and have higher sales growth (*SG* versus *CSG*). The sales-weighted average trading relationship between suppliers and their major customers is about 4.4 years (*LINKAGE*). Around 79 percent of the supplier-year observations employ Big N auditors (*BigN*).

Table 2 shows the pairwise correlations between the main variables. The correlations between supplier characteristics and *Pct_Common_Auditor* indicate that suppliers with larger firm size, lower leverage, younger age, higher growth, higher R&D intensity, lower advertising intensity, Big N auditors, larger customers, longer trading relationships with customers, and higher customer concentration are more likely to use the same auditor as their customers. Importantly, the correlation between suppliers' *ROA* and *Pct_Common_Auditor* gives preliminary evidence that there could be a positive relationship between the presence of a common auditor and the supplier's performance.

V. EMPIRICAL RESULTS

Baseline Test

To test H1, we estimate Equation (2), examining the association between the common auditor's presence and the supplier's performance.

$$ROA_{it} = \beta_0 + \beta_1 Common\_Auditor\_Presence_{it} + \gamma Controls_{it} + \in_{it} \quad (2)$$

The dependent variable is the return on assets (ROA_{it}) of supplier i in year t. It measures the supplier's performance. The primary explanatory variable is the existence of a common auditor (*Common_Auditor_Presence*), measured as the sales-weighted percentage of customers who employ the same audit firm as the supplier (*Pct_Common_Auditor*). We

[3] Our results are robust if the customers without auditor data are excluded from the sample. The results are shown in Online Appendix, Table OA1.

[4] A mean value of 23.6 percent for *Dum_Common_Auditor* does not mean there is no demand for common auditors. When focusing on the post-2003 period, when Big N auditors consolidated to the Big 4 firms, we found that 29.2 percent of instances had common auditors. If there were no preference for common auditors, the frequency should be only 25 percent. This suggests that the use of common auditors among suppliers is higher than random pairing. However, although shared auditors have a positive correlation with supplier performance, there are costs and risks associated with using common auditors, such as a contagious negative market reaction from the supplier to the customer or *vice versa* when the common auditor resigns from either side.

TABLE 1

Descriptive Statistics

Variable	n	Mean	Std. Dev.	5th	25th	50th	75th	95th
ROA	39,307	−0.075	0.330	−0.664	−0.087	0.025	0.071	0.169
Pct_Common_Auditor	39,307	0.050	0.122	0.000	0.000	0.000	0.000	0.300
Dum_Common_Auditor	39,307	0.236	0.425	0.000	0.000	0.000	0.000	1.000
Pct_Common_Auditor_Same_Office	17,286	0.009	0.049	0.000	0.000	0.000	0.000	0.000
Pct_Common_Auditor_Different_Office	17,286	0.049	0.117	0.000	0.000	0.000	0.000	0.295
Dum_Common_Auditor_Same_Office	17,286	0.047	0.213	0.000	0.000	0.000	0.000	0.000
Dum_Common_Auditor_Different_Office	17,286	0.237	0.425	0.000	0.000	0.000	0.000	1.000
SIZE	39,307	18.646	2.268	15.030	17.023	18.499	20.253	22.575
LEV	39,307	0.530	0.371	0.109	0.285	0.487	0.672	1.091
Lag_ROA	39,307	−0.067	0.320	−0.656	−0.078	0.027	0.074	0.179
AGE	39,307	12.757	11.276	1.000	4.000	9.000	19.000	37.000
SG	39,307	0.245	0.736	−0.369	−0.048	0.090	0.293	1.242
RD_Intensity	39,307	0.069	0.130	0.000	0.000	0.007	0.085	0.321
AD_Intensity	39,307	0.010	0.029	0.000	0.000	0.000	0.002	0.059
BigN	39,307	0.785	0.411	0.000	1.000	1.000	1.000	1.000
Pct_Common_Analyst	39,307	0.092	0.273	0.000	0.000	0.000	0.000	1.000
Pct_Common_Ownership	39,307	0.315	0.443	0.000	0.000	0.000	1.000	1.000
CSIZE	39,307	23.189	3.141	19.270	22.305	23.772	24.795	26.117
CAGE	39,307	24.923	12.952	2.000	16.000	25.384	34.000	46.931
CSG	39,307	0.098	0.203	−0.152	0.000	0.070	0.150	0.439
LINKAGE	39,307	4.439	3.793	1.000	2.000	3.000	6.000	12.377
CC	39,307	0.113	0.179	0.003	0.017	0.043	0.119	0.500
ATO	39,307	1.088	0.802	0.131	0.493	0.956	1.470	2.568
PM	39,307	−0.291	1.254	−1.794	−0.105	0.023	0.078	0.249
OM	38,549	−0.125	1.037	−1.376	−0.001	0.093	0.177	0.477
NOM	38,549	−0.160	0.328	−0.629	−0.168	−0.082	−0.042	0.051
SGA	39,307	0.332	0.465	0.000	0.093	0.207	0.388	1.038
GM	39,307	0.251	0.755	−0.209	0.205	0.337	0.514	0.797
Days of Receivables	39,075	68.935	50.465	17.867	42.296	58.635	80.386	147.548
Days of Inventory	38,930	73.518	80.726	0.000	8.371	54.464	106.787	224.481
Days of Payables	39,176	77.318	120.714	10.482	27.393	44.472	74.807	241.209
Operating Cycle	38,728	145.310	107.422	32.103	77.346	120.766	182.001	337.503
Bullwhip_Effect	31,646	1.347	1.038	0.442	0.893	1.000	1.431	3.359
AB_PROD	36,197	−0.011	0.413	−0.568	−0.149	−0.013	0.116	0.518
Lag_Bullwhip_Effect	23,943	1.338	1.010	0.433	0.884	1.000	1.441	3.344
SEASONALITY	31,646	−0.792	4.077	−5.077	−0.367	0.206	0.577	0.913
AR1RHO	31,699	−0.295	0.557	−1.118	−0.594	−0.320	−0.025	0.619
Pct_Common_Firm_City	17,286	0.012	0.052	0.000	0.000	0.000	0.000	0.100
Dum_Common_Firm_City	17,286	0.067	0.250	0.000	0.000	0.000	0.000	1.000

This table presents the descriptive statistics of the main variables used in all empirical tests. The number of observations may vary across different variables used in different tests because of data availability. All continuous variables are Winsorized at the 1 percent and 99 percent levels. Refer to Appendix A for variable definitions.

employ an alternative proxy for the presence of common auditors, *Dum_Common_Auditor*, which is a dummy that equals 1 if at least one of the supplier's customers uses the same audit firm as the supplier and 0 otherwise.

Following Patatoukas (2012), we use a vector of control variables that are correlated with the supplier's *ROA*; these variables include the supplier's firm size (*SIZE*), sales growth (*SG*), firm age (*AGE*), leverage (*LEV*), previous-year *ROA* (*Lag_ROA*), research and development intensity (*RD_Intensity*), advertisement intensity (*AD_Intensity*), and Big N

TABLE 2

Pairwise Pearson Correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) *ROA*	1								
(2) *Pct_Common_Auditor*	0.011**	1							
(3) *SIZE*	0.317***	0.114***	1						
(4) *LEV*	−0.383***	−0.027***	−0.021***	1					
(5) *Lag_ROA*	0.574***	−0.008	0.305***	−0.299***	1				
(6) *AGE*	0.143***	−0.033***	0.361***	0.055***	0.148***	1			
(7) *SG*	−0.002	0.021***	−0.064***	−0.080***	−0.186***	−0.185***	1		
(8) *RD_Intensity*	−0.514***	0.062***	−0.236***	0.074***	−0.434***	−0.153***	0.087***	1	
(9) *AD_Intensity*	−0.044***	−0.023***	−0.018***	0.066***	−0.013**	0.014***	−0.015***	0.011**	1
(10) *BigN*	0.114***	0.206***	0.356***	−0.072***	0.113***	−0.011**	0.014***	0.020***	−0.015***
(11) *Pct_Common_Analyst*	0.086***	0.040***	0.268***	−0.049***	0.087***	0.122***	−0.016***	−0.005	0.012**
(12) *Pct_Common_Ownership*	0.112***	0.040***	0.291***	−0.108***	0.122***	0.223***	−0.057***	0.007	0.019***
(13) *CSIZE*	0.043***	0.061***	0.228***	0.018***	0.049***	0.154***	−0.040***	−0.017***	−0.019***
(14) *CAGE*	0.053***	−0.001	0.208***	0.045***	0.058***	0.246***	−0.073***	−0.045***	−0.007
(15) *CSG*	0.025***	0.007	−0.063***	−0.044***	−0.007	−0.095***	0.148***	0.026***	0.025***
(16) *LINKAGE*	0.137***	0.028***	0.253***	0.021***	0.147***	0.429***	−0.170***	−0.115***	0.030***
(17) *CC*	−0.164***	0.214***	−0.201***	0.005	−0.186***	−0.131***	0.127***	0.232***	−0.070***

	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) *ROA*								
(2) *Pct_Common_Auditor*								
(3) *SIZE*								
(4) *LEV*								
(5) *Lag_ROA*								
(6) *AGE*								
(7) *SG*								
(8) *RD_Intensity*								
(9) *AD_Intensity*								
(10) *BigN*	1							
(11) *Pct_Common_Analyst*	0.115***	1						
(12) *Pct_Common_Ownership*	0.094***	0.433***	1					
(13) *CSIZE*	0.049***	0.047***	0.166***	1				
(14) *CAGE*	−0.016***	0.081***	0.226***	0.428***	1			
(15) *CSG*	0.018***	0.018**	−0.028***	−0.074***	−0.208***	1		
(16) *LINKAGE*	0.010*	0.106***	0.176***	0.186***	0.293***	−0.133***	1	
(17) *CC*	−0.081***	−0.027***	−0.051***	0.002	−0.027***	0.011**	−0.026***	1

*, **, *** Indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.
This table presents pairwise Pearson correlations between the main variables in the baseline test.
All variables are defined in Appendix A.

auditor indicator (*BigN*).[5] Both the supplier's *ROA* and the presence of a common auditor might be associated with the customers' characteristics. Therefore, we control for customer characteristics, including a sales-weighted average of customer firm size (*CSIZE*), sales growth (*CSG*), firm age (*CAGE*), supplier-customer duration (*LINKAGE*), and customer concentration (*CC*).[6] Other common intermediaries—such as common institutional investors between suppliers and customers—might increase information transfer along the supply chain (Cheung et al. 2020). To exclude the influence of other common intermediaries, we control for the presence of a common institutional investor (*Pct_Common_Ownership*) and a common analyst (*Pct_Common_Analyst*) along the supply chain. In addition, we control for the industry and year fixed effects and cluster the standard errors by supplier firms.

Table 3 reports the regression estimates. The coefficients of both *Pct_Common_Auditor* and *Dum_Common_Auditor* are positive and significant, suggesting common auditors help increase the supplier's *ROA*.[7] Column (1) shows that an increase of one standard deviation in *Pct_Common_Auditor* (i.e., 12.2 percent) would lead to an increase of 0.5 percent in the supplier's *ROA* (0.122×0.038), which stands for a 20 percent increase in the sample median of the supplier's *ROA* (i.e., 2.5 percent). Column (2) shows that the presence of a common auditor could increase the supplier's *ROA* by 0.6 percent, which stands for a 24 percent increase in the sample median of the supplier's *ROA*. These results suggest that the impact of a common auditor on the performance of its supplier clients is economically significant.

DuPont Profitability Analysis

We follow Patatoukas (2012) and investigate the associations between the common auditor's presence and each component of the supplier's *ROA* via the DuPont Profitability Analysis (Soliman 2008). Specifically, in Equation (2), we decompose the supplier's *ROA* into two multiplicative components: profit margin (*PM*) and asset turnover (*ATO*). *PM* is measured as net income divided by net sales, and *ATO* is measured as net sales divided by total assets.

$$ROA = \frac{Net\ Income}{Net\ Sales} \times \frac{Net\ Sales}{Total\ Assets} \tag{3}$$

Table 4, Panel A, columns (1) and (2) show the empirical results. *Pct_Common_Auditor* is positively associated with a supplier's *PM*, but not significantly related to the supplier's *ATO*, suggesting that the positive impact of a common auditor on a supplier's profitability is driven mainly by the supplier's improved efficiency in cost saving.

We further decompose *PM* into nonoperating margin (*NOM*) and operating margin (*OM*). Specifically, we decompose net income (*NI*), which is the numerator of the profit margin, into "operating income before depreciation" and "other items." Table 4, Panel A, columns (3) and (4) report the regression estimates. We find that *Pct_Common_Auditor* is positively associated with both the supplier's *OM* (significant at 1 percent level) and *NOM* (significant at 10 percent level). The coefficient on *NOM* is much smaller than that on *OM*, suggesting that the presence of common auditors improves suppliers' *PM* mainly through the improved operating margin.

Next, we further decompose *OM* into gross margin (*GM*) and SG&A ratio (*SGA*). Table 4, Panel A, column (6) shows a significant and positive relationship between *Pct_Common_Auditor* and the supplier's *GM*. Column (5) shows that there is no significant association between *Pct_Common_Auditor* and the supplier's SG&A expenses. Taken together, these results indicate that the positive impact of common auditors on the supplier's *ROA* is dominated by the supplier's improved gross margin, which might arise from the presence of common auditors helping with customers' demand forecasts and production plans (Radhakrishnan et al. 2014).[8] Table 4, Panel B reports the empirical results of *Dum_Common_Auditor* as an alternative measure of common auditor presence. The results of Panel B are qualitatively similar to those of Panel A.

Impact of Common Auditors on Suppliers' Demand Forecast

To further examine whether common auditors transfer customers' demand information to suppliers and hence facilitate suppliers' demand forecasts, we examine the bullwhip effect for the supplier firm. The bullwhip effect is defined as

[5] In an additional test, we control for auditor specialists in the supplier's industry that may lead to both the presence of a common auditor and better performance by the supplier. Our results remain qualitatively unchanged after adding this control. In addition, common auditors are found to increase RSI in supply chains as documented by Dhaliwal et al. (2017). To reduce the concern that our finding of the common auditor effect is driven by the alternative channel of increased RSI, we add the additional control of the supplier's crosscitation of its customers' patents and still find significant results of *Pct_Common_Auditor* and *Dum_Common_Auditor*. The regression results are shown in Online Appendix, Table OA11.

[6] To control for customer characteristics and to reduce measurement error, we use the sales weight only among sales accounted for by identifiable major customers to calculate the sales-weighted average. The regression results are similar when we use the sales weight of customers among the total sales of the supplier.

[7] We use return on equity (ROE) as an alternative measure of the supplier's performance and find similar results. The regression results are reported in Online Appendix, Table OA2.

[8] In untabulated empirical results, we find that the increased gross margin is partly driven by a reduction in suppliers' cost of goods sold.

TABLE 3

Common Auditors and the Supplier's Profitability

	(1)	(2)
Variables	***ROA***	
Pct_Common_Auditor	0.038***	
	(3.29)	
Dum_Common_Auditor		0.006**
		(2.08)
SIZE	0.023***	0.023***
	(18.79)	(18.78)
LEV	−0.222***	−0.222***
	(−24.18)	(−24.19)
Lag_ROA	0.315***	0.315***
	(26.05)	(26.06)
AGE	0.001***	0.001***
	(4.02)	(3.97)
SG	0.034***	0.034***
	(12.48)	(12.46)
RD_Intensity	−0.868***	−0.868***
	(−30.37)	(−30.38)
AD_Intensity	−0.263***	−0.262***
	(−3.38)	(−3.37)
BigN	0.002	0.003
	(0.43)	(0.59)
Pct_Common_Analyst	0.000	0.000
	(0.09)	(0.07)
Pct_Common_Ownership	0.004	0.004
	(1.10)	(1.10)
CSIZE	−0.000	−0.000
	(−0.83)	(−0.79)
CAGE	0.000*	0.000*
	(1.87)	(1.82)
CSG	0.038***	0.038***
	(5.12)	(5.13)
LINKAGE	0.002***	0.002***
	(5.53)	(5.61)
CC	−0.006	−0.001
	(−0.56)	(−0.06)
Constant	−0.336***	−0.337***
	(−14.61)	(−14.62)
Observations	39,307	39,307
R^2	0.516	0.516
Industry FE and Year FE	Yes	Yes
Firm Cluster	Yes	Yes

*, **, *** Indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively, and t-statistics are shown in parentheses. This table presents the empirical results of the association between common auditors and the supplier's performance. The dependent variable is the supplier's *ROA*.

Variable Definitions:
Pct_Common_Auditor = percentage of sales to major customers that use the same auditor as the supplier; and
Dum_Common_Auditor = indicator that is equal to 1 if at least one of the major customers uses the same auditor as the supplier and 0 otherwise.
Appendix A provides the definition of all other variables.

TABLE 4

Common Auditors and the Supplier's Profitability—Decomposed Profit

Panel A: Common Auditor Presence Measured by *Pct_Common_Auditor*

Variables	(1) *ATO*	(2) *PM*	(3) *OM*	(4) *NOM*	(5) *SGA*	(6) *GM*
Pct_Common_Auditor	0.028	0.286***	0.248***	0.034*	−0.025	0.191***
	(0.56)	(3.22)	(3.26)	(1.75)	(−0.75)	(2.85)
SIZE	−0.105***	0.012**	0.025***	−0.014***	−0.035***	−0.008**
	(−19.06)	(2.32)	(5.85)	(−9.10)	(−16.52)	(−2.21)
LEV	0.536***	0.053	0.187***	−0.125***	−0.102***	0.036
	(24.10)	(1.43)	(6.45)	(−12.02)	(−7.52)	(1.51)
Lag_ROA	0.371***	1.125***	0.955***	0.146***	−0.427***	0.363***
	(18.87)	(22.07)	(24.14)	(10.44)	(−20.21)	(12.98)
AGE	0.004***	0.003***	0.001**	0.002***	−0.001**	0.001
	(4.50)	(4.62)	(2.10)	(9.17)	(−2.14)	(1.31)
SG	−0.003	0.094***	0.077***	0.015***	−0.002	0.063***
	(−0.58)	(5.56)	(5.70)	(3.71)	(−0.35)	(6.34)
RD_Intensity	−0.457***	−2.497***	−2.134***	−0.237***	0.558***	−1.173***
	(−6.67)	(−16.91)	(−17.46)	(−6.96)	(9.45)	(−10.79)
AD_Intensity	2.212***	1.125***	0.854***	0.267***	1.570***	2.294***
	(8.26)	(4.31)	(3.97)	(3.89)	(13.30)	(12.71)
BigN	0.001	−0.050**	−0.038**	−0.003	−0.008	−0.053***
	(0.04)	(−2.36)	(−2.14)	(−0.56)	(−0.80)	(−3.45)
Pct_Common_Analyst	0.013	0.015	0.007	0.010*	0.021**	0.029
	(0.55)	(0.59)	(0.29)	(1.70)	(2.15)	(1.38)
Pct_Common_Ownership	−0.007	0.010	−0.000	0.007	−0.003	−0.002
	(−0.41)	(0.50)	(−0.01)	(1.47)	(−0.38)	(−0.10)
CSIZE	0.004**	0.004	0.003	0.001	−0.002**	−0.001
	(2.04)	(1.49)	(1.36)	(1.22)	(−1.96)	(−0.51)
CAGE	0.001*	−0.001	−0.001	0.000	−0.000	−0.001**
	(1.72)	(−0.86)	(−1.36)	(0.76)	(−1.36)	(−1.97)
CSG	0.059***	0.111***	0.073**	0.021**	−0.025*	0.034
	(2.95)	(3.13)	(2.42)	(1.98)	(−1.72)	(1.42)
LINKAGE	0.014***	0.013***	0.010***	0.002***	−0.004***	0.005***
	(5.90)	(7.48)	(6.97)	(3.89)	(−5.34)	(3.52)
CC	−0.172***	−0.926***	−0.846***	−0.040**	−0.115***	−0.801***
	(−3.78)	(−10.40)	(−11.04)	(−2.08)	(−3.60)	(−12.45)
Constant	2.571***	−0.377***	−0.497***	0.125***	1.065***	0.588***
	(24.67)	(−3.75)	(−5.98)	(4.35)	(24.46)	(8.27)
Observations	39,307	39,307	38,549	38,549	39,307	39,307
R^2	0.391	0.323	0.358	0.155	0.278	0.238
Industry FE and Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm Cluster	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: Common Auditor Presence Measured by *Dum_Common_Auditor*

Variables	(1) *ATO*	(2) *PM*	(3) *OM*	(4) *NOM*	(5) *SGA*	(6) *GM*
Dum_Common_Auditor	0.008	0.062***	0.052***	0.007	−0.008	0.034***
	(0.56)	(3.64)	(3.52)	(1.53)	(−1.16)	(2.68)
SIZE	−0.105***	0.012**	0.025***	−0.014***	−0.035***	−0.008**
	(−19.04)	(2.26)	(5.80)	(−9.08)	(−16.43)	(−2.19)

(continued on next page)

TABLE 4 (continued)

Variables	(1) *ATO*	(2) *PM*	(3) *OM*	(4) *NOM*	(5) *SGA*	(6) *GM*
LEV	0.536***	0.051	0.186***	−0.125***	−0.102***	0.035
	(24.11)	(1.39)	(6.41)	(−12.04)	(−7.51)	(1.48)
Lag_ROA	0.371***	1.125***	0.955***	0.146***	−0.427***	0.363***
	(18.87)	(22.07)	(24.13)	(10.44)	(−20.21)	(12.98)
AGE	0.004***	0.003***	0.001**	0.002***	−0.001**	0.001
	(4.51)	(4.56)	(2.02)	(9.15)	(−2.15)	(1.24)
SG	−0.003	0.093***	0.077***	0.015***	−0.002	0.063***
	(−0.58)	(5.55)	(5.68)	(3.70)	(−0.35)	(6.33)
RD_Intensity	−0.457***	−2.498***	−2.135***	−0.238***	0.558***	−1.174***
	(−6.68)	(−16.90)	(−17.45)	(−6.96)	(9.46)	(−10.78)
AD_Intensity	2.213***	1.132***	0.859***	0.268***	1.569***	2.298***
	(8.27)	(4.34)	(4.00)	(3.90)	(13.30)	(12.74)
BigN	0.000	−0.049**	−0.036**	−0.003	−0.007	−0.050***
	(0.02)	(−2.31)	(−2.04)	(−0.51)	(−0.73)	(−3.27)
Pct_Common_Analyst	0.013	0.015	0.006	0.010*	0.021**	0.028
	(0.54)	(0.57)	(0.25)	(1.67)	(2.15)	(1.36)
Pct_Common_Ownership	−0.007	0.010	0.000	0.007	−0.003	−0.002
	(−0.41)	(0.51)	(0.01)	(1.48)	(−0.39)	(−0.10)
CSIZE	0.004**	0.004	0.003	0.001	−0.002*	−0.001
	(2.03)	(1.51)	(1.39)	(1.23)	(−1.95)	(−0.47)
CAGE	0.001*	−0.001	−0.001	0.000	−0.000	−0.001**
	(1.72)	(−0.89)	(−1.39)	(0.74)	(−1.36)	(−2.02)
CSG	0.059***	0.112***	0.074**	0.021**	−0.025*	0.034
	(2.95)	(3.16)	(2.45)	(1.99)	(−1.73)	(1.44)
LINKAGE	0.014***	0.013***	0.011***	0.002***	−0.004***	0.005***
	(5.91)	(7.58)	(7.05)	(3.94)	(−5.34)	(3.60)
CC	−0.168***	−0.883***	−0.810***	−0.035*	−0.119***	−0.773***
	(−3.81)	(−10.32)	(−10.99)	(−1.88)	(−3.86)	(−12.47)
Constant	2.572***	−0.379***	−0.501***	0.124***	1.064***	0.583***
	(24.62)	(−3.76)	(−6.00)	(4.31)	(24.36)	(8.16)
Observations	39,307	39,307	38,549	38,549	39,307	39,307
R^2	0.391	0.322	0.358	0.155	0.278	0.237
Industry FE and Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm Cluster	Yes	Yes	Yes	Yes	Yes	Yes

*, **, *** Indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively, and t-statistics are shown in parentheses.
This table presents the empirical results of the DuPont Profitability Analysis of decomposed suppliers' *ROA*. Panel A shows the results of using *Pct_Common_Auditor* as the measure of common auditor presence, and Panel B shows the results of using *Dum_Common_Auditor* as the alternative measure of common auditor presence.
Appendix A provides the definition of all other variables.

the amplification of demand variability moving up along the supply chain. This means that upstream suppliers face higher demand variability than downstream customers. The bullwhip effect can create inefficiencies for upstream suppliers, such as distortions of demand forecasting, inventory management, and capacity planning issues (Metters 1997), which can increase suppliers' operating costs. A supplier's bullwhip effect can be reduced if the supplier gets more information about customer demand. Therefore, if common auditors in the supply chain transfer customers' demand information to the supplier, the supplier's bullwhip effect will be reduced.

To test the effect of common auditors on the supplier's bullwhip effect, we estimate Equation (4).

$$Bullwhip\_Effect_{it} = \beta_0 + \beta_1 Common\_Auditor\_Presence_{it} + \gamma Controls_{it} + \in_{it} \quad (4)$$

We follow Zhao, Mashruwala, Pandit, and Balakrishnan (2019) and measure the dependent variable $Bullwhip\_Effect_{it}$ as follows:

$$Bullwhip\_Effect_{it} = \frac{\sigma(PRODUCTION_{it})}{\sigma(DEMAND_{it})} \tag{5}$$

where $\sigma(PRODUCTION_{it})$ is the standard deviation of quarterly *PRODUCTION*; $\sigma(DEMAND_{it})$ is the standard deviation of quarterly *DEMAND* to supplier *i* in fiscal year *t*. $PRODUCTION_{it}$ is the supplier *i*'s production, measured by its cost of goods sold plus inventory changes; $DEMAND_{it}$ is the demand of customers, measured by supplier *i*'s cost of goods sold. In Equation (5), we first take the logarithm of a supplier's production and then take its first difference to form *PRODUCTION*. In the same way, we first take the logarithm of customers' demand and then take its first difference to form *DEMAND*. As we use firm quarterly data to measure the bullwhip effect, we require our sample to have financial data for all four quarters of each year. The independent variable of common auditor presence is measured by using both *Pct_Common_Auditor* and *Dum_Common_Auditor*.

Following Shan, S. Yang, S. Yang, and Zhang (2014), we control variables that are associated with the supplier's bullwhip effect, that is, the supplier's firm size (*SIZE*), gross margin (*GM*), inventory days (*Days of Inventory*), accounts payable days (*Days of Payables*), seasonality in demand (*SEASONALITY*), and correlation in demand (*AR1RHO*). The definitions of these control variables are shown in Appendix A. In addition, we control for characteristics of the supplier and its customers that may affect the supplier's bullwhip effect and the probability of an existing common auditor; these characteristics are the supplier's firm age (*AGE*), advertisement intensity (*AD_Intensity*), Big N auditor indicator (*BigN*), relationship duration with customers (*LINKAGE*), and customer concentration (*CC*).

Table 5, Panel A reports the regression estimates. The coefficient of *Dum_Common_Auditor* is negative and significant, suggesting that the presence of a common auditor mitigates a supplier's bullwhip effect. The coefficient of *Pct_Common_Auditor* is negative and marginally significant. This finding indicates that a common auditor in a supply chain could help improve the supplier's forecast of its customers' demand and further reduce production variability. The reduced production variability would save operating costs, which may explain the higher gross margin we documented earlier.

To delve deeper into the potential cost savings derived from the mitigation of demand distortion attributed to the presence of a common auditor, we directly assess the impact of common auditors on suppliers' abnormal production costs. The regression results are reported in Table 5, Panel B. In these regressions, the dependent variable *AB_PROD* is the abnormal production cost calculated by following Roychowdhury (2006), where the production cost is the sum of the cost of goods sold and the change of inventory. Our findings indicate a negative relationship between the presence of common auditors and suppliers' abnormal production costs. This negative correlation suggests that common auditors play a role in assisting suppliers in reducing their production costs. This result bolsters our previous finding, which highlights the common auditors' capacity to transmit demand-related information across the supply chain and consequently alleviate demand distortion experienced by suppliers.

Impact of Common Auditors on Suppliers' Efficiency

We further examine the impact of common auditors on suppliers' speed of cash collection and length of operating cycle. In the previous section, we show that common auditors might help suppliers improve demand forecasts and reduce production variability, which will further benefit operating efficiency. Furthermore, common auditors can transfer information about customers' financial condition to suppliers, which enables suppliers to seek faster cash collection from customers. In this section, we examine the impact of common auditors on the supplier's receivables conversion periods (*Days of Receivables*) and operating efficiency (*Operating Cycle*) to explore whether common auditors could increase the supplier's efficiency in purchasing raw materials, producing goods, selling inventory, and collecting cash.

Table 6 shows the regression results. Columns (1) and (2), where suppliers' *Days of Receivables* is the dependent variable, show that the coefficients of both *Pct_Common_Auditor* and *Dum_Common_Auditor* are negative and significant, suggesting that a common auditor can help suppliers collect receivables from their customers more quickly, consistent with our prediction. Reduction of a supplier's period for receivable conversion can also reduce their financing costs and increase profits. In columns (3) and (4), where suppliers' *Operating Cycle* is the dependent variable, we find some indication that the presence of common auditors (but not the extensity of common auditors) reduces the operating cycle, indicating an overall improvement in the supplier's operating efficiency.[9]

[9] In addition, in untabulated empirical results, we find that common auditors are also associated with a lower likelihood of engaging financially distressed customers and lower propensity for customers to declare bankruptcy in the future.

TABLE 5

Common Auditors and Distortion of the Supplier's Demand Forecast

Panel A: The Bullwhip Effect

	(1)	(2)
Variables	***Bullwhip_ Effect***	
Pct_Common_Auditor	−0.108*	
	(−1.76)	
Dum_Common_Auditor		−0.053***
		(−3.08)
Lag_Bullwhip_Effect	0.230***	0.230***
	(18.74)	(18.73)
GM	0.053***	0.053***
	(6.69)	(6.70)
Days of Inventory	0.002***	0.002***
	(11.61)	(11.60)
Days of Payables	−0.000	−0.000
	(−1.05)	(−1.09)
SEASONALITY	−0.052***	−0.052***
	(−12.55)	(−12.58)
AR1RHO	0.079***	0.079***
	(6.83)	(6.83)
SIZE	0.001	0.001
	(0.15)	(0.28)
AGE	−0.003***	−0.003***
	(−3.98)	(−4.04)
AD_Intensity	−0.964***	−0.967***
	(−4.18)	(−4.19)
BigN	0.075***	0.083***
	(3.53)	(3.84)
Pct_Common_Analyst	0.046	0.046
	(1.52)	(1.52)
Pct_Common_Ownership	0.002	0.001
	(0.10)	(0.07)
LINKAGE	0.004*	0.004*
	(1.76)	(1.75)
CC	−0.094**	−0.110***
	(−2.22)	(−2.66)
Constant	0.853***	0.846***
	(10.02)	(9.95)
Observations	22,828	22,828
R^2	0.152	0.153
Industry FE and Year FE	Yes	Yes
Firm Cluster	Yes	Yes

Panel B: Abnormal Production Costs

	(1)	(2)
Variables	***AB_PROD***	
Pct_Common_Auditor	−0.045*	
	(−1.67)	
Dum_Common_Auditor		−0.005
		(−0.77)

(continued on next page)

TABLE 5 (continued)

	(1)	(2)
Variables	***AB_PROD***	
SIZE	0.011***	0.011***
	(5.07)	(5.03)
LEV	0.058***	0.058***
	(5.06)	(5.07)
Lag_ROA	−0.142***	−0.142***
	(−8.46)	(−8.47)
AGE	0.000	0.000
	(0.03)	(0.07)
SG	−0.026***	−0.026***
	(−4.43)	(−4.41)
RD_Intensity	−0.153***	−0.153***
	(−3.26)	(−3.25)
AD_Intensity	−1.980***	−1.980***
	(−14.41)	(−14.42)
BigN	−0.003	−0.004
	(−0.31)	(−0.47)
Pct_Common_Analyst	−0.014	−0.014
	(−1.28)	(−1.28)
Pct_Common_Ownership	−0.007	−0.007
	(−0.94)	(−0.94)
CSIZE	0.000	0.000
	(0.13)	(0.10)
CAGE	0.000	0.000*
	(1.64)	(1.68)
CSG	−0.024*	−0.024*
	(−1.83)	(−1.84)
LINKAGE	0.001	0.001
	(1.38)	(1.34)
CC	0.200***	0.193***
	(8.22)	(8.14)
Constant	−0.248***	−0.245***
	(−6.14)	(−6.07)
Observations	36,197	36,197
R^2	0.060	0.060
Industry FE and Year FE	Yes	Yes
Firm Cluster	Yes	Yes

*, **, *** Indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively, and t-statistics are shown in parentheses. This table presents the empirical results of the association between common auditors and distortion of the supplier's demand forecast.

Variable Definitions:

Bullwhip_Effect = measured as the ratio of quarterly *PRODUCTION*'s standard deviation to quarterly *DEMAND*'s standard deviation in a fiscal year;

PRODUCTION = first difference in the logarithm of suppliers' production, which is measured as the cost of goods sold plus inventory changes in every quarter;

DEMAND = first difference in the logarithm of customers' demand, which is measured as the supplier's quarterly cost of goods sold. The supplier-year observations are required to have financial data for all four quarters in this testing data sample; and

AB_PROD = abnormal production costs borrowed from Roychowdhury (2006), where the production cost is calculated by cost of goods sold plus change of inventory.

Appendix A provides the definition of all other variables.

TABLE 6

Common Auditors and the Supplier's Operating Efficiency

	(1)	(2)	(3)	(4)
Variables	***Days of Receivables***		***Operating_Cycle***	
Pct_Common_Auditor	−10.650***		−1.800	
	(−2.64)		(−0.18)	
Dum_Common_Auditor		−2.927***		−3.719*
		(−3.16)		(−1.74)
SIZE	1.283***	1.302***	0.505	0.571
	(3.41)	(3.45)	(0.67)	(0.75)
LEV	−5.442***	−5.392***	−17.476***	−17.431***
	(−4.17)	(−4.14)	(−6.75)	(−6.74)
Lag_ROA	−6.623***	−6.632***	−10.799***	−10.805***
	(−4.68)	(−4.69)	(−3.61)	(−3.61)
AGE	−0.140***	−0.140***	−0.014	−0.021
	(−2.83)	(−2.83)	(−0.13)	(−0.19)
SG	3.125***	3.127***	2.854**	2.839**
	(5.58)	(5.59)	(2.52)	(2.51)
RD_Intensity	−14.088***	−14.063***	−31.749***	−31.711***
	(−3.57)	(−3.57)	(−3.59)	(−3.58)
AD_Intensity	−62.652***	−62.961***	97.890***	97.660***
	(−4.96)	(−4.99)	(3.01)	(3.01)
BigN	−3.588***	−3.476***	−14.662***	−13.802***
	(−2.76)	(−2.67)	(−5.16)	(−4.90)
Pct_Common_Analyst	−2.167	−2.148	−4.618	−4.619
	(−1.39)	(−1.38)	(−1.35)	(−1.35)
Pct_Common_Ownership	−2.007*	−2.017*	0.261	0.236
	(−1.89)	(−1.90)	(0.11)	(0.10)
CSIZE	0.031	0.033	−1.449***	−1.429***
	(0.22)	(0.23)	(−3.97)	(−3.92)
CAGE	−0.091**	−0.091**	0.039	0.035
	(−2.25)	(−2.24)	(0.46)	(0.42)
CSG	0.439	0.398	7.240**	7.216**
	(0.29)	(0.26)	(2.25)	(2.24)
LINKAGE	−0.343***	−0.348***	−0.753***	−0.747***
	(−3.02)	(−3.06)	(−2.84)	(−2.80)
CC	0.950	−0.613	−32.775***	−32.995***
	(0.26)	(−0.17)	(−4.50)	(−4.69)
Constant	57.167***	57.005***	194.014***	192.617***
	(7.85)	(7.82)	(12.70)	(12.56)
Observations	39,075	39,075	38,728	38,728
R^2	0.106	0.106	0.150	0.150
Industry FE and Year FE	Yes	Yes	Yes	Yes
Firm Cluster	Yes	Yes	Yes	Yes

*, **, *** Indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively, and t-statistics are shown in parentheses. This table presents the results of estimating the effect of common auditors on the supplier's operating performance through increasing the supplier's efficiency.

Variable Definitions:
Days of Receivables = supplier's receivables conversion period measured by dividing accounts receivable by sales and multiplying by 365 days; and *Operating_Cycle* = supplier's operating cycle, measured as the sum of days of inventory and days of receivables.
Appendix A provides the definition of all other variables.

Common Auditors from the Same Office

To test H2a, we investigate whether common audit offices have a stronger effect on the supplier's performance than common audit firms.[10] We divide *Pct_Common_Auditor* in Equation (2) into two variables: *Pct_Common_Auditor_Same_Office* measures the sales-weighted percentage of customers who use the same audit firm as their supplier when the auditors of both customer and supplier are located in the same office and *Pct_Common_Auditor_Different_Office* measures the sales-weighted percentage of customers whose supplier uses the same audit firm but the auditors are located in different offices. As an alternative measure, we divide *Dum_Common_Auditor* in Equation (2) into two parts: *Dum_Common_Auditor_Same_Office* is an indicator that equals 1 if at least one of a supplier's customers uses auditors in the same office as auditors used by the supplier and 0 otherwise; *Dum_Common_Auditor_Different_Office* is the indicator that equals 1 if at least one of a supplier's customers use the same audit firm as the supplier but no customer uses auditors who are in the same office as the auditors used by the supplier and 0 otherwise. To further address the concern that the common audit office may capture the geographic closeness of supplier and customer, we add one more control: the headquarters of both the supplier and the customer are in the same city. We construct the following two control variables: *Pct_Common_Firm_City* is the sales-weighted average of a supplier's customers whose headquarters are in the same city as the supplier's headquarters and *Dum_Common_Firm_City* is a dummy variable that is equal to 1 if at least one of the supplier's customers has its headquarters in the same city as the supplier's headquarters.

The regression results are shown in Table 7. Column (1) shows that the coefficient of *Pct_Common_Auditor_Same_Office* is larger and more significant than the coefficient of *Pct_Common_Auditor_Different_Office*. The difference between the two coefficients is positive and significant. Column (2) shows that the coefficient of *Dum_Common_Auditor_Same_Office* is positive and significant. However, the coefficient of *Dum_Common_Auditor_Different_Office* is no longer significant. The difference between these two coefficients is positive and significant.[11] The finding indicates that office-level common auditors have a stronger impact on their supplier clients' performance than do firm-level common auditors, consistent with the conjecture that it is easier for auditors of the same office to share information about their customer and supplier clients.

Impact of the Enactment of the Sarbanes-Oxley Act

To test H2b, we examine whether the effect of common auditors on suppliers' performance is mitigated after SOX. We use the pre- and post-SOX three-year window to test the impact of SOX on the common auditor effect. We define the pre-SOX period as 2000–2002 and the post-SOX period as 2003–2005. Table 8 reports the subsample regression results of Equation (2). The coefficients of both *Pct_Common_Auditor* and *Dum_Common_Auditor* are positive and significant only in the pre-SOX subsample and are no longer significant in the post-SOX subsample. This result indicates that the positive effect of common auditors on suppliers' performance was mitigated after SOX, as common auditors might have had less opportunity and incentive to gain and transfer customer information to the supplier client after SOX.[12]

Cross-Sectional Tests

Customer Information Environments

To test H3a, we investigate suppliers' performance under different information asymmetry environments of their customers. In this section, we examine the common auditor effect under information asymmetry in the capital market and the operating information environments.

Firms with high uncertainty are likely to have high information asymmetry. Following Cai et al. (2016), we measure customers' capital market information environment by using their stock bid-ask spread in the stock market. Market

[10] As the data on auditor offices are available from 2000, the testing sample period is 2000–2016. Suppliers with no audit office data were deleted from the testing sample. If customers have no audit office data but use the same audit firm as their supplier, they are regarded as using an auditor office that is different from that of the supplier.

[11] We tried to fill the common audit office data prior 2000 by defining a common audit office as present when a supplier and a customer share the same audit firm and both supplier and customer have headquarters located in the same city. The regression results of this sample are shown in Online Appendix, Table OA3. The results are similar to the results shown in Table 7, except that the coefficient of *Pct_Common_Auditor_Different_Office* becomes significant, but its magnitude is still smaller than the coefficient of *Pct_Common_Auditor_Same_Office*.

[12] To examine the impact of nonaudit services on the SOX effect, we explore whether the influence of common auditors becomes more significant when the extent of nonaudit services provided to the supplier is greater, as indicated by higher nonaudit service fees. Our analysis, presented in an untabulated table, reveals supportive findings and indicates that the impact of common auditors is stronger when a higher volume of nonaudit services is extended to the supplier. However, this effect diminishes after 2002, coinciding with the implementation of stricter regulatory constraints on nonaudit services imposed by the SOX.

TABLE 7

Common Auditors and the Supplier's Profitability—Office Level

	(1)	(2)
Variables	***ROA***	
Pct_Common_Auditor_Same_Office	0.167**	
	(2.56)	
Pct_Common_Auditor_Different_Office	0.029*	
	(1.69)	
Dum_Common_Auditor_Same_Office		0.023***
		(2.96)
Dum_Common_Auditor_Different_Office		−0.000
		(−0.05)
Pct_Common_Firm_City	0.014	
	(0.39)	
Dum_Common_Firm_City		0.002
		(0.27)
Diff: *Same_Office − Different_Office*	0.138**	0.023***
p-value	0.035	0.004
Observations	17,286	17,286
R^2	0.541	0.541
Controls	Yes	Yes
Industry FE and Year FE	Yes	Yes
Firm Cluster	Yes	Yes

*, **, *** Indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively, and t-statistics are shown in parentheses. This table presents the empirical results of the association between the presence of common audit offices and the supplier's operating performance after controlling for the geographic closeness between the supplier and customer. The testing sample period is 2000–2016 because data on audit offices in the Audit Analytics database are only available from 2000.

Variable Definitions:
Pct_Common_Auditor_Same_Office = percentage of the supplier's sales to major customers that share the same audit office as the supplier;
Pct_Common_Auditor_Different_Office = percentage of the supplier's sales to major customers that share the same audit firm but that use audit offices different from those used by the supplier;
Dum_Common_Auditor_Same_Office = indicator that is equal to 1 if at least one of the major customers shares the same audit office with the supplier and 0 otherwise;
Dum_Common_Auditor_Different_Office = indicator that is equal to 1 if at least one of a supplier's major customers shares the same audit firm as the supplier but no customer uses the same audit office as the supplier and 0 otherwise;
Pct_Common_Firm_City = sales-weighted average of a supplier's customers whose headquarters are in the same city as the supplier's headquarters; and
Dum_Common_Firm_City = dummy variable that is equal to 1 if the headquarters of at least one of the customers is in the same city as the supplier's headquarters.
Appendix A provides the definition of all other variables.

makers use bid-ask spreads to protect themselves from losing money in trading with more informed investors, so the bid-ask spread could be used as a proxy for the customer's information-asymmetry level.[13] To conduct the cross-sectional test, we build a dummy variable to indicate the poorer information environment of customers. *High_Customer_Spread* is equal to 1 if a supplier's sales-weighted customer bid-ask spread is above the sample median and 0 otherwise. We include the interaction term between the common auditor's presence and *High_Customer_Spread* in Equation (2). Table 9, Panel A shows the regression results of the cross-sectional test. Column (1) shows that the coefficient of the interaction term between *Pct_Common_Auditor* and *High_Customer_Spread* is positive and significant. Column (2), in which *Dum_Common_Auditor* is used as an alternative measure of common auditor presence, also shows a positive and significant coefficient of the interaction term. The results demonstrate that the impact of common auditors

[13] Because the bid or ask prices of many firms in NASDAQ were not reported before 1983, we use the data sample from 1983–2016 for this test.

TABLE 8

Common Auditors and the Supplier's Profitability—Pre- and Post-SOX

	(1)	(2)	(3)	(4)
Variables	*ROA*			
Subsamples	**Pre-SOX**		**Post-SOX**	
Pct_Common_Auditor	0.135***		0.022	
	(2.68)		(0.67)	
Dum_Common_Auditor		0.026**		0.003
		(1.97)		(0.41)
SIZE	0.028***	0.028***	0.019***	0.019***
	(5.68)	(5.70)	(5.27)	(5.28)
LEV	−0.284***	−0.286***	−0.184***	−0.184***
	(−8.36)	(−8.40)	(−5.65)	(−5.65)
Lag_ROA	0.220***	0.220***	0.386***	0.386***
	(7.29)	(7.28)	(8.56)	(8.57)
AGE	0.002***	0.002***	0.001***	0.001***
	(3.78)	(3.77)	(2.60)	(2.59)
SG	0.014	0.014	0.037***	0.037***
	(1.32)	(1.29)	(3.44)	(3.44)
RD_Intensity	−1.404***	−1.403***	−0.801***	−0.800***
	(−14.71)	(−14.67)	(−7.15)	(−7.15)
AD_Intensity	−0.540	−0.529	−0.910**	−0.909**
	(−1.46)	(−1.43)	(−2.21)	(−2.21)
BigN	−0.023	−0.022	0.010	0.011
	(−1.02)	(−0.95)	(0.71)	(0.74)
Pct_Common_Analyst	−0.006	−0.005	0.003	0.003
	(−0.31)	(−0.27)	(0.24)	(0.25)
Pct_Common_Ownership	0.005	0.004	−0.011	−0.011
	(0.29)	(0.25)	(−0.95)	(−0.95)
CSIZE	0.004	0.004	0.002	0.002
	(0.95)	(0.98)	(0.64)	(0.66)
CAGE	0.000	0.000	−0.000	−0.000
	(0.72)	(0.67)	(−0.76)	(−0.78)
CSG	0.015	0.017	0.028	0.028
	(0.53)	(0.61)	(1.07)	(1.07)
LINKAGE	0.006***	0.006***	0.002**	0.002**
	(4.31)	(4.34)	(2.06)	(2.08)
CC	0.021	0.042	−0.002	0.002
	(0.41)	(0.85)	(−0.04)	(0.04)
Constant	−0.554***	−0.561***	−0.325***	−0.327***
	(−4.94)	(−5.01)	(−3.51)	(−3.54)
Observations	3,800	3,800	3,653	3,653
R^2	0.501	0.501	0.557	0.557
Industry FE and Year FE	Yes	Yes	Yes	Yes
Firm Cluster	Yes	Yes	Yes	Yes

*, **, *** Indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively, and t-statistics are shown in parentheses. This table presents the results of the impact of the Sarbanes-Oxley Act (SOX) on the common auditor effect on suppliers' performance. The pre-SOX subsample includes observations three years before SOX (2000–2002), and the post-SOX subsample includes observations three years after SOX (2003–2005).
Appendix A provides the definition of all other variables.

TABLE 9

Common Auditors and the Supplier's Profitability—Customer Information Asymmetry

Panel A: Capital Market Information Asymmetry

	(1)	(2)
Variables	***ROA***	
Pct_Common_Auditor × *High_Customer_Spread*	0.058**	
	(2.42)	
Pct_Common_Auditor	0.014	
	(0.90)	
Dum_Common_Auditor × *High_Customer_Spread*		0.018***
		(2.82)
Dum_Common_Auditor		−0.002
		(−0.42)
High_Customer_Spread	−0.002	−0.004
	(−0.33)	(−0.53)
Observations	24,240	24,240
R^2	0.522	0.522
Controls	Yes	Yes
Industry FE and Year FE	Yes	Yes
Firm Cluster	Yes	Yes

Panel B: Financial Reporting Quality

	(1)	(2)
Variables	***ROA***	
Pct_Common_Auditor × *High_Customer_EM*	0.049**	
	(2.14)	
Pct_Common_Auditor	0.026**	
	(1.97)	
Dum_Common_Auditor × *High_Customer_EM*		0.003
		(0.51)
Dum_Common_Auditor		0.006*
		(1.65)
High_Customer_EM	−0.004	−0.002
	(−1.25)	(−0.64)
Observations	39,307	39,307
R^2	0.516	0.516
Controls	Yes	Yes
Industry FE and Year FE	Yes	Yes
Firm Cluster	Yes	Yes

*, **, *** Indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively, and t-statistics are shown in parentheses. This table presents the results of cross-sectional tests based on the customers' information asymmetry. The total testing sample period in Panel A is 1983–2016 because of data availability.

Variable Definitions:

High_Customer_Spread = dummy variable that is equal to 1 if a supplier's customer-base sales-weighted bid-ask spread is above the sample median and 0 otherwise;

High_Customer_EM = dummy variable that is equal to 1 if the supplier's customer-base sales-weighted *EarningsManagement* is larger than the sample median; and

EarningsManagement = dummy variable that is equal to 1 if the customer's earnings just meet or beat the analyst forecast, i.e., the difference between the customer's earnings (EPS) and the analyst consensus forecast is non-negative and no larger than 0.01.

Appendix A provides the definition of all other variables.

on suppliers' performance is more pronounced when customers have a poorer information environment or when suppliers face higher information asymmetry of their customers.

In addition to the capital market environment, when the operating and financial information is more asymmetric between suppliers and customers, we also expect that the common auditor effect will be more pronounced. We use customers' earnings quality as the measure of their information asymmetry in the operating environment. Customers' earnings quality is regarded as low if their earnings just meet or beat analyst forecasts. Employing a cross-sectional analysis, we introduce a dummy variable, *High_Customer_EM*, which is equal to 1 if the supplier has a higher proportion of customers whose earnings just meet or beat analyst forecasts. Subsequently, we interact this variable with the two variables indicating common auditor presence. As shown in the regression results reported in Table 9, Panel B, we observe a positive and significant coefficient of the interaction term *Pct_Common_Auditor* × *High_Customer_EM*, which indicates that, when the customers' earnings quality is low, the common auditor effect is more pronounced. Findings from the above cross-sectional tests collectively demonstrate that, when information asymmetry along the supply chain is higher, common auditors hold more value for suppliers. This provides further evidence that the common auditor effect is derived from reducing information asymmetry.[14]

Suppliers' Dependence on Customers

To test H3b, we use customer concentration and customer-supplier relative size to measure suppliers' dependence on their major customers. When a supplier's sales are concentrated on several major customers, the supplier's performance is highly dependent on trading with those customers. When customers are much larger than their supplier, they dominate the supply chain relationship and have significant bargaining power, because their trading order accounts for a large proportion of the supplier's sales. Both higher customer concentration and larger customer-supplier relative size would increase suppliers' dependence on their customers.

First, we conduct the cross-sectional test based on customer concentration. We build a dummy variable to indicate higher supplier dependence: *High_CC* is equal to 1 if a supplier's customer concentration (*CC*) is above the sample median and 0 otherwise. We include the interaction term between the common auditor's presence and *High_CC* in Equation (2). Table 10, Panel A shows the regression results. Column (1) shows that the coefficient of the interaction term between *Pct_Common_Auditor* and *High_CC* is positive and significant. Column (2), in which *Dum_Common_Auditor* is used as an alternative measure of the common auditor's presence, also shows a positive and significant coefficient of the interaction term. The results support the argument that the association between common auditor presence and suppliers' performance is more pronounced when suppliers have higher customer concentration.

Second, we conduct the cross-sectional test based on the customer-supplier's relative size. We build another dummy variable to indicate higher supplier dependence: *High_Relative_Size* is equal to 1 if the customer-supplier relative size is above the sample median and 0 otherwise. The customer-supplier relative size is calculated as the ratio of the customer-base total assets to the supplier's total assets, where customer-base total assets are calculated as the sales-weighted average of the customer's total assets. We include the interaction term between the common auditor's presence and *High_Relative_Size* in Equation (2). Table 10, Panel B shows the regression results. Column (1) shows that the coefficient of the interaction term between *Pct_Common_Auditor* and *High_Relative_Size* is positive, although not significant. Column (2), in which *Dum_Common_Auditor* is used as an alternative measure of the common auditor's presence, shows a positive and significant coefficient of the interaction term. These results indicate that the common auditor effect is more pronounced when the customers' size is much larger relative to the size of the supplier.

The results from the two cross-sectional tests show that the common auditor effect on suppliers' performance is more pronounced when suppliers are more dependent on their customers. These findings demonstrate that common auditors have a stronger impact on suppliers' performance when suppliers face higher information asymmetry regarding their customers and when the information transfer is more valuable to suppliers; this is also consistent with the conjecture that common auditors can improve the supplier's performance by transferring customers' information to the supplier.

Length of Relationship

We expect the quality and importance of the information transferred by common auditors to have a great influence on suppliers' performance. We examine two relationships that affect the quality of the information transferred. The first

[14] In untabulated empirical results, we also find that common auditors are more effective in reducing the information asymmetry when the supplier's sales and customer's cashflows are more volatile. Furthermore, we find that the common auditor effect is marginally stronger when suppliers experience financial distress. These findings further support that common auditors can help improve suppliers' performance when the information obtained from common auditors is more valuable.

TABLE 10

Common Auditors and the Supplier's Profitability—Supplier Dependence

Panel A: Customer Concentration

	(1)	(2)
Variables	***ROA***	
Pct_Common_Auditor × *High_CC*	0.067**	
	(2.14)	
Pct_Common_Auditor	−0.022	
	(−0.74)	
Dum_Common_Auditor × *High_CC*		0.024***
		(4.29)
Dum_Common_Auditor		−0.006
		(−1.47)
High_CC	−0.004	−0.007*
	(−1.14)	(−1.86)
Observations	39,307	39,307
R^2	0.516	0.516
Controls	Yes	Yes
Industry FE and Year FE	Yes	Yes
Firm Cluster	Yes	Yes

Panel B: Customer-Supplier Relative Size

	(1)	(2)
Variables	***ROA***	
Pct_Common_Auditor × *High_Relative_Size*	0.027	
	(1.30)	
Pct_Common_Auditor	0.024*	
	(1.85)	
Dum_Common_Auditor × *High_Relative_Size*		0.013**
		(2.11)
Dum_Common_Auditor		0.001
		(0.29)
High_Relative_Size	0.010***	0.008**
	(2.73)	(2.27)
Observations	39,307	39,307
R^2	0.517	0.516
Controls	Yes	Yes
Industry FE and Year FE	Yes	Yes
Firm Cluster	Yes	Yes

*, **, *** Indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively, and t-statistics are shown in parentheses. This table presents the results of cross-sectional tests based on supplier dependence, which is measured by the supplier's customer-base concentration (Panel A) and the customer-supplier relative size (Panel B). The customer-supplier relative size is calculated as the ratio of the customer-base total assets to the supplier's total assets, where customer-base total assets are calculated as the sales-weighted average of the customers' total assets.

Variable Definitions:
High_CC = dummy variable that is equal to 1 if a supplier's customer concentration is above the sample median and 0 otherwise; and
High_Relative_Size = dummy variable that is equal to 1 if the customer-supplier relative size ratio is above the sample median and 0 otherwise.
Appendix A provides the definition of all other variables.

relationship is that between the customer's (common) auditor and the customer, which we label as the customer's "auditor tenure." The importance of the common auditor to the supplier will increase with the auditor's tenure with the customer. Longer tenure with a customer enriches the auditor's understanding of the customer and increases the value of the information transferred to the supplier. We conjecture that, when the customer's auditor tenure is longer, the common auditor effect will be stronger. The second relationship we examine is the length of the supply-chain partner relationship, which we call "duration." We expect a common auditor will be less important to the supplier if the supplier and the customer have been supply-chain partners for a longer time. This is because repeated interactions throughout a long trading relationship provide the supplier with a sound understanding of its customer, leaving less room for a common auditor to contribute.

To test H3c regarding customers' auditor tenure, we perform a cross-sectional test by using a dummy variable, *High_Auditor_Tenure_C*, which is equal to 1 if a supplier's customer-base auditor tenure is above the sample median and 0 otherwise; the customer-base auditor tenure is calculated as the sales-weighted average of the customers' auditor tenures. In regression Equation (2), we interact this dummy variable with the measures of the common auditor's presence. The regression results of this cross-sectional test are shown in Table 11, Panel A. In column (1), the coefficient of the interaction term between *Pct_Common_Auditor* and *High_Auditor_Tenure_C* is positive, although not significant. In column (2), the coefficient of the interaction term between *Dum_Common_Auditor* and *High_Auditor_Tenure_C* is positive and significant. This suggests that the positive association between the common auditor's presence and suppliers' performance is more pronounced when the customers' auditors have served those customers for a longer period.[15]

In addition, to test H3c regarding the supply chain duration, we also conduct a cross-sectional test based on the length of the supplier-customer pair relationship. Table 11, Panel B shows the regression results. We introduce a new variable, *Long_SC_Duration*, which is a dummy that is equal to 1 if the length of the supplier's customer-base, sales-weighted supply chain relationship is longer than the sample median and 0 otherwise. We find a negative and significant coefficient of the interaction term *Dum_Common_Auditor* × *Long_SC_Duration*, which shows that the common auditor effect is less pronounced when the supply chain duration is longer. The above findings indicate that, when the common auditor is more important and can provide more useful information to suppliers, the impact of the common auditor's presence on the supplier's performance is stronger.

Overall, the results of all the above cross-sectional tests indicate suppliers would benefit more from collecting customers' information when suppliers face higher information asymmetry regarding their customers and when the collected information is more valuable. These findings provide evidence of the information channel within the association between the presence of a common auditor and the performance of suppliers.

Common Auditors and Customers' Performance

As we find that the presence of a common auditor can improve supplier performance, whether this presence benefits or hurts the customers becomes an interesting question. Although disclosure of information about major suppliers is not required, we still run regression tests using currently available data on supply chain relationships to examine the impact of common auditors on customers' performance.

To conduct the test, we still utilize the regression Equation (2) but define the variables from the customers' perspective and aggregate the observations at the customer-year level. The descriptive statistics and the variable definition of this test are listed in Online Appendix, Tables OA4 and OA5. Regression results are listed in Online Appendix, Table OA6. We find positive and slightly significant coefficients of the variables that measure the presence of a common auditor. The results provide some evidence that a common auditor might also help improve customer performance and lead to a win-win situation in the supply chain relationship. The results in this section should be interpreted with caution due to data limitations. Since customers can use their stronger bargaining power to extract information directly from suppliers, the benefit of knowledge spillover via a common auditor may be limited.

Robustness Tests

DiD Test with Big N Auditor Mergers

Our study might be subject to endogeneity concerns. Common auditors might help customers to select high-performing suppliers. Unobservable variables related to both the common auditor's presence and the supplier's performance might be omitted. To address these endogeneity concerns, we conduct a DiD test based on audit-firm merger events. If a supplier's audit firm merges with the audit firm of its customer, the supplier and customer will share a

[15] In untabulated empirical results, we also find that a longer common auditorship period allows for a greater transfer of customer information from the common auditor to the supplier, enhancing the supplier's performance.

TABLE 11

Common Auditors and the Supplier's Profitability—Relationship Length

Panel A: Customers' Auditor Tenure

	(1)	(2)
Variables	***ROA***	
Pct_Common_Auditor × *High_Auditor_Tenure_C*	0.031	
	(1.15)	
Pct_Common_Auditor	0.015	
	(0.59)	
Dum_Common_Auditor × *High_Auditor_Tenure_C*		0.016***
		(2.85)
Dum_Common_Auditor		−0.002
		(−0.43)
High_Auditor_Tenure_C	−0.003	−0.005
	(−1.07)	(−1.56)
Observations	39,307	39,307
R^2	0.516	0.516
Controls	Yes	Yes
Industry FE and Year FE	Yes	Yes
Firm Cluster	Yes	Yes

Panel B: Supply Chain Duration

	(1)	(2)
Variables	***ROA***	
Pct_Common_Auditor × *Long_SC_Duration*	−0.016	
	(−0.80)	
Pct_Common_Auditor	0.045***	
	(2.74)	
Dum_Common_Auditor × *Long_SC_Duration*		−0.012**
		(−2.30)
Dum_Common_Auditor		0.012***
		(2.83)
Long_SC_Duration	0.020***	0.022***
	(5.81)	(6.08)
Observations	39,307	39,307
R^2	0.517	0.517
Controls	Yes	Yes
Industry FE and Year FE	Yes	Yes
Firm Cluster	Yes	Yes

*, **, *** Indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively, and t-statistics are shown in parentheses. This table presents the results of cross-sectional tests based on the importance of the common auditor, which is measured by the length of the auditor relationship (Panel A) and supply chain relationship (Panel B).

Variable Definitions:

High_Auditor_Tenure_C = dummy variable that is equal to 1 if a supplier's customer-base sales-weighted auditor tenure is above the sample median and 0 otherwise; and

Long_SC_Duration = dummy that is equal to 1 if the supplier's customer-base sales-weighted supply chain relationship length is longer than the sample median and 0 otherwise.

Appendix A provides the definition of all other variables.

common auditor after the merger. An audit-firm merger event is an exogenous shock for the supplier, as it is not likely controlled by the supplier. In 1989, Touche Ross merged with Deloitte, Haskins, and Sells to form Deloitte and Touche and Arthur Young merged with Ernst and Whinney to form Ernst & Young. In 1998, Coopers & Lybrand merged with Price Waterhouse to form PricewaterhouseCoopers. We use a four-year window that includes, as the DiD sample period, two years before each merger and two years afterward (including the year of merger); specifically, we include the years 1987–1990 and 1996–1999. The treatment group includes suppliers who used Touche Ross, Arthur Young, or Coopers & Lybrand as their external auditors and shared no common auditors with their customers before the merger (i.e., in 1987–1988 or 1996–1997) but started to share common auditors with their customers as a result of the merger (i.e., in 1989–1990 or 1998–1999). The control group includes suppliers who shared no common auditors with their customers during the four-year window (i.e., 1987–1990 or 1996–1999). We estimate Equation (6):

$$ROA_{it} = \beta_0 + \beta_1 Treat_{it} + \beta_2 Post_{it} + \beta_3 Treat_{it} \times Post_{it} + \gamma Controls_{it} + \in_{it} \quad (6)$$

where *Treat* is an indicator variable that equals 1 if the observation is in the treatment group and 0 otherwise. *Post* is an indicator that equals 1 if the observation is after the mergers (i.e., in 1989–1990 or 1998–1999) and 0 otherwise. The coefficient of *Treat* × *Post* is expected to be positive and significant.

We use propensity-score matching (PSM) to address potential sample selection concerns. We conduct the PSM by using Kernel matching and the Logit model based on the control variables of the characteristics of the supplier and its customers.[16] Table 12, Panel A shows the PSM matching results. Based on the t-statistics of each control variable, we find no significant difference between the treated group and the control group after the PSM matching. Then, we use the matched sample to conduct the DiD test.[17] Table 12, Panel B reports the regression result of Equation (6). The coefficient of *Treat* × *Post* is positive and significant, suggesting that the common auditor presence caused by the auditor mergers has a significant and positive effect on suppliers' *ROA*. The DiD design has limitations, as the audit-firm merger might influence the supplier's audit quality and the supplier's reported *ROA*.

Subsample Test of Suppliers with Only Big N Auditors

Another concern of the regression results is that Big N auditors dominate supplier and major customer firms in the United States. Given that suppliers with non-Big N auditors are unlikely to share a common auditor with their customers, our findings may be influenced by the limited number of suppliers who use non-Big N auditors. To address this concern, we exclude the suppliers with non-Big N auditors from our testing sample; the results are still similar and are listed in Online Appendix, Table OA7.[18]

Lead-Lag Analysis

There might be a reverse causality concern about our findings: more profitable firms are more likely to use Big N auditors, which may increase the probability of the presence of a common auditor. To alleviate this concern, we conduct the lead-lag analysis by using the lagged one-year variables of common auditor presence (*Pct_Common_Auditor* and *Dum_Common_Auditor*) in our baseline test. In the regression results shown in Online Appendix, Table OA8, we still find positive and significant coefficients of the lag-1-year term variables of a common auditor's presence, which indicates that common auditors can also improve the supplier's performance in the next year.

Matched Sample of Common Auditor Presence

Some characteristics of the observations might be correlated with the presence of a common auditor. To reduce the concern regarding a systematic difference between firm-years with common auditors and firm-years with different auditors in our sample, we use the PSM method to match the noncommon auditor group observations with the common-auditor group observations and rerun the baseline regression. We use the neighbor 1:1 matching of PSM based on the control variables listed in the baseline test. In the regression results using this matched sample shown in Online Appendix, Table OA9, we still find significant results of the common auditor effect on the supplier's performance.

[16] As merger events are infrequent, resulting in a small treatment group unsuitable for 1:1 matching PSM, we employ Kernel matching to guarantee an adequate sample size in our difference-in-differences (DiD) design.

[17] In untabulated tables, we also find consistent results using the entropy balancing method to get the matched sample for the DiD test.

[18] We also perform a robustness test by concentrating on suppliers who have at least two major customers. In these cases, the probability of having a shared auditor with one of the customers is significantly increased, given the limited choice of auditors. However, if the presence of common auditors increases without helping transfer valuable information, we may fail to find significant effect of common auditors on supplier performance. Despite this, we still find consistent evidence that sharing a common auditor with at least one of the customers is associated with better supplier performance. For brevity, this result is not tabulated in the paper.

TABLE 12

Common Auditors and the Supplier's Profitability—DiD Test with Audit-Firm Mergers

Panel A: PSM Matching Results

	Mean		t-statistics
Variables	**Treated**	**Control**	**p-value**
SIZE	18.391	18.454	0.838
LEV	0.559	0.547	0.819
Lag_ROA	0.023	0.019	0.900
AGE	10.367	11.598	0.472
SG	0.164	0.172	0.914
RD_Intensity	0.030	0.032	0.866
AD_Intensity	0.027	0.021	0.562
BigN	0.983	0.994	0.606
Pct_Common_Analyst	0.035	0.051	0.626
Pct_Common_Ownership	0.421	0.372	0.563
CSIZE	22.437	22.635	0.742
CAGE	21.370	22.225	0.683
CSG	0.116	0.114	0.944
LINKAGE	4.459	4.728	0.597
CC	0.068	0.074	0.723

Panel B: DiD Test

Variables	***ROA***
Treat	0.016
	(1.01)
Treat × *Post*	0.040**
	(2.02)
Observations	2,129
R^2	0.578
Controls	Yes
Industry FE and Year FE	Yes
Firm Cluster	Yes

*, **, *** Indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively, and t-statistics are shown in parentheses. This table presents the results of the DiD test based on the three Big N auditor mergers in 1989 and 1998. The testing sample period is the pre and post two years relative to the event years. The treatment group includes supplier firms using Touche Ross or Arthur Young as auditors in 1988 or Coopers & Lybrand in 1997 and having no common auditor before the mergers but having common auditors after the mergers within the testing sample period. The *Post* variable is omitted because of the control of year-fixed effect.

Variable Definitions:
Treat = an indicator variable that is equal to 1 if the observations are in the treatment group and 0 otherwise; and
Post = an indicator variable that is equal to 1 if the observations are two years after the mergers of Touche Ross and Arthur Young (i.e., in 1989 and 1990) or two years after the merger of Coopers & Lybrand (i.e., in 1998 and 1999) and 0 otherwise.
Appendix A provides the definition of all other variables.

Regression with Firm Fixed Effect

In the previous regressions, we use industry fixed effects to control for time-invariant factors. To reduce the concern of potential omitted variables, we use the firm fixed effect to substitute for the industry fixed effect in our regression. In the results of baseline regression with firm fixed effect shown in Online Appendix, Table OA10, we still find a positive and significant coefficient of *Pct_Common_Auditor*. The coefficient of *Dum_Common_Auditor* is not significant, which could be due to low variation in the supplier's status regarding the presence of a common auditor, as a firm is less likely to change its auditor often. These findings alleviate the concern that the common auditor effect is influenced by omitted variables.

Additional Controls

In this subsection, we further control for variables that potentially influence supplier performance. First, there is a slight chance that our finding might be driven by the effect of common management—such as a common CEO, Chief Financial Officer (CFO), or director—which could improve the information environment and supply chain coordination. As shown in columns (1) and (2) of Online Appendix, Table OA11, we still find a significant common auditor effect after controlling for the presence of common management, which further alleviates the concern that our finding might be driven by the presence of common third parties.

Furthermore, an industry-specialist auditor could improve the supplier's performance by providing particular industry knowledge, which may drive our findings. In columns (3) and (4) of Online Appendix, Table OA11, we continue to observe a significant common auditor effect after controlling for the supplier's auditor as an industry specialist. This finding further proves that our results are robust to the characteristics of the auditor.

In addition, our finding could be driven by the increased RSI (Dhaliwal et al. 2017) instead of by reduced information asymmetry and improved operating efficiency. Columns (5) and (6) of Online Appendix, Table OA11 show that the results of the common auditor effect remain after the additional control of the supplier's patent crosscitations with customers. This finding alleviates the concern that our finding might be driven by the alternative explanation of RSI.

VI. CONCLUSION

Common auditors in the supply chain could transfer information between a supplier and its customers and could influence the performance of the supplier. Using U.S.-listed firm data for 1980–2016, we find that common auditors in the supply chain are associated with higher performance by supplier firms. Specifically, we find that common auditors have a positive and significant effect on suppliers' ROA, which is mainly driven by the increase in suppliers' gross margin. Furthermore, suppliers who use the same auditor as their customers show lower distortion in customer demand and shorter periods for accounts receivable collection, which could contribute to the suppliers' production efficiency and increase profitability. We also find that the impact of common auditors on suppliers' performance is more pronounced if both suppliers and customers use auditors located in the same office than when they only use the same audit firm. The performance enhancement is also more significant during the pre-SOX period, when auditors could provide both audit and nonaudit services to the same client. Furthermore, we find that the common auditor effect is more pronounced when suppliers face higher information asymmetry regarding their customers, when suppliers are more dependent on their major customers, and when the auditor tenure of customers is longer. These empirical findings indicate that common auditors can improve supplier performance by facilitating information flow along the supply chain, and the results are robust to alternative measures of common-auditor presence, alternative explanations, and potential endogeneity concerns.

There are several limitations of this study. First, the data show only suppliers' major customers, but not customers' major suppliers; as a result, the average size of customers is much larger than that of suppliers. Thus, the research findings of this study might not be generalized to all supply chain relationships. Second, because our data are limited by the lack of information on major suppliers, our evidence on the effect of common auditors on the customers' performance has to be interpreted with caution.

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APPENDIX A

Variable Definitions

Variables	Definition
Main Variables	
ROA	Suppliers' *ROA* measured as the ratio of net income to total assets.
Pct_Common_Auditor	The percentage of suppliers' sales to the major customers that use the same audit firm as the supplier.
Dum_Common_Auditor	Dummy variable equals 1 if at least one of the major customers use the same audit firm as the supplier and 0 otherwise.
Pct_Common_Auditor_Same_Office	The percentage of supplier's sales to the major customers that use the same audit office as the supplier.
Pct_Common_Auditor_Different_Office	The percentage of supplier's sales to the major customers that use the same audit firm but different audit offices as the supplier.
Dum_Common_Auditor_Same_Office	Dummy variable equals 1 if at least one of the major customers use the same audit office as the supplier and 0 otherwise.
Dum_Common_Auditor_Different_Office	Dummy variable equals 1 if at least one of the major customers use the same audit firm as the supplier but no customer uses the same audit office as the supplier and 0 otherwise.
ATO	Suppliers' assets turnover calculated as sales divided by total assets.
PM	Suppliers' profit margin calculated as net income divided by sales.
OM	Suppliers' operating margin calculated as operating income before depreciation divided by sales.
NOM	Suppliers' nonoperating margin calculated as the difference between profit margin and operating margin.
SGA	Suppliers' SG&A ratio calculated as SG&A expenses divided by sales.
GM	Suppliers' gross margin calculated as the ratio of the difference between sales and cost of goods sold to sales.
Bullwhip_Effect	Suppliers' bullwhip effect, measured as the ratio of *PRODUCTION*'s standard deviation to *DEMAND*'s standard deviation in a fiscal year. *PRODUCTION* is the first difference of the logarithm of suppliers' production measured as cost of goods sold plus inventory changes in every quarter. *DEMAND* is the first difference of the logarithm of customers' demand measured as supplier's quarterly cost of goods sold.
AB_PROD	Suppliers' abnormal production costs borrowed from Roychowdhury (2006) where the production cost is calculated by cost of goods sold plus change of inventory.
Days of Receivables	Suppliers' receivables conversion period measured as dividing accounts receivable by sales and multiplying 365 days.
Operating Cycle	Suppliers' operating cycle measured as the sum of days of inventory and days of receivables.
Control Variables	
SIZE	Suppliers' firm size measured as the natural logarithm of total assets.
LEV	Suppliers' leverage calculated as total liabilities divided by total assets.
Lag_ROA	Suppliers' prior-year *ROA*.
AGE	Suppliers' firm age measured as the difference between current fiscal year and corporate IPO year.
SG	Suppliers' sales growth calculated as the difference of current-year sales and previous-year sales, divided by previous-year sales.
RD_Intensity	Suppliers' R&D intensity measured as the ratio of R&D expenses to total assets (0 if missing).
AD_Intensity	Suppliers' advertising intensity measured as the ratio of advertising expenses to total assets (0 if missing).

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APPENDIX A (continued)

Variables	Definition
BigN	Dummy variable equals 1 if the supplier's auditor is one of the Big N auditor firms and 0 otherwise.
Pct_Common_Analyst	Sales-weighted percentage of the major customers that have at least one common analyst with the supplier.
Pct_Common_Ownership	Sales-weighted percentage of the major customers that have at least one common institutional investor with the supplier in more than two quarters in a year.
CSIZE	Sales-weighted average of major customers' firm size.
CAGE	Sales-weighted average of major customers' firm age.
CSG	Sales-weighted average of major customers' sales growth.
LINKAGE	Sales-weighted average of major customers' relationship duration with the supplier. The customer' relationship duration with a specific supplier is counted as the years that the customer has been in the supply chain relationship with this specific supplier until current fiscal year. The relationship duration is calculated starting from 1977, when the data of major customers are available.
CC	Customer concentration measured as the sum of the squares of sales share accounted for by each major customer.
Days of Inventory	Suppliers' inventory conversion period measured as dividing inventory by cost of goods sold and multiplying 365 days.
Days of Payables	Suppliers' payables conversion period measured as dividing accounts payable by cost of goods sold and multiplying 365 days.
Lag_Bullwhip_Effect	Suppliers' prior-year *Bullwhip_Effect.*
SEASONALITY	The seasonality of customers' demand, calculated as the difference between the variance of customers' *DEMAND* and the variance of customers' deseasonalized *DEMAND*, divided by the variance of customers' *DEMAND*. Quarterly data are used to measure variances for each year. Deseasonalized *DEMAND* is defined as the residuals obtained from regressing *DEMAND* of each company on the quarter dummy variables. *DEMAND* is the first difference of the logarithm of customers' demand measured as supplier's quarterly cost of goods sold.
AR1RHO	The autoregressive coefficient of deseasonalized *DEMAND*, which is estimated by using quarterly data in each year.
Pct_Common_Firm_City	Sales-weighted average of a supplier's customers whose headquarters are in the same city as the supplier's headquarters.
Dum_Common_Firm_City	Dummy variable that is equal to 1 if at least one of the customers' headquarters is in the same city as the supplier's headquarters.
High_Customer_Spread	Dummy variable that is equal to 1 if a supplier's customer-base sales-weighted bid-ask spread is above the sample median and 0 otherwise.
High_Customer_EM	Dummy variable that is equal to 1 if the supplier's customer-base sales-weighted *EarningsManagement* is larger than the sample median. We define the customer's *EarningsManagement* as a dummy variable that is equal to 1 if the customer's earnings just meet or beat the analyst forecast, i.e., the difference between the customer's earnings (EPS) and the analyst consensus forecast is non-negative and no larger than 0.01.
High_CC	Dummy variable that is equal to 1 if a supplier's customer concentration (*CC*) is above the sample median and 0 otherwise.
High_Relative_Size	Dummy variable that is equal to 1 if the customer-supplier relative size ratio is above the sample median and 0 otherwise. The customer-supplier relative size is calculated as the ratio of the customer-base total assets to the supplier's total assets, where customer-base total assets are calculated as the sales-weighted average of the customers' total assets.

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APPENDIX A (continued)

Variables	Definition
High_Auditor_Tenure_C	Dummy variable that is equal to 1 if a supplier's customer-base sales-weighted auditor tenure is above the sample median and 0 otherwise.
Long_SC_Duration	Dummy variable that is equal to 1 if the supplier's customer-base sales-weighted supply chain relationship length is longer than the sample median and 0 otherwise.
Treat	Dummy variable that is equal to 1 if the observations are in the treatment group and 0 otherwise. The treatment group includes supplier firms using Touche Ross or Arthur Young as auditors in 1988 or Coopers & Lybrand in 1997 and having no common auditor before the mergers but having common auditors after the mergers within the testing sample period.
Post	Dummy variable that is equal to 1 if the observations are two years after the mergers of Touche Ross and Arthur Young (i.e., in 1989 and 1990) or two years after the merger of Coopers & Lybrand (i.e. in 1998 and 1999) and 0 otherwise.