

The effect of management information quality on external stakeholders: evidence from suppliers

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Abstract

Purpose – This study investigates how the quality of internal information within a firm impacts its external stakeholders, focusing on the investment behaviors of suppliers. It aims to determine whether higher-quality demand information from a customer reduces uncertainty to increase investment in working capital (real options view) or reduces working capital levels to increase efficiency (operations view).

Design/methodology/approach – The study uses revenue guidance and financial restatements as a proxy for information quality shared with customers. I estimate the impact of information quality on investments in working capital for the customer, including inventory and accounts receivable. I also examine how customer information quality affects sensitivity to general uncertainty.

Findings – The study finds that suppliers invest more in working capital and exhibit reduced sensitivity to uncertainty when their customers provide high-quality demand information (real options view). Customer revenue forecasts are associated with lower expected volatility and higher levels of supplier investment. The results suggest that high-quality internal information facilitates better decision-making within the firm and extends to external stakeholders, such as suppliers.

Originality/value – This research empirically demonstrates the positive effects of internal information quality on external stakeholders, highlighting the role of high-quality demand information in reducing investment uncertainty for suppliers. It contributes to the literature on investment under uncertainty and supply chain information dynamics, providing evidence that publicly disclosed forecasts are a valid proxy for internal information quality.

Keywords Supply chain, Investment, Customer, Supplier, Disclosure, Internal information quality

Paper type Research article

1. Introduction

High-quality internal information is vital for managers to make operational and strategic decisions. Information quality affects all types of decisions from investment, acquisitions, capital structure, etc. (Lassoued, 2022; Chen *et al.*, 2018). Academic research on accounting quality has also recognized the importance of internal information quality and described links between a firm's accounting quality and several important firm outcomes (Antle and Eppen, 1985; Bento *et al.*, 2018; Felix, 2018; Gallemore and Labro, 2015). While internally generated information is generally intended to facilitate decisions within the firm, the knowledge that comes from creating internal information can affect the quality of information shared with external users (Hemmer and Labro, 2008; Ittner and Michels, 2017; Verrecchia, 1990). A firm's suppliers are dependent on the customer for information about future demand. Therefore, I focus on the effect of a customer's information quality (CIQ) on the supplier's information environment and investment decisions.

Customers with higher-quality internal information have more opportunity to share quality information with their suppliers [1]. However, the effect of CIQ on a supplier's operations is less clear, particularly when considering a supplier's choice to handle inventory and other working capital that relates to a customer. On one hand, better information reduces investment uncertainty for suppliers leading to more total investment (Arif *et al.*, 2016; Dixit and Pindyck, 1994; Leahy and Whited, 1996). Arif *et al.* (2016) demonstrate a negative relation between a company's uncertainty and investment in working capital. Alternatively, high-quality demand



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information may facilitate efficient operations and approaches to just-in-time manufacturing that reduce working capital (Alles *et al.*, 2000; Zelbst *et al.*, 2014).

I focus on suppliers as a potential beneficiary of higher quality internal information for several reasons. First, suppliers are important stakeholders of their customer firms, and the effect of information quality on suppliers is of interest to the accounting profession. Second, information about future demand is an important factor in nearly all investment decisions. Compared to suppliers, customers have superior understanding and access to recent information about the end consumer and make more accurate predictions about upcoming changes in demand (Lee *et al.*, 1997). Finally, customers and suppliers share a substantial amount of information. The supplier always has information about the customer's orders, but it is also common for suppliers to access customer inventory information and have regular contact with the customer's managers. The customer's management can share information related to shifts in demand, changes in the customer's strategy, and other information relevant to the supplier's business.

Because direct communication between a customer and a supplier is inherently unobservable, I use customers' voluntary disclosures as proxies for the quality of information they share with their suppliers. Prior research links the quality of publicly disclosed information to the quality of internal information that the firm uses for investment decisions (Goodman *et al.*, 2014; Hemmer and Labro, 2008; McNichols and Stubben, 2008; Trueman, 1986; Verrecchia, 1990). Intuitively, if a customer can accurately predict demand, then it can use that ability to make public sales forecasts. The customer can also use that ability to share high quality information with its suppliers. My primary proxy for customer information quality (CIQ) is an indicator variable for whether or not the customer issues a sales forecast [2]. Verrecchia (1990) predicts that a manager is more likely to disclose private information when that information is more precise. If a customer's revenue forecast is indicative of high-quality information about demand, then customers that issue revenue forecasts have better demand information to share with their suppliers. Additionally, I use an indicator for earnings forecasts as a proxy for CIQ. Earnings forecasts (1) are more common, (2) represent information quality beyond demand, and (3) are specifically linked to higher-quality internal information (Ittner and Michels, 2017). Because a customer's major information advantage comes from superior understanding of consumer demand, I expect sales forecasts to be highly associated with supplier decision making. However, additional information about costs and risks in earnings information may also be useful to suppliers.

My second construct of interest is a company's uncertainty regarding returns on investment. I use the supplier's expected stock return volatility as a proxy for this uncertainty (Eisdorfer, 2008; Arif *et al.*, 2016). The supplier's volatility captures information that investors deem to be relevant in predicting future cash flows and approximates the uncertainty that a manager faces when making an investment decision (Leahy and Whited, 1996). Finally, I investigate the company's investment in working capital as a relevant issue related to the customer and due to the paradoxical nature of investment in working capital under uncertainty (Arif *et al.*, 2016; Fairfield *et al.*, 2003).

The underlying relationships between customer information quality, the supplier's uncertainty, and supplier investment levels lead to several testable hypotheses. First, I expect to find a negative relation between the customer's information quality and the supplier's expected volatility. Second, the effect of the customer's information quality on the supplier's investment in working capital is theoretically unclear and primed for testing. Third, the relation between a customer's information quality and the supplier's investment in working capital will be mediated by the supplier's expected volatility.

My final prediction allows for the possibility that the shared information is private, so that observed stock volatility does not incorporate the shared information that affects the supplier's uncertainty. Like prior research that examines how an information source mitigates the effect of observed uncertainty when that measured uncertainty is unaffected by the information source in question, I expect to observe an attenuated relation between the supplier's expected

volatility and the supplier's investment levels when customer information quality is higher (Czarnitzki and Toole, 2011; Wellman, 2017) [3].

I construct a sample of public customer-supplier pairs from 2001–2018. The results indicate that, when customers issue sales forecasts, their suppliers experience lower expected volatility, consistent with high-quality demand information reducing supplier uncertainty. However, I do not find a detectable difference in the supplier's expected volatility when customers issue an earnings forecast. Second, customer revenue forecasts are associated with higher levels of supplier investment, but that association does not hold for earnings forecasts. My third test indicates that the relation between customer sales forecasts and supplier investment levels is weaker when accounting for the supplier's expected volatility, consistent with the effect of CIQ on supplier investment working through supplier uncertainty. Overall, these results provide evidence that high-quality customer demand information has a positive influence on a supplier's investment levels. This is consistent with working capital decisions being dominated by the effects of investment under uncertainty and not the use of information to improve operational efficiency.

My second set of tests examines whether the customer's information mitigates the effect of observed uncertainty on supplier investment levels. The relation between a supplier's investment in working capital assets and expected volatility is attenuated when a customer issues sales forecasts. However, this is not the case when a customer issues an earnings forecast. These results are consistent with the previous set of results, but provide evidence that the effects are driven by private communication. Taken together, the results suggest that demand information has a positive influence on supplier investment levels by reducing the supplier's uncertainty.

In addition to these tests, I use customer financial statement restatements as an additional proxy for CIQ. I test whether the supplier's investment is affected during periods that are eventually restated by the customer. I do not find that customer restatements are related to the supplier's observed uncertainty, but I do find that the relation between volatility and investment is weaker for suppliers during these periods. This result is consistent with customers producing lower quality information during restated periods, but the market not capturing that uncertainty because the information is not yet public.

My results contribute to several lines of research. First, I add to the literature on the effect of uncertainty on investment. These studies generally indicate a negative relation between investment and uncertainty, and several focus on an economic force or incentive that mitigates the response to uncertainty [4]. Within the accounting literature, Wellman (2017) examines political connections as a source of information that reduces uncertainty regarding returns from investments. While she finds that access to information mitigates the effect of uncertainty, I find that information quality not only decreases suppliers' investment sensitivity to observable uncertainty, but also reduces observable uncertainty. Both of these effects imply that improved information systems may lead to more real investment.

I also contribute to a growing stream of research that examines the effect of information along the supply chain. Researchers who examine the effect of customer's information on the supplier generally focus on how the information is processed by a third party (Dhaliwal *et al.*, 2025; Files and Gurun, 2018; Madsen, 2017). Recent research also examines how customer's public disclosures affect supplier profitability and investment efficiency (Chen *et al.*, 2018; Chiu *et al.*, 2018; Radhakrishnan *et al.*, 2014). I contribute to this stream of research by testing how customer information affects the quality of supplier information, allowing higher quality information to be communicated privately from the customer to the supplier, and examining the theoretically ambiguous effect of information quality on working capital decisions.

Finally, I advance the literature on the link between disclosure choice and the quality of a firm's internal information (Trueman, 1986; Verrecchia, 1990; Goodman *et al.*, 2014; Itner and Michels, 2017). These prior studies either derive a theoretical association between disclosure and information quality, associate outcomes from internal decision-making processes with disclosures, or associate disclosure quality with data about a firm's internal

systems. In contrast, I examine a setting that is known to have substantial private information flow and provide evidence that the quality of shared information is associated with disclosure choice. Additionally, separating the investment decision from the disclosure choice strengthens the inferred connection between disclosure and internal information quality (Chen *et al.*, 2018).

2. Hypothesis development

2.1 *Real options and investment under uncertainty*

A stream of research in economics has long investigated the effect of uncertainty on investment (Abel, 1983; Abel and Eberly, 1994; Bernanke, 1983; Dixit and Pindyck, 1994; Hartman, 1972) [5]. This literature predicts a negative relation between uncertainty and investment under certain conditions. If an investment opportunity has some degree of irreversibility, uncertainty, and the manager has leeway over the timing of investment, then the option to wait is valuable and that value increases in the uncertainty of returns on investment (Dixit and Pindyck, 1994). A manager will choose to exercise the option to wait so long as the expected value of immediate investment does not exceed the value of the option. As the value of the option increases in uncertainty, the manager will reject more projects if uncertainty is high, reducing overall investment. Leahy and Whited (1996) find a negative relation between uncertainty and investment by examining the relation between a firm's stock price volatility and capital expenditures in a set of manufacturing firms. A number of other studies examine volatility and investment and continue to observe the negative relation (Arif *et al.*, 2016; Bulan *et al.*, 2009; Bulan, 2005; Eisdorfer, 2008; Ogawa and Suzuki, 2000).

Panousi and Papanikolaou (2012) examine managerial risk aversion as a contributing factor to the relation between investment and uncertainty along with factors that can mitigate the effect of uncertainty. They find a negative relation between uncertainty and idiosyncratic volatility and find that this relation varies with the ownership stake that the manager has in the firm. They also find that this effect is weaker when an owner has more option-based compensation and when the firm has high institutional ownership, suggesting that the relation between uncertainty and investment partially operates through managerial risk aversion.

Because the negative relation between uncertainty and investment implies lost investment opportunities, a number of studies have examined mechanisms that mitigate the negative effect of uncertainty. Czarnitzki and Toole (2011) find that patent protection can help spur more innovation by reducing the effect of uncertainty on investment. Czarnitzki and Toole (2011) find that government R&D subsidies reduce the negative effect of product market uncertainty on investment, while Czarnitzki and Toole (2011) conclude that the volatility of new product sales has a weaker effect on firms that have more existing patents. Julio and Yook (2012) investigate the effect of uncertainty from political elections on firm level investment across 50 countries. They find that upcoming elections reduce investment across the full sample, but that countries with common-law systems, more stable governments, governments that play a smaller role in the economy, and governments with a system of checks and balances have a smaller decrease in investment prior to political elections.

Wellman (2017) investigates how information can alter the effect of political uncertainty on investment. She builds on prior research that finds a negative relation between political uncertainty and investment and tests whether access to political information improves a managers information set, causing a relatively weaker relation between observed political uncertainty and investment (Baker *et al.*, 2016; Julio and Yook, 2012). She finds that firms that make more political contributions have weaker investment response to political uncertainty, suggesting that managers of these firms perceive lower spreads in their firms' potential returns due to general political uncertainty. Similarly, I investigate information flow from a major customer and test whether the customer's information quality affects the uncertainty of the supplier and alters investment levels.

Arif *et al.* (2016) investigate the effect of uncertainty on working capital investment. Working capital is an important investment but differs in important ways from the capital investments studied in the majority of the literature. Namely, working capital is a short-term asset that does not actively produce for a company, but allows for operations to continue. Excessive in working capital tends to generate expenses as opposed to allow for operation. This dynamic has led to competing theories that suggest higher quality information should reduce levels of working capital (Alles *et al.*, 2000). Arif *et al.* (2016) provides evidence that uncertainty and working capital have the same general relation that we see between uncertainty and longer-term investments. However, it is unclear that information quality from a customer would have the same directional effect. In particular, quality demand information may do more for a supplier's operational efficiency than general reduction of uncertainty because it would more closely facilitate lean operations.

2.2 *The operations effect and customer-supplier relationships*

The link between customers and suppliers offers a promising setting to examine external information affecting a firm's uncertainty. First of all, customers are generally better informed about downstream demand for the final product than their suppliers. Customers tend to have closer relationships with the final consumer and are better informed about upcoming production schedules and other factors relevant to the supplier's business (Lee and Whang, 2000). Additionally, we know that there is significant information flow along the supply chain, making it likely that relevant private information to a customer is being passed on to the supplier (Andon *et al.*, 2015).

Although suppliers are an important stakeholder in a customer firm, and the customer's information should be valued by the supplier, the majority of studies in accounting that assess the value of a customer's information to a supplier investigate how information about the customer affects assessments of the supplier by a third party. For example, Olsen and Dietrich (1985) study the effect of a customer's information on the supplier's shareholders. They find that major retailers' sales information affects security returns of their suppliers, while Cohen and Frazzini (2008) find that a customer's earnings predict the supplier's future returns. Files and Gurun (2018) find that lenders require a higher interest rate from suppliers after a major customer has had a restatement and that the effect on interest rates is more pronounced when a supplier has higher switching costs. Finally, both auditors and analysts produce higher quality outputs for the supplier when they work with major customers as well (Dhaliwal *et al.*, 2025; Guan *et al.*, 2015; Johnstone *et al.*, 2014; Luo and Nagarajan, 2015; Nelson *et al.*, 2025). These studies suggest that customer information is valued by third parties that are assessing a supplier.

Other closely related studies examine how customer information affects the supplier itself. Raman and Shahrur (2008) predict that customers will manipulate publicly available information to induce relationship-specific investment by their suppliers. They find that when industries require more relationship-specific investment they tend to have higher levels of absolute discretionary accruals and that customers manipulate earnings to induce investment by suppliers. Radhakrishnan *et al.* (2014) examines the relation between customer information quality and supplier performance. Chen *et al.* (2018) examines the text of management earnings forecasts and its relation to investment efficiency. Chiu *et al.* (2018) looks at the relation between risk factor disclosures and supplier investment efficiency. These studies provide evidence that suppliers use publicly observable information from their customers to make investment decisions.

Research in supply chain management examines the effect of information passing along the supply chain (Cachon and Lariviere, 2001; Chatfield *et al.*, 2004; Lee *et al.*, 1997; Taylor and Xiao, 2010). These studies generally focus on inducing full information sharing between the two parties and find that customers often distort information shared with the supplier. Taylor and Xiao (2010) theoretically find that a supplier's profits are decreasing in the accuracy of its

customer's demand information. [Alles et al. \(2000\)](#) suggests a negative relation between inventory levels and information quality. These findings suggest that the net effect of CIQ on supplier investment in working capital is unclear and open to empirical investigation.

My first set of hypotheses assumes that the customer's shared information quality is at least partially publicly observable, so that the observed uncertainty measure (expected volatility) will incorporate customer information that may influence a supplier's investment decisions. If this is true, I should first observe a negative relation between CIQ and the supplier's uncertainty. Second, while the operations view suggests that high CIQ may reduce working capital, the real options framework suggests a positive relation. [Arif et al. \(2016\)](#) provide empirical evidence that suggests that the real options effect will dominate in this setting. Finally, if the relation between CIQ and the supplier's investment is due to the effect of CIQ on supplier uncertainty then the supplier's uncertainty should mediate that relation. I state these predictions more formally in my first set of hypotheses:

- H1a.* Suppliers face less uncertainty when their customers have high-quality information.
- H1b.* Suppliers invest more in working capital when their customers have high-quality information.
- H1c.* Supplier uncertainty mediates the relation between customer information quality and supplier investment levels.

My first set of hypotheses explores a causal chain from a customer's information quality to its supplier's uncertainty to supplier investment and tests the implied associations along the causal chain [6]. My second hypothesis tests an association implied by the same causal chain, but is designed to provide evidence of private communication as a mechanism for the effect. Specifically, I can only find evidence for [H1a](#) if a publicly observable proxy for uncertainty captures the effect of CIQ on supplier uncertainty. However, communication between customers and suppliers is largely private and may not be captured by a public proxy.

My second hypothesis allows communication between customers and suppliers to remain completely private and have no effect on the supplier's expected volatility (my proxy for uncertainty). If the supplier updates its beliefs based on private customer information, and expected volatility does not capture this change in belief, then the gap between my proxy for supplier uncertainty and the supplier's actual uncertainty grows. As this gap between the construct and proxy widens, the observable relation between uncertainty and investment is attenuated, suggesting an unobservable reduction in uncertainty through private communication. Stated formally:

- H2.* High-quality customer information mitigates the negative effect of observed uncertainty on investment.

3. Data

3.1 Sample selection

I begin my sample selection with the intersection of Compustat and CRSP from 2001 through 2018. I find 47,263 firm-years that have the necessary data to examine the relation between expected volatility and investment after dropping utility and financial firms. I use Accounting Standards Codification (ASC) 280 disclosures to identify customer-supplier links [7]. ASC 280 requires firms to disclose major external customers that make up at least 10% of total sales for the firm. I require I/B/E/S coverage for all customers, in order to ensure that I properly capture customer guidance. I also require the percentage of sales that come from a customer to be between 0 and 100% [8]. This results in 15,635 customer-supplier-year observations and is the primary sample I use throughout my analysis [9].

[Table 1](#) provides some details on the sample composition. Panel A presents the industry distribution of suppliers, 67% of supplier firms are from the manufacturing sector compared to

Table 1. Sample composition

Panel A: Supplier industry composition			
SIC Codes	Classification	Supplier Observations	%
2000–3999	Manufacturing	10,410	66.58%
7000–8999	Services	2,543	16.26%
5000–5199	Wholesale Trade	751	4.80%
4000–4999	Transportation	695	4.45%
1000–1499	Mining	582	3.72%
9900–9999	Nonclassifiable	256	1.64%
5200–5999	Retail Trade	241	1.54%
1500–1799	Construction	129	0.83%
0100–0999	Agriculture, Forestry and Fishing	28	0.18%
		15,635	

Panel B: Common customers		
Name	Count	%
1 - Wal-Mart	1,355	8.67%
2 - McKesson Corp	464	2.97%
3 - Cardio Dynamics	459	2.94%
4 - Amerisource Health	356	2.28%
5 - Home Depot	323	2.07%
6 - Bell Atlantic (Verizon)	303	1.94%
7 - AT&T	295	1.89%
8 - General Electric	288	1.84%
9 - Dayton Hudson (Target)	283	1.81%
10 - Ford	279	1.78%

Note(s): This table provides an overview of some sample characteristics. Panel A provides the 1-digit SIC industry code of suppliers in the sample. Panel B lists the most common customers in the sample, the number of observations for each, and the percentage of the total sample

51% from the general Compustat population. Panel B lists the 10 most common customers in the sample. Walmart is the most common customer, accounting for almost 9% of the observations in my sample [10]. Large retail, health, and manufacturing firms make up the remainder of the top 10.

3.2 Measuring uncertainty

Ideally, the empirical measure of uncertainty should capture the variance of potential returns that a manager expects from investment opportunities. I follow prior research and use the supplier's expected stock return volatility as a proxy for the uncertainty that the manager faces. Specifically, I use a generalized autoregressive conditional heteroskedasticity (GARCH) (1, 1) model to transform the series of stock returns into an expected measure of volatility (Eisdorfer, 2008; Arif *et al.*, 2016). The GARCH model estimates the volatility of returns in year $t + 1$ conditional on returns up until the end of year t . More recent returns are given greater weight in the model and large volatility shocks persist for longer periods compared to historical volatility. Consistent with Arif *et al.* (2016) I use the series of firm returns up until the last trading day of year t . I require at least 200 daily return observations for the firm to be included in the sample. While this measure of expected volatility does not specifically incorporate market participants' expectations of future uncertainty (as opposed to option-based implied volatility or analyst dispersion), it only requires a relatively short series of market prices and does not impose major restrictions on my sample [11].

3.3 Customer information quality

I am interested in capturing the supplier's updated beliefs based on the information that it receives from the customer. I assume that customers with high-quality information share better information with their suppliers and reduce the supplier's uncertainty more than customer with low-quality information. Researchers have developed a number of ways to measure the quality of a firm's externally reported information, but the information shared with suppliers is not necessarily publicly available. I rely on the literature that links the quality of a firm's voluntarily disclosed information to the quality of its internal information to capture the quality of information shared with suppliers (Hemmer and Labro, 2008; Goodman *et al.*, 2014; Ittner and Michels, 2017; Gallemore and Labro, 2015; Verrecchia, 1990; Trueman, 1986).

The theoretical literature linking voluntary disclosure to a firm's information quality shows that the probability of disclosure increases as the precision of private information increases (Verrecchia, 1990). Therefore, I use indicator variables for whether or not the customer issues guidance to proxy for the customer's information quality. I use the disclosure properties over the previous three years to classify information quality [12] (Goodman *et al.*, 2014). I use an indicator for the issuance of sales guidance (*Rev*) as my main proxy because it most closely relates to the underlying construct of demand related information quality. Customers that issue sales guidance should have better information about future demand. Such high-quality information about a customer's future demand should be useful to suppliers, as their demand is directly tied to the customer's demand for their inputs. I also use an indicator for earnings guidance (*MF*). Earnings forecasts are more common and should be indicative of information quality beyond just demand information. Using earnings forecasts allows for a broader set of customers to be considered as having high-quality information and the differential impact of earnings versus sales forecasts should be informative about the importance of demand information to the supplier. Because the customer's information advantage stems from its proximity to the end consumer, I expect demand related information to have a stronger effect on supplier decisions.

One potential concern in my setting is the endogenous nature of management forecasts. Customers are more likely to provide forecasts when operating in a steady and predictable environment, while suppliers are less likely to be affected by uncertainty when they have a steady and reliable customer that accounts for a significant portion of their sales. I am interested in the effect of information that customers share with their suppliers, not the way that economic stability affects investment. Therefore, the driving factors of forecasting behavior and accuracy are correlated variables that must be controlled for to examine the effect of internal information passing from customer to supplier.

Fortunately, analysts provide a natural control for the factors that influence the customer's forecast decisions and guidance properties. Analysts' forecasts should reflect external information that affects the customer's guidance [13]. I include *Cust_Analyst_Accuracy* as the average accuracy of the analyst's annual forecasts measured over the same time period as the customer's guidance. One issue with controlling for analyst accuracy in this setting is that analysts have close contact with management and their forecasts likely reflect the quality of internal information at the firms for which they forecast. If managers' forecasts lead analysts to issue more accurate earnings estimates, then controlling for the accuracy of those earnings estimates will inappropriately bias against finding an effect of customer information quality on supplier investment. Therefore, the estimated effect of a manager's forecasting properties is likely to be a lower bound on the true effect when controlling for the analysts' forecasting accuracy [14].

Because I want to capture the customer's ability to generate and share reliable information, and not the predictability of the customer's economics, I control for other factors that influence guidance properties. I include the standard deviation of the customer's quarterly earnings (*Cust_STD_ROA*) from year $t-2$ through year t as another proxy for the customer's

predictability. I also control for the log of the customer's market value of equity (*Cust_Size*) to capture other features of the customer's information environment.

Table 2 presents descriptive statistics for the primary sample. I find that customers are significantly larger than suppliers with a median market capitalization of about \$30 billion, compared to \$473 million for suppliers. This size disparity is consistent with prior research, the disclosure requirements in ASC 280, and the most common customers in the sample being large firms. This size disparity makes it likely that the customers will have more resources to conduct market research and invest in other information gathering processes than the suppliers. Measures of expected volatility are similar to those reported in Arif *et al.* (2016). Panel B displays differences between observations with a customer issuing a sales forecast and those without. Consistent with my set of predictions in H1, suppliers have higher investment in working capital and lower volatility when their customers issue sales forecasts. The customers' analysts provide forecasts that are more accurate when the customer issues a revenue forecast and customers that issue a revenue forecast have a lower standard deviation of earnings, emphasizing the importance of controlling for those aspects.

Univariate correlations in Panel C indicate that customer revenue forecasts are positively correlated with supplier investment in working capital and all CIQ proxies are negatively related to the supplier's expected volatility. These univariate statistics provide initial evidence for my first hypothesis.

3.4 Choice of investment variable

I begin by investigating the relation between investment and uncertainty within my sample. Although prior research has generally found a negative relation between uncertainty and investment, understanding the relation within my sample will inform my conclusions about the effect of CIQ. I replicate the following model from Arif *et al.* (2016) to establish the baseline relation between volatility and investment within my sample and for comparison to prior research.

$$\begin{aligned}
 Investment_{it+1} = & \beta_1 Expected_Volatility_{it} + \beta_2 Size_{it} + \beta_3 MTB_{it} + \beta_4 Leverage_{it} + \beta_5 CFO_{it} \\
 & + \beta_6 Capital_Intensity_{it} + \beta_7 Recession_{it+1} + \beta_8 Default_Spread_{it+1} \\
 & + \beta_9 Interest_Rate_{it+1} + \epsilon_{it}
 \end{aligned}
 \tag{1}$$

I investigate three potential proxies for investment. I adopt the perspective that working capital accruals represent an intentional investment made by the firm (Fairfield *et al.*, 2003; Zhang, 2007). Arif *et al.* (2016) find that working capital accruals are negatively related to a firm's expected volatility and that the asset portion of working capital accruals has the strongest relation. Additionally, working capital assets represent sales to customers and investment in inventory to customers. Finally, the creation of inventory itself is an investment that a supplier makes to sell directly to the customer. Hence, I use net working capital accruals, *WC*, the asset portion of working capital accruals, *WC Assets*, and changes in inventory, *Inventory*, as proxies for investment and examine their relation to uncertainty within my sample.

I control for other determinants of a firm's investment levels (Eisdorfer, 2008; Arif *et al.*, 2016). *Size* is the natural log of the firm's market value of equity. *MTB* is the ratio of a firm's market value to book value and is meant to capture growth opportunities. *Leverage* and *CFO* capture availability of capital for investment. *Capital Intensity* is measured as the ratio of net property, plant, and equipment to total assets and controls for the supplier's reliance on capital equipment. I control for other macroeconomic factors by including *Recession*, an

Table 2. Descriptive statistics

Panel A: Descriptive statistics						
Variable	<i>N</i>	Mean	p50	p25	p75	sd
<i>WC</i>	15,636	0.499	0.275	-2.456	3.360	6.926
<i>WC_Assets</i>	15,636	2.022	1.172	-1.868	5.019	9.048
<i>Inventory</i>	15,636	0.696	0.019	-0.452	1.641	4.029
<i>Expected_Firm_Volatility</i>	15,636	0.034	0.029	0.021	0.041	0.020
<i>Rev</i>	15,636	0.521	1.000	0.000	1.000	0.500
<i>MF</i>	15,636	0.663	1.000	0.000	1.000	0.473
<i>Supplier controls</i>						
<i>CFO</i>	15,636	0.071	0.102	0.025	0.163	0.167
<i>Size</i>	15,636	3,920	473	128	1,716	13,619
<i>MTB</i>	15,636	3.151	2.062	1.282	3.511	3.668
<i>Lev</i>	15,636	0.442	0.438	0.254	0.605	0.222
<i>Customer controls</i>						
<i>Cust_MTB</i>	15,636	3.815	2.831	1.765	4.226	3.667
<i>Cust_Analyst_Accuracy</i>	15,636	-0.019	-0.010	-0.021	-0.005	0.026
<i>Cust_Size</i>	15,636	70,703	29,864	8,053	106,152	88,235
<i>Cust_STD_ROA</i>	15,636	0.012	0.006	0.004	0.013	0.018
<i>Sale_PCT</i>	11,599	0.195	0.155	0.106	0.236	0.149
Panel B: Comparison of high CIQ to low CIQ by <i>REV</i>						
Variable	Rev = 0		Rev = 1		Difference	<i>T</i> -Stat
	<i>N</i>	Mean	<i>N</i>	Mean		
<i>WC</i>	7,484	0.127	8,152	0.841	-0.714	-3.63
<i>WC_Assets</i>	7,484	1.528	8,152	2.475	-0.947	-2.89
<i>Inventory</i>	7,484	0.457	8,152	0.915	-0.458	-3.57
<i>Expected_Firm_Volatility</i>	7,484	0.038	8,152	0.031	0.007	7.22

(continued)

Table 2. Continued

Panel B: Comparison of high CIQ to low CIQ by *REV*

Variable	Rev = 0		Rev = 1		Difference	T-Stat
	N	Mean	N	Mean		
<i>Supplier controls</i>						
<i>CFO</i>	7,484	0.075	8,152	0.067	0.008	1.12
<i>Size</i>	7,484	2,891	8,152	4,864	-1,974	-1.93
<i>MTB</i>	7,484	2.878	8,152	3.401	-0.524	-2.77
<i>Lev</i>	7,484	0.442	8,152	0.443	-0.001	-0.11
<i>Customer controls</i>						
<i>Cust_MTB</i>	7,484	3.996	8,152	3.649	0.347	0.86
<i>Cust_Analyst_Accuracy</i>	7,484	-0.024	8,152	-0.014	-0.010	-4.52
<i>Cust_Size</i>	7,484	69,258	8,152	72,029	-2,771	-0.3
<i>Cust_STD_ROA</i>	7,484	0.014	8,152	0.010	0.004	3.12
<i>Sale_PCT</i>	5,734	0.195	5,865	0.196	-0.001	0.17

Panel C: Correlations

	1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)	13)	14)	15)	16)
1) WC	1.00															
2) WC_Assets	0.71*	1.00														
3) Inventory	0.53*	0.70*	1.00													
4) <i>Expected_Firm_Volatility</i>	-0.10*	-0.12*	-0.10*	1.00												
5) Rev	0.06*	0.05*	0.05*	-0.20*	1.00											
6) Size	0.00	0.02*	0.03*	-0.53*	0.11*	1.00										
7) MTB	0.06*	0.12*	0.07*	-0.10*	0.06*	0.26*	1.00									
8) Lev	-0.03*	-0.07*	-0.04*	-0.09*	0.00	0.31*	0.28*	1.00								
9) CFO	0.13*	0.09*	0.06*	-0.33*	-0.02*	0.32*	-0.12*	0.07*	1.00							

(continued)

Table 2. Continued

Panel C: Correlations																
	1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)	13)	14)	15)	16)
10) <i>Cust_Analyst_Accuracy</i>	0.02*	0.05*	0.03*	-0.05*	0.12*	0.03*	0.08*	-0.02	-0.02	1.00						
11) <i>cust_std_roa</i>	-0.04*	-0.04*	-0.04*	0.14*	-0.03*	-0.08*	-0.02*	-0.08*	-0.06*	-0.34*	1.00					
12) <i>cust_size</i>	-0.05*	-0.06*	-0.04*	-0.10*	0.01	0.14*	-0.01	0.13*	0.05*	0.15*	-0.27*	1.00				
13) <i>cust_mtb</i>	-0.01	-0.00	-0.01	-0.00	-0.06*	0.02*	0.06*	0.03*	-0.02	0.18*	-0.02	0.15*	1.00			
14) <i>recession</i>	-0.12*	-0.17*	-0.13*	0.31*	-0.05*	-0.08*	-0.07*	-0.01	-0.01	-0.03*	0.05*	-0.01	-0.03*	1.00		
15) <i>default_spread</i>	-0.06*	-0.12*	-0.09*	0.15*	0.05*	-0.06*	-0.08*	-0.03*	0.00	-0.05*	0.05*	-0.02	-0.05*	0.50*	1.00	
16) <i>interest_rate</i>	-0.01	-0.00	0.00	0.04*	-0.11*	-0.09*	0.01	-0.04*	-0.04*	0.01	0.01	-0.01	-0.02*	0.04*	-0.25*	1.00

Note(s): This table provides descriptive statistics for the sample that I use in subsequent tests. Panel A displays distributional properties of variables used in tests. Panel B provides comparison of means between observations with a customer issuing a sales forecast ($Rev = 1$) and those that do not have a customer sales forecast ($Rev = 0$). Panel C displays the correlation matrix of relevant variables. * represents correlations that are significant at $\alpha < 0.05$. I define all variables in [Appendix](#). I present *Size* and *Cust_Size* in millions of dollars, not logged, for ease of interpretation. I winsorize continuous variables at the 1st and 99th percentiles

indicator for whether period $t+1$ is defined as a recession period by the National Bureau of Economic Research (NBER) because investment is lower during times of recession; *Default_Spread*, the yield spread between Aaa and Baa rated bonds; and *Interest_Rate*, the nominal rate on a 1 year U.S. treasury bill. For comparability with prior results, and to allow cross-sectional differences in volatility to capture the firm's uncertainty, I do not include fixed effects (Eisdorfer, 2008; Arif *et al.*, 2016). All variable definitions can be found in Appendix.

Table 3 presents the result from estimating Equation (1) within my sample of customers and suppliers. The relation between investment in working capital and volatility is significantly negative within my sample. Consistent with assets being a controllable investment, the relation is particularly strong for the asset portion of working capital and inventory within my sample [15].

4. Research design

4.1 The effect of CIQ on supplier uncertainty

I next investigate the relation between a customer's information quality, the supplier's uncertainty, and the supplier's investment levels. I hypothesize that when a customer shares

Table 3. The effect of a firm's expected volatility on investment

Dependent variable:	WC Coeff T-Stat	WC assets Coeff T-Stat	Inventory Coeff T-Stat
<i>Uncertainty</i>			
<i>Expected Firm Volatility</i>	-0.354* (-1.813)	-0.824*** (-3.108)	-0.375*** (-3.232)
<i>Supplier controls</i>			
<i>Size</i>	-0.631*** (-6.152)	-0.707*** (-3.553)	-0.225** (-2.193)
<i>MTB</i>	0.615*** (4.935)	1.120*** (5.528)	0.372*** (4.567)
<i>Leverage</i>	-0.0624 (-0.636)	-0.582*** (-3.917)	-0.185*** (-2.250)
<i>CFO</i>	0.858*** (6.369)	0.960*** (7.793)	0.346*** (5.096)
<i>Capital intensity</i>	-0.118 (-1.127)	-0.159 (-1.176)	-0.0640 (-0.948)
<i>Macro</i>			
<i>Recession</i>	-1.614** (-2.432)	-2.565*** (-3.248)	-1.095** (-2.859)
<i>Default_Spread</i>	-0.134 (-0.870)	-0.590** (-2.670)	-0.195* (-2.031)
<i>Interest_Rate</i>	-0.0197 (-0.111)	0.106 (0.424)	0.0555 (0.646)
Observations	9,130	9,130	9,130
R-squared	0.036	0.068	0.033
Fixed effects	No	No	No

Note(s): This table displays the results of estimating Equation (1) within my primary sample. It displays the results for estimating the relation between expected volatility and both capital investment and working capital investment within my sample of suppliers. I winsorize all continuous variables at 1 and 99 percent and standardize independent variables to have zero mean and a standard deviation of one. *, **, and *** represent significance at the 0.1, 0.05, and 0.01 levels using a two-tailed test. I use two-way clustering of standard errors at the customer and supplier level in Panel A. Panel B has standard errors clustered at the firm level

high-quality information with suppliers, the information reduces supplier uncertainty, and the reduced uncertainty causes the supplier to increase investment levels. My first set of hypotheses focuses on the scenario in which the customer's shared information is not completely private and is somewhat impounded into the supplier's stock volatility. To test this hypothesis, I examine the observable associations along the theoretical causal chain that I propose. Multiple associations consistent with the causal chain provide evidence that my proposed relations are true.

H1a predicts that CIQ has a negative effect on the supplier's observed uncertainty. To test this prediction, I regress the supplier's observed uncertainty proxy, *Expected_Volatility*, on CIQ proxies. I include *Size* as a control for its information environment, *MTB* because growth firms are more volatile, *Leverage* because more highly levered firms experience more drastic changes in equity prices, and *CFO* as a common determinant of volatility. I control for *Recession*, *Default_Spread*, and *Interest_Rate* because macroeconomic conditions are highly associated with uncertainty. I include fixed effects for the supplier's two digit SIC code to account for unobservable industry differences that are related to the customer's propensity to disclose and the supplier's investment levels. Finally, I control for aspects of the customer firm that are associated with the propensity to disclose management forecasts. I estimate the following OLS regression to test **H1a**:

$$\begin{aligned}
 \text{Expected_Volatility}_{it} = & \alpha + \beta_1 \text{CIQ}_{jt} + \beta_2 \text{Size}_{it} + \beta_3 \text{MTB}_{it} + \beta_4 \text{Leverage}_{it} + \beta_5 \text{CFO}_{it} \\
 & + \beta_6 \text{Capital_Intensity}_{it} + \beta_7 \text{Cust_Analyst_Accuracy}_{jt} \\
 & + \beta_8 \text{Cust_STD_ROA}_{jt} + \beta_9 \text{Cust_Horizon}_{jt} + \beta_{10} \text{Cust_Size}_{jt} \\
 & + \beta_{11} \text{Cust_MTB}_{jt} + \beta_{12} \text{Recession}_{it+1} + \beta_{13} \text{Default_Spread}_{it+1} \\
 & + \beta_{14} \text{Interest_Rate}_{it+1} + \psi + \epsilon_{ijt}
 \end{aligned} \tag{2}$$

Where i indexes the supplier firm, j indexes the customer firm and t indexes the fiscal year. I use two-way clustering on the supplier and customer level to account for correlated errors that arise from matching suppliers to multiple customers and vice versa. Continuous independent variables are winsorized at the 1st and 99th percentiles and standardized to mean 0 with variance equal to 1 for ease of interpretation.

Table 4 panel A presents results from estimating Equation (2) within my sample of suppliers. The dependent variable is the supplier's expected volatility as of the end of year t and has been standardized to have 0 mean and unit variance. The coefficient on *REV* indicates that supplier's *Expected_Volatility* is approximately 0.24 standard deviations lower when its customer issues a sales forecast. The coefficient on *MF* is not significantly different from 0, suggesting that the information underlying a customer's earnings forecast does not affect the supplier's uncertainty. Control variables indicate that larger suppliers with higher cash flows are less volatile, while more leveraged suppliers are more volatile. The customer's earnings volatility is associated with higher expected returns volatility for the supplier and expected volatility is 0.68 standard deviations higher during recessions.

These results are consistent with a negative relation between customer information quality and supplier uncertainty. The relation between *Rev* and *Expected_Volatility* suggests that at least some of the shared information is publicly observable. The differential results between *Rev* and *MF* indicate that high-quality information about future demand is particularly useful in mitigating a supplier's uncertainty. **H1b** predicts that CIQ has a positive effect on investment levels. I estimate the following equation to test this hypothesis:

Table 4. The relation between CIQ, uncertainty, and investment

Panel A: The effect of CIQ on supplier volatility		
Dependent variable:	Exp. Vol. Coeff T-Stat	Exp. Vol. Coeff T-Stat
<i>Customer information quality</i>		
REV	-0.239*** (-8.528)	
MF		0.000923 (0.0269)
<i>Supplier controls</i>		
Size	-0.417*** (-20.78)	-0.426*** (-21.04)
MTB	-0.0144 (-1.114)	-0.0151 (-1.146)
Leverage	0.103*** (5.599)	0.101*** (5.358)
CFO	-0.182*** (-11.16)	-0.179*** (-10.62)
Capital intensity	0.0332 (1.322)	0.0492* (1.868)
<i>Customer controls</i>		
Cust_Analyst_Accuracy	0.0174 (1.417)	0.000835 (0.0721)
Cust_STD_ROA	0.0695*** (4.309)	0.0717*** (3.978)
Cust_Size	-0.00495 (-0.299)	-0.0100 (-0.586)
Cust_MTB	0.00962 (0.766)	0.0206 (1.381)
<i>Macro</i>		
Recession	0.680*** (17.93)	0.696*** (17.59)
Default_Spread	0.00343 (0.260)	-0.00506 (-0.378)
Interest_Rate	-0.0229** (-2.015)	-0.0197* (-1.814)
Observations	15,636	15,636
R-squared	0.413	0.401
Fixed effects	Industry	Industry

Panel B: The effect of CIQ on investment using WC					
Dependent variable:	WC Coeff T-Stat	WC Coeff T-Stat	WC Coeff T-Stat	WC Coeff T-Stat	Diff. Diff. P(χ^2)
<i>CIQ and uncertainty</i>					
REV	0.657*** (3.774)	0.591*** (3.505)			0.066* 0.05
MF			-0.0324 (-0.197)	-0.0286 (-0.176)	-0.0038 0.61
Expected_Volatility		-0.273** (-2.069)		-0.325** (-2.435)	

(continued)

Table 4. Continued

Panel B: The effect of CIQ on investment using WC

Dependent variable:	WC	WC	WC	WC	Diff. Diff. P(χ^2)
	Coeff T-Stat	Coeff T-Stat	Coeff T-Stat	Coeff T-Stat	
<i>Supplier controls</i>					
<i>Size</i>	-0.563*** (-5.168)	-0.676*** (-5.833)	-0.539*** (-4.927)	-0.678*** (-5.807)	
<i>MTB</i>	0.774*** (5.587)	0.770*** (5.582)	0.776*** (5.621)	0.771*** (5.616)	
<i>Leverage</i>	-0.289** (-2.371)	-0.261** (-2.098)	-0.285** (-2.334)	-0.252** (-2.025)	
<i>CFO</i>	0.972*** (8.089)	0.922*** (7.297)	0.965*** (8.059)	0.907*** (7.173)	
<i>Capital intensity</i>	-0.0113 (-0.0873)	-0.00226 (-0.0174)	-0.0553 (-0.430)	-0.0393 (-0.304)	
<i>Customer controls</i>					
<i>Cust_Analyst_Accuracy</i>	0.0425 (0.591)	0.0473 (0.667)	0.0879 (1.248)	0.0882 (1.270)	
<i>Cust_STD_ROA</i>	-0.186* (-1.935)	-0.167* (-1.782)	-0.192* (-1.876)	-0.169* (-1.711)	
<i>Cust_Size</i>	-0.271*** (-3.549)	-0.272*** (-3.589)	-0.257*** (-3.258)	-0.260*** (-3.333)	
<i>Cust_MTB</i>	-0.0483 (-0.701)	-0.0457 (-0.672)	-0.0785 (-1.072)	-0.0718 (-1.006)	
<i>Macro</i>					
<i>Recession</i>	-1.797*** (-6.266)	-1.611*** (-5.651)	-1.841*** (-6.437)	-1.614*** (-5.698)	
<i>Default_Spread</i>	-0.129 (-1.316)	-0.128 (-1.308)	-0.106 (-1.062)	-0.107 (-1.084)	
<i>Interest_Rate</i>	-0.0906 (-1.126)	-0.0969 (-1.206)	-0.0996 (-1.252)	-0.106 (-1.334)	
Observations	15,636	15,636	15,636	15,636	
R-squared	0.050	0.051	0.048	0.049	
Fixed effects	Industry	Industry	Industry	Industry	

Panel C: The effect of CIQ on investment using WC Assets

Dependent variable:	WC assets	WC assets	WC assets	WC assets	Diff. Diff. P(χ^2)
	Coeff T-Stat	Coeff T-Stat	Coeff T-Stat	Coeff T-Stat	
<i>CIQ and uncertainty</i>					
<i>REV</i>	0.713*** (2.627)	0.562** (2.095)			0.151*** 0.002
<i>MF</i>			0.0805 (0.340)	0.0885 (0.374)	-0.008 0.579
<i>Expected volatility</i>		-0.631*** (-3.348)		-0.681*** (-3.618)	
<i>Supplier controls</i>					
<i>Size</i>	-0.452** (-2.533)	-0.716*** (-3.942)	-0.425** (-2.379)	-0.715*** (-3.933)	
<i>MTB</i>	1.389*** (7.896)	1.380*** (7.869)	1.390*** (7.981)	1.379*** (7.943)	

(continued)

Table 4. Continued

Panel C: The effect of CIQ on investment using WC Assets					
Dependent variable:	WC assets Coeff T-Stat	WC assets Coeff T-Stat	WC assets Coeff T-Stat	WC assets Coeff T-Stat	Diff. Diff. P(χ^2)
<i>Leverage</i>	-0.984*** (-5.896)	-0.919*** (-5.352)	-0.981*** (-5.887)	-0.912*** (-5.318)	
<i>CFO</i>	1.136*** (8.048)	1.021*** (6.774)	1.129*** (7.986)	1.007*** (6.688)	
<i>Capital intensity</i>	0.0677 (0.415)	0.0887 (0.537)	0.0219 (0.136)	0.0554 (0.340)	
<i>Customer controls</i>					
<i>Cust_Analyst_Accuracy</i>	0.175* (1.737)	0.186* (1.869)	0.216** (2.132)	0.217** (2.162)	
<i>Cust_STD_ROA</i>	-0.289** (-2.428)	-0.246** (-2.123)	-0.292** (-2.297)	-0.243** (-2.001)	
<i>Cust_Size</i>	-0.436*** (-3.973)	-0.439*** (-3.976)	-0.426*** (-3.868)	-0.433*** (-3.906)	
<i>Cust_MTB</i>	-0.0670 (-0.606)	-0.0609 (-0.560)	-0.0983 (-0.878)	-0.0843 (-0.768)	
<i>Macro</i>					
<i>Recession</i>	-3.062*** (-7.603)	-2.632*** (-6.683)	-3.110*** (-7.675)	-2.635*** (-6.696)	
<i>Default_Spread</i>	-0.500*** (-3.805)	-0.497*** (-3.778)	-0.475*** (-3.594)	-0.479*** (-3.616)	
<i>Interest_Rate</i>	-0.0267 (-0.232)	-0.0412 (-0.360)	-0.0384 (-0.337)	-0.0518 (-0.456)	
Observations	15,636	15,636	15,636	15,636	
R-squared	0.082	0.085	0.081	0.084	
Fixed effects	Industry	Industry	Industry	Industry	

Panel D: The effect of CIQ on investment using Inventory					
Dependent variable:	Inventory Coeff T-Stat	Inventory Coeff T-Stat	Inventory Coeff T-Stat	Inventory Coeff T-Stat	Diff. Diff. P(χ^2)
<i>CIQ and uncertainty</i>					
<i>REV</i>	0.370*** (3.289)	0.295*** (2.705)			0.075** 0.001
<i>MF</i>			0.0828 (0.835)	0.0868 (0.894)	-0.004 0.58
<i>Expected_Volatility</i>		-0.311*** (-3.778)		-0.337*** (-4.051)	
<i>Supplier controls</i>					
<i>Size</i>	-0.0745 (-0.983)	-0.204** (-2.482)	-0.0593 (-0.787)	-0.203** (-2.464)	
<i>MTB</i>	0.419*** (5.653)	0.415*** (5.608)	0.419*** (5.730)	0.414*** (5.664)	
<i>Leverage</i>	-0.412*** (-5.309)	-0.381*** (-4.864)	-0.412*** (-5.317)	-0.377*** (-4.829)	
<i>CFO</i>	0.327*** (5.186)	0.271*** (4.104)	0.323*** (5.121)	0.263*** (4.003)	
<i>Capital Intensity</i>	0.118 (1.577)	0.129* (1.702)	0.0954 (1.253)	0.112 (1.462)	

(continued)

Table 4. Continued

Panel D: The effect of CIQ on investment using Inventory					
Dependent variable:	Inventory	Inventory	Inventory	Inventory	Diff. Diff. P(χ^2)
	Coeff	Coeff	Coeff	Coeff	
	T-Stat	T-Stat	T-Stat	T-Stat	
<i>Customer controls</i>					
<i>Cust_Analyst_Accuracy</i>	0.0570 (1.429)	0.0624 (1.592)	0.0759* (1.908)	0.0762* (1.945)	
<i>Cust_STD_ROA</i>	-0.0981* (-1.922)	-0.0765 (-1.571)	-0.0980* (-1.781)	-0.0738 (-1.429)	
<i>Cust_Size</i>	-0.177*** (-3.341)	-0.178*** (-3.381)	-0.173*** (-3.199)	-0.177*** (-3.286)	
<i>Cust_MTB</i>	-0.00342 (-0.0690)	-0.000426 (-0.00883)	-0.0192 (-0.373)	-0.0122 (-0.248)	
<i>Macro</i>					
<i>Recession</i>	-1.194*** (-6.541)	-0.983*** (-5.133)	-1.219*** (-6.723)	-0.984*** (-5.168)	
<i>Default_Spread</i>	-0.131** (-2.251)	-0.130** (-2.224)	-0.119** (-2.027)	-0.120** (-2.051)	
<i>Interest_Rate</i>	-0.0201 (-0.393)	-0.0272 (-0.535)	-0.0269 (-0.532)	-0.0335 (-0.664)	
Observations	15,636	15,636	15,636	15,636	
R-squared	0.061	0.064	0.059	0.063	
Fixed effects	Industry	Industry	Industry	Industry	

Note(s): This table presents the set of tests for H1a, H1b, and H1c. Panel A presents estimates of Equation (2) with *Rev* as a measure for CIQ in column 1 and *MF* in column 2. Panel B presents estimates of Equation (3) using *WC* as investment. *Rev* is used as the measure of CIQ in columns 1 and 2 and *MF* is used in columns 3 and 4. Panel C replicates Panel B using *WC Assets* as the dependent variable. Panel D replicates Panel B with *Inventory* as the dependent variable. I winsorize all continuous variables at 1 and 99 percent and standardize independent variables to have zero mean and a standard deviation of one. *, **, and *** represent significance at the 0.1, 0.05, and 0.01 levels using a two-tailed test. I use two-way clustering of standard errors at the customer and supplier level

$$\begin{aligned}
 Investment_{it+1} = & \alpha + \gamma_1 CIQ_{jt} + \gamma_2 Size_{it} + \gamma_3 MTB_{it} + \gamma_4 Leverage_{it} + \gamma_5 CFO_{it} \\
 & + \gamma_6 Capital_Intensity_{it} + \gamma_7 Cust_Analyst_Accuracy_{jt} \\
 & + \gamma_8 Cust_STD_ROA_{jt} + \gamma_9 Cust_Horizon_{jt} + \gamma_{10} Cust_Size_{jt} \\
 & + \gamma_{11} Cust_MTB_{jt} + \gamma_{12} Recession_{it+1} + \gamma_{13} Default_Spread_{it+1} \\
 & + \gamma_{14} Interest_Rate_{it+1} + \psi + \epsilon_{ijt}
 \end{aligned} \tag{3}$$

The results from estimating Equation (3) using *WC* as the proxy for investment are presented in Table 4 Panel B. The positive coefficient on *Rev* in the first column indicates that suppliers invest 0.66% more of total assets into working capital when customers issue sales guidance. The difference is approximately a 0.09 (0.657/6.926) [16] standard deviation increase in working capital investment when a customer issues a revenue forecast. In contrast, there is no statistical association between the customer's issuance of an earnings forecast and the supplier's investment in working capital.

To test hypothesis H1c, that uncertainty mediates the relation between customer information quality and supplier investment, I next add *Expected_Volatility* as an independent variable to Equation (3). If the relation between investment and CIQ is mediated by uncertainty, then the coefficient from regressing investment on CIQ should be

lower when including uncertainty. Columns 2 and 4 present the results of these estimations, with Column 5 presenting a statistical test of the differences in estimated coefficients. The coefficient on *Rev* decreases by 10% when including *Expected_Volatility* and the difference is significant at $\alpha = 0.05$. This test provides evidence that the association between customer sales forecasts and supplier investment is mediated by uncertainty [17].

Table 4 Panel C presents estimates of Equation (3) using *WC Assets* as the proxy for investment. The results are similar to those in Panel B. Customer sales forecasts are associated with an increase in investment but customer earnings forecasts are not. Column 5 indicates that the relation between *WC Assets* and *Rev* is significantly weaker when including *Expected_Volatility* in the regression, providing evidence that the relation between CIQ and investment is partially mediated by uncertainty. The coefficients indicate that 21% (0.151/0.713) of the investment effect of a sales forecast on investment is due to the observable relation between *Rev* and *Expected_Volatility*. The remaining relation between CIQ and supplier investment is either due to an unobservable effect of CIQ on the supplier's uncertainty or some other mechanism through which the customer's information affects supplier investment. I do not observe a relation between *MF* and the supplier's volatility or investment.

Table 4 Panel D presents results using *Inventory* as the dependent variable. Again, there is a significant positive relation between *Rev* and the dependent variable that is mediated by *Expected_Volatility*. The combined results when using *Rev* and *MF* indicate that the customer's demand for information is particularly relevant to suppliers.

4.2 Mitigating the effect of uncertainty

My next set of tests examines the effect of CIQ on the supplier's sensitivity to observed uncertainty. The key assumption that differentiates this design from the set of tests in the prior section is that the measure of supplier uncertainty does not completely reflect the information shared between the customer and supplier. My design follows prior research that examines factors that mitigate the effect of observed uncertainty on investment (Wellman, 2017; Czarnitzki and Toole, 2011). Each of these studies regresses investment on an observed measure of uncertainty (e.g. policy uncertainty in Wellman, 2017), the mitigating factor (e.g. political connectedness), and the interaction between the two. Prior studies interpret a positive coefficient on the interaction as evidence that the factor of interest (private communication of quality information) mitigates the effect of the observed uncertainty on the firm's beliefs about returns on investment, thus reducing the firm's investment sensitivity to observed uncertainty. Similarly, I test my hypothesis by regressing investment on *Expected_Volatility*, CIQ, and the interaction between the two [18].

$$\begin{aligned}
 Invest_{it+1} = & \alpha + \beta_1 CIQ_{jt} + \beta_2 Expected_Volatility_{it} + \beta_3 CIQ_{jt} * Expected_Volatility_{it} \\
 & + \beta_4 Size_{it} + \beta_5 MTB_{it} + \beta_6 Leverage_{it} + \beta_7 CFO_{it} + \beta_8 Capital_Intensity_{it} \\
 & + \beta_9 Cust_Analyst_Accuracy_{jt} \\
 & + \beta_{10} Cust_Analyst_Accuracy_{jt} * Expected_Volatility_{it} + \beta_{11} Cust_STD_ROA_{jt} \\
 & + \beta_{12} Cust_Horizon_{jt} + \beta_{13} Cust_Size_{jt} + \beta_{14} Cust_MTB_{jt} + \beta_{15} Recession_{it+1} \\
 & + \beta_{16} Default_Spread_{it+1} + \beta_{17} Interest_Rate_{it+1} + \psi + \epsilon_{ijt}
 \end{aligned}
 \tag{4}$$

I control for the relation between CIQ and investment, so β_3 captures the differential impact of uncertainty on investment for suppliers that have customers issuing either sales or earnings forecasts. In addition to controls used in prior specifications, I include an interaction between

Cust_Analyst_Accuracy and *Expected_Volatility* to control for factors in the customer's information environment that also affect the supplier's uncertainty.

Table 5 presents estimations of Equation (4) with *WC* as the dependent variable in columns one and four, *WC Assets* as the dependent variable in columns two and five, and inventory in columns three and six. The first three columns indicate that the main positive effect of *Rev* and negative effect of *Expected_Volatility* are still significant, but the negative effect of uncertainty is attenuated for suppliers when their customers issue sales forecasts. I test the sum of β_2 and β_3 and find that the sum is not significantly different from zero when using *Rev* to proxy for *CIQ*, which indicates that the relation between volatility and investment is fully attenuated by the customer's information. Suppliers whose customers issue revenue forecasts are not sensitive to observed uncertainty, consistent with relevant, precise information having a strong effect on the supplier's final information set. Consistent with results in the previous section, the supplier's sensitivity to volatility is not attenuated by a customer's earnings forecast, which is indicative of the importance of demand-related information.

The combined results from sections 4.1 and 4.2 indicate that the customer's demand-related information reduces the supplier's uncertainty and increases investment. The partial mediation in the first set of tests and the full attenuation in the second set are both consistent with private communication of internal information driving the effect.

5. Additional tests

5.1 Restatements

I further investigate the relation between *CIQ* and supplier investment levels by using customers' restatements as an additional proxy for low *CIQ*. Prior research has found that restatements are related to the quality of a firm's internal information, which can be shared with suppliers (Gallemore and Labro, 2015). I obtain restatement data from Audit Analytics, which causes me to drop some observations, resulting in a sample of 15,579 observations. *No_Error* is an indicator variable for customers that do not eventually restate financial statements for year t . It is important to note that the restatements are not observable during the period that is restated, but are announced with a lag. Therefore, I do not expect my public measure of uncertainty to capture the effect of lower *CIQ* on the supplier's actual uncertainty.

Table 6 presents results from estimating Equations (2) to (4) within this sample using *No_Error* for *CIQ*. Panel A indicates that, as expected, customer restatements are not related to the supplier's expected volatility or working capital investment. Panel B tests whether restatements mitigate the effect of uncertainty on investment. I find that the relation between *Expected_Volatility* and investment in working capital, working capital assets, and inventory is attenuated when customers do not have a restatement. Results also indicate that the negative effect of uncertainty on investment is only partially attenuated, so outside uncertainty still affects suppliers' investment when their customers properly report financial statements. These results provide more evidence, that *CIQ* mitigates the effect of uncertainty on supplier investment and are consistent with the non-public nature of restatements before their announcement.

5.2 Vendor managed inventory

Because inventory is a major part of the dependent variable, changes in working capital at the supplier may be part of a coordinated strategy between the customer and supplier, as opposed to an information story. Thus, I split the sample into high vendor managed inventory (VMI) and low VMI subsamples based on the supplier's industry. I define retail, wholesale, retail, and consumer goods manufacturing as high VMI (SIC Codes, 2000–28999, 5000–5999) and mining, construction, and services as low VMI (SIC Codes 1000–1499, 7000–8999).

Table 7 displays the results of estimating equation (3) both with and without *Expected_Volatility* in the two subsamples. Rather than being driven by high-VMI industries, the effect of

Table 5. The effect of customer information quality on the volatility-investment relationship

Dependent variable:	WC Acc Coeff T-Stat	WC assets Coeff T-Stat	Inventory Coeff T-Stat	WC Acc Coeff T-Stat	WC assets Coeff T-Stat	Inventory Coeff T-Stat
<i>CIQ and uncertainty</i>						
<i>Rev</i>	0.633*** (3.849)	0.635** (2.512)	0.308*** (2.861)			
<i>MF</i>				-0.0189 (-0.117)	0.0902 (0.383)	0.0864 (0.893)
<i>Expected volatility</i>	-0.428*** (-3.035)	-0.980*** (-5.296)	-0.381*** (-4.465)	-0.120 (-0.747)	-0.763*** (-3.758)	-0.357*** (-3.531)
<i>Rev*Expected Volatility</i>	0.498*** (2.746)	1.067*** (4.131)	0.211** (2.159)			
<i>MF*Expected volatility</i>				-0.287* (-1.703)	0.143 (0.678)	0.0305 (0.337)
<i>Supplier controls</i>						
<i>Size</i>	-0.629*** (-5.462)	-0.627*** (-3.524)	-0.188** (-2.307)	-0.674*** (-5.779)	-0.698*** (-3.879)	-0.201** (-2.451)
<i>MTB</i>	0.759*** (5.510)	1.360*** (7.798)	0.411*** (5.577)	0.766*** (5.593)	1.376*** (7.935)	0.414*** (5.660)
<i>Leverage</i>	-0.259** (-2.088)	-0.919*** (-5.388)	-0.381*** (-4.881)	-0.249** (-2.007)	-0.907*** (-5.306)	-0.377*** (-4.831)
<i>CFO</i>	0.936*** (7.346)	1.045*** (6.925)	0.275*** (4.172)	0.912*** (7.202)	1.011*** (6.697)	0.263*** (4.007)
<i>Capital intensity</i>	0.000358 (0.00276)	0.0961 (0.591)	0.131* (1.730)	-0.0430 (-0.335)	0.0531 (0.326)	0.112 (1.461)
<i>Customer controls</i>						
<i>Cust_Analyst_ Accuracy</i>	0.0402 (0.585)	0.186* (1.916)	0.0642* (1.688)	0.0721 (1.050)	0.203** (2.017)	0.0754** (1.964)
<i>Cust_Analyst_ Accuracy*Volatility</i>	0.128 (1.516)	0.121 (1.407)	0.00635 (0.148)	0.172** (2.164)	0.146* (1.765)	0.00742 (0.176)
<i>Cust_STD_ROA</i>	-0.154* (-1.692)	-0.230** (-2.097)	-0.0750 (-1.566)	-0.163* (-1.684)	-0.226* (-1.869)	-0.0721 (-1.390)
<i>Cust_Size</i>	-0.284*** (-3.794)	-0.458*** (-4.294)	-0.181*** (-3.457)	-0.265*** (-3.391)	-0.441*** (-3.990)	-0.177*** (-3.290)
<i>Cust_MTB</i>	-0.0366 (-0.533)	-0.0390 (-0.358)	0.00420 (0.0865)	-0.0769 (-1.082)	-0.0866 (-0.790)	-0.0122 (-0.248)
<i>Macro</i>						
<i>Recession</i>	-1.591*** (-5.588)	-2.591*** (-6.554)	-0.975*** (-5.089)	-1.607*** (-5.683)	-2.635*** (-6.700)	-0.985*** (-5.168)
<i>Default_Spread</i>	-0.152 (-1.580)	-0.546*** (-4.171)	-0.139** (-2.394)	-0.113 (-1.148)	-0.478*** (-3.616)	-0.120** (-2.046)
<i>Interest_Rate</i>	-0.0813 (-1.013)	-0.00895 (-0.0793)	-0.0210 (-0.415)	-0.108 (-1.354)	-0.0496 (-0.439)	-0.0332 (-0.660)
Prob($\beta_2 + \beta_3 = 0$)	0.6891	0.751	0.1157	0.0077	0.0046	0.0003
Observations	15,636	15,636	15,636	15,636	15,636	15,636
R-squared	0.053	0.088	0.065	0.050	0.084	0.063
Fixed effects	Industry	Industry	Industry	Industry	Industry	Industry

Note(s): This table presents estimates of Equation (4) to test Hypothesis 2. Columns 1, 2 and 3 use *Rev* as the proxy for CIQ, while columns 4, 5, and 6 use *MF*. Dependent variables are displayed above each column. I winsorize all continuous variables at 1 and 99 percent and standardize independent variables to have zero mean and a standard deviation of one. *, **, and *** represent significance at the 0.1, 0.05, and 0.01 levels using a two-tailed test. I use two-way clustering of standard errors at the customer and supplier level

Table 6. Restatements as a proxy for CIQ

Panel A: The relationship between restatements, uncertainty, and investment							
Dependent variable:	Exp. Vol. Coeff T-Stat	WC Acc Coeff T-Stat	WC Acc Coeff T-Stat	WC assets Coeff T-Stat	WC assets Coeff T-Stat	Inventory Coeff T-Stat	Inventory Coeff T-Stat
<i>No_Error</i>	-0.0638 (-1.590)	0.261 (1.363)	0.241 (1.282)	0.318 (1.218)	0.275 (1.077)	0.131 (0.901)	0.110 (0.776)
<i>Expected_Volatility</i>			-0.319** (-2.405)		-0.662*** (-3.537)		-0.327*** (-3.974)
<i>Supplier controls</i>							
<i>Size</i>	-0.429*** (-20.95)	-0.546*** (-5.014)	-0.683*** (-5.883)	-0.438** (-2.462)	-0.722*** (-3.989)	-0.0668 (-0.892)	-0.207** (-2.527)
<i>MTB</i>	-0.0145 (-1.104)	0.763*** (5.604)	0.758*** (5.599)	1.374*** (7.915)	1.364*** (7.881)	0.417*** (5.724)	0.412*** (5.666)
<i>Leverage</i>	0.104*** (5.492)	-0.285** (-2.326)	-0.251** (-2.014)	-0.987*** (-5.902)	-0.918*** (-5.330)	-0.413*** (-5.339)	-0.379*** (-4.848)
<i>CFO</i>	-0.181*** (-10.63)	0.946*** (7.896)	0.888*** (7.016)	1.122*** (7.913)	1.002*** (6.637)	0.321*** (5.063)	0.262*** (3.971)
<i>Capital intensity</i>	0.0485* (1.821)	-0.0567 (-0.438)	-0.0413 (-0.318)	0.00454 (0.0280)	0.0366 (0.223)	0.0858 (1.119)	0.102 (1.319)
<i>Customer controls</i>							
<i>Cust_STD_ROA</i>	0.0738*** (4.246)	-0.208** (-2.135)	-0.184* (-1.963)	-0.363*** (-2.940)	-0.314*** (-2.639)	-0.125** (-2.280)	-0.101* (-1.948)
<i>Cust_Size</i>	-0.00887 (-0.506)	-0.252*** (-3.085)	-0.255*** (-3.170)	-0.396*** (-3.502)	-0.402*** (-3.565)	-0.160*** (-2.832)	-0.163*** (-2.939)
<i>Cust_MTB</i>	0.0202 (1.359)	-0.0682 (-0.970)	-0.0618 (-0.900)	-0.0747 (-0.690)	-0.0614 (-0.577)	-0.0111 (-0.223)	-0.00453 (-0.0946)
<i>Macro</i>							
<i>Recession</i>	0.701*** (17.56)	-1.841*** (-6.418)	-1.618*** (-5.694)	-3.093*** (-7.611)	-2.628*** (-6.654)	-1.210*** (-6.662)	-0.980*** (-5.142)

(continued)

Table 6. Continued

Panel A: The relationship between restatements, uncertainty, and investment							
Dependent variable:	Exp. Vol. Coeff T-Stat	WC Acc Coeff T-Stat	WC Acc Coeff T-Stat	WC assets Coeff T-Stat	WC assets Coeff T-Stat	Inventory Coeff T-Stat	Inventory Coeff T-Stat
<i>Default_Spread</i>	-0.00422 (-0.310)	-0.112 (-1.131)	-0.113 (-1.149)	-0.486*** (-3.680)	-0.489*** (-3.697)	-0.123** (-2.116)	-0.125** (-2.134)
<i>Interest_Rate</i>	-0.0191* (-1.741)	-0.0920 (-1.153)	-0.0980 (-1.232)	-0.0294 (-0.256)	-0.0421 (-0.368)	-0.0239 (-0.470)	-0.0302 (-0.594)
Observations	15,579	15,579	15,579	15,579	15,579	15,579	15,579
R-squared	0.400	0.048	0.049	0.080	0.083	0.059	0.063
Fixed effects	Industry	Industry	Industry	Industry	Industry	Industry	Industry

Panel B: Restatements mitigating the effect of uncertainty			
Dependent variable:	WC Acc Coeff T-Stat	WC assets Coeff T-Stat	Inventory Coeff T-Stat
<i>No_Error</i>	0.199 (1.106)	0.193 (0.812)	0.0765 (0.560)
<i>Expected volatility</i>	-0.690*** (-3.436)	-1.389*** (-5.456)	-0.623*** (-4.865)
<i>No_Error*Expected volatility</i>	0.427** (2.064)	0.835*** (3.258)	0.340*** (2.742)
<i>Supplier controls Size</i>	-0.684*** (-5.884)	-0.723*** (-3.997)	-0.208** (-2.528)
<i>MTB</i>	0.760*** (5.615)	1.368*** (7.914)	0.413*** (5.702)

(continued)

Table 6. Continued

Dependent variable:	WC Acc Coeff <i>T</i> -Stat	WC assets Coeff <i>T</i> -Stat	Inventory Coeff <i>T</i> -Stat
<i>Leverage</i>	−0.252** (−2.012)	−0.919*** (−5.332)	−0.379*** (−4.846)
<i>CFO</i>	0.890*** (7.035)	1.006*** (6.651)	0.263*** (3.993)
<i>Capital intensity</i>	−0.0434 (−0.334)	0.0326 (0.200)	0.100 (1.299)
<i>Customer controls</i>			
<i>Cust_STD_ROA</i>	−0.180* (−1.898)	−0.306** (−2.535)	−0.0975* (−1.870)
<i>Cust_Size</i>	−0.252*** (−3.148)	−0.397*** (−3.560)	−0.161*** (−2.930)
<i>Cust_MTB</i>	−0.0643 (−0.933)	−0.0663 (−0.618)	−0.00655 (−0.135)
<i>Macro</i>			
<i>Recession</i>	−1.613*** (−5.676)	−2.619*** (−6.651)	−0.977*** (−5.125)
<i>Default_Spread</i>	−0.120 (−1.208)	−0.501*** (−3.796)	−0.129** (−2.223)
<i>Interest_Rate</i>	−0.0984 (−1.239)	−0.0428 (−0.377)	−0.0305 (−0.606)
Prob(<i>Volatility</i> + <i>CIQ</i> * <i>Volatility</i> = 0)	0.0606	0.0051	0.0009
Observations	15,579	15,579	15,579
<i>R</i> -squared	0.049	0.084	0.064
Fixed effects	Industry	Industry	Industry

Note(s): This table presents results of tests using restatements as a proxy for *CIQ.No_Error* is an indicator variable that equals 1 if the customer firm restated any portion of year *t*, and equals 0 otherwise. Panel A presents estimations of Equation (2) in column 1 and Equation (3) in columns 2 to 7. Columns 3, 5, and 7 include *Expected_Volatility*. Panel B presents estimations of Equation (4). I winsorize all continuous variables at 1 and 99 percent and standardize independent variables to have zero mean and a standard deviation of one. *, **, and *** represent significance at the 0.1, 0.05, and 0.01 levels using a two-tailed test. I use two-way clustering of standard errors at the customer and supplier level

Table 7. Vendor managed inventory subsamples

Dependent variable:	Hi VMI WC assets Coeff T-Stat	WC assets Coeff T-Stat	Low VMI WC assets Coeff T-Stat	WC assets Coeff T-Stat
<i>CIQ and uncertainty</i>				
REV	0.345 (1.277)	0.392 (1.449)	0.998*** (3.079)	0.892*** (2.839)
<i>Expected_Volatility</i>				
		0.278 (0.938)		-0.351 (-1.311)
<i>Supplier controls</i>				
Size	-0.598*** (-3.192)	-0.482** (-2.260)	-0.652*** (-2.663)	-0.814*** (-2.948)
MTB	0.551*** (2.972)	0.554*** (2.972)	0.907** (2.574)	0.904** (2.584)
Leverage	-0.463* (-1.869)	-0.477* (-1.942)	0.0728 (0.288)	0.105 (0.419)
CFO	1.017*** (4.673)	1.052*** (4.635)	0.669*** (2.899)	0.605** (2.586)
Capital intensity	0.114 (0.437)	0.0999 (0.397)	0.0618 (0.205)	0.0881 (0.287)
<i>Customer controls</i>				
Cust_Analyst_Accuracy	-0.0197 (-0.111)	-0.0341 (-0.189)	-0.119 (-0.780)	-0.106 (-0.700)
Cust_STD_ROA	-0.0822 (-0.581)	-0.112 (-0.802)	0.0248 (0.201)	0.0337 (0.274)
Cust_Size	-0.134 (-0.927)	-0.137 (-0.959)	-0.145 (-0.688)	-0.154 (-0.735)
Cust_MTB	0.00885 (0.0868)	0.00992 (0.0970)	0.00941 (0.0695)	0.00963 (0.0714)
<i>Macro</i>				
Recession	-1.417*** (-2.753)	-1.584*** (-3.054)	-1.447** (-1.984)	-1.161 (-1.648)
Default_Spread	-0.129 (-0.738)	-0.121 (-0.694)	0.170 (0.781)	0.179 (0.814)
Interest_Rate	-0.195 (-1.408)	-0.177 (-1.263)	-0.243 (-1.251)	-0.248 (-1.287)
Observations	4,417	4,417	3,125	3,125
R-squared	0.045	0.046	0.043	0.045
Fixed effects	Industry	Industry	Industry	Industry

Note(s): This table presents the set of tests for H1b, and H1c within two different subsamples. Columns 1 and 2 use only High-VMI customer industries (SIC Codes, 2000–28999, 5000–5999) with columns 3 and 4 showing low VMI industries (SIC Codes 1000–1499, 7000–8999). I winsorize all continuous variables at 1 and 99 percent and standardize independent variables to have zero mean and a standard deviation of one. *, **, and *** represent significance at the 0.1, 0.05, and 0.01 levels using a two-tailed test. I use two-way clustering of standard errors at the customer and supplier level

CIQ on working capital investment seems to be concentrated in low-VMI industries. This provides a boundary condition for the main results, and is consistent with the customer's information quality being much more important to the supplier when there is less of a coordinated effort to project end-user demand and the supplier has to rely on the customer's projections.

5.3 Information content of forecasts

The mean-preserving nature of new information is an important assumption of the models that study investment under uncertainty (Dixit and Pindyck, 1994). Customers may issue revenue forecasts when they have good news about future prospects, leading to a violation of this assumption. I include the customer's and supplier's market to book ratio as a control for the supplier's investment opportunities in my main specification, but I include additional controls relating to the customer's growth opportunities in untabulated analyses. My main results are robust to inclusion of the customer's sales growth, market return, and investment opportunity set as defined by Baber *et al.* (1996). These additional tests help to ensure that the main results are not attributable to the customer's growth prospects.

6. Discussion

6.1 Practical implications

This study has several takeaways for practitioners. Suppliers need to understand that the information quality at their customers will affect the company's operations. They can take the customer's forecasting properties as a signal of that information quality before pursuing large contracts. The effect is most important for suppliers in low-VMI industries that may not have as close of a working relationship with customers and as strong of an understanding of end-user demand. Customers should recognize that their disclosure choices may affect how potential suppliers see them. Effective disclosure, both externally and to the suppliers, can affect the supplier's operations, increase supply chain visibility, and reduce stockout risks.

6.2 Limitations

While the results in this study are informative to both researchers and practitioners, there are limitations on potential conclusions. First, the sample is based solely on public-to-public pairings of customers and suppliers. The customers are all large public firms that have substantial levels of control and advanced information systems. Public disclosures cannot be used when supplying to private firms and the information environment for such firms is substantially different from those in my sample. ASC 280 requires disclosure of customers that account for 10% or more of sales. It is unclear how important this effect will be for less important customers or those that require less specialized production.

Additionally, I cannot observe the hypothesized private information flow. Disclosures are a simple proxy for the quality of demand information that is available. They do not account for information sharing or other mechanisms that may be at play. All the results are based on observational correlations. While the study design and untabulated results using a difference in differences procedure provide some assurance of the findings, it is impossible to rule out other endogenous factors.

Future research can build on the findings here and in the existing literature. More detailed analysis of individual relationships and how those relationships change with information quality would be important. Qualitative and survey studies may complement the work here as well. Finally, compiling datasets of supply chain relationships that do not rely on ASC 280 may provide further insight.

7. Conclusion

A firm's suppliers are stakeholders in the firm and rely on the information that they receive from the customer. I investigate how the customer's information quality (CIQ) affects working capital investment decisions by the supplier. Existing theory suggests that quality information may increase investment in working capital (real options view) or decrease investment in working capital to increase overall efficiency (operations view).

I use the customer's voluntary sales guidance as a proxy for its information quality and the supplier's expected volatility as a proxy for uncertainty. When a customer issues a sales

forecast, its supplier has lower expected volatility and higher investment in working capital. The relation between the customer's sales forecasts and the supplier's working capital investment is mediated by expected volatility. These results provide evidence that the customer's information quality regarding demand affects the supplier's uncertainty, thereby affecting investment and is consistent with the real options framework dominating working capital investment decisions.

I also account for the possibility that shared information remains private and the supplier's expected volatility does not incorporate the customer's information. A wider gap between the supplier's actual uncertainty and the observed uncertainty implies a weaker relation between observed uncertainty and the supplier's investment. I find that when a customer issues sales forecasts, the relation between investment and volatility for the supplier is weaker. This result provides further evidence that the customer's demand-related information quality affects the supplier's investment decisions by altering the supplier's uncertainty.

I investigate restatements as an alternative proxy for a customer's information quality. I continue to find evidence that CIQ attenuates the relation between investment and uncertainty, suggesting that reduced information quality from the customer alters the supplier's information set, but that it is not captured publicly. Additionally, I find that the results are concentrated in industries with low rates of vendor managed inventory. This suggests that CIQ is more important when there is less frequent communication between the customer and supplier.

My results add to the literature on investment under uncertainty by demonstrating that demand-related information from a customer can reduce a supplier's uncertainty and increase investment in working capital. Theory on the relation between investment and uncertainty suggests that this additional investment reduces the dead-weight loss caused by uncertainty (Dixit and Pindyck, 1994). I also contribute to the literature in accounting that examines how information coming from a customer is useful for a supplier and add to the broader literature that examines the spillover of information from one firm to another (Bauer *et al.*, 2017; Cohen and Frazzini, 2008; Pandit *et al.*, 2011; Raman and Shahrur, 2008). Finally, I provide further evidence that publicly disclosed forecasts are a valid proxy for the quality of a firm's internal information by examining forecasts in a setting that is known to have substantial private information flow (Goodman *et al.*, 2014; Ittner and Michels, 2017; Verrecchia, 1990).

Overall, I provide initial evidence that a customer's information quality affects the supplier's decision making. The role of information sharing along the supply chain should be of interest to both accounting academics and those interested in supply chain dynamics. Future research may include the effect of the customer's information quality on other operational areas such as inventory management and operational efficiency.

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(The Appendix follows overleaf)

Table A1. Variable definitions

Variable name	Definition
<i>Information quality</i>	
<i>REV</i>	An indicator variable equal to 1 if the customer has issued a management revenue forecast in the preceding three years, and zero otherwise.
<i>MF</i>	An indicator variable equal to 1 if the customer has issued an annual earnings forecast in the preceding three years, and zero otherwise.
<i>No_Error</i>	An indicator variable equal to 1 if the customer did not have a restatement for any period in year t , and zero otherwise.
<i>Uncertainty</i>	
<i>Expected firm volatility</i>	The estimated total volatility from a GARCH (1,1) model for the supplier firm's stock using returns available in year t with at least 200 observations.
<i>Investment</i>	
<i>WC</i>	Working capital accruals in year $t+1$ from Compustat scaled by total assets at the beginning of the year. Measured as $\Delta((rect + invt + aco) - (ap + lco))/at$.
<i>WC_Assets</i>	Working capital asset accruals in year $t+1$ from Compustat scaled by total assets at the beginning of the year. Measured as $\Delta(rect + invt + aco)/at$.
<i>Inventory</i>	Inventory accruals in year $t+1$ from Compustat scaled by beginning total assets ($\Delta invt/at$).
<i>Supplier controls</i>	
<i>Size</i>	The log of market value of equity as of the end of year t .
<i>MTB</i>	The market value of the firm scaled by book value of equity (<i>seq</i>) at the end of year t .
<i>Leverage</i>	The ratio of debt to total assets at the end of year t .
<i>CFO</i>	Cash flows from operations scaled by total assets.
<i>Capital intensity</i>	The net property plant and equipment (<i>ppent</i>) scaled by the total assets (<i>at</i>) at the beginning of year t .
<i>Customer controls</i>	
<i>Cust_Analyst_Accuracy</i>	The average accuracy of the customer firm's analysts measured over the same time period of <i>Cust_Accuracy</i> . Using analyst sales forecasts when the test uses management sales forecasts and earnings forecasts when the test uses earnings.
<i>Cust_STD_ROA</i>	The standard deviation of quarterly earnings (<i>ibq/atq</i>) over the same time period as <i>Cust_Accuracy</i> .
<i>Cust_Size</i>	The log of market value of equity as of the end of year t .
<i>PCT_Sales</i>	The portion of the supplier's sales that go to the customer.
<i>Macro</i>	
<i>Default_Spread</i>	The default risk spread as of the middle of year $t+1$, measured as the yield spread between long-term Baa and Aaa rated securities from the St. Louis Federal Reserve Bank.
<i>Interest_Rate</i>	The nominal return on 1 year T-Bill as of the middle of year $t+1$.
<i>Recession</i>	An indicator equal to 1 if any of the months in year $t+1$ are recognized as a recession by the NBER.

Notes

1. In general, the quality of information in a particular context reflects both the precision of the information and the relevance of that information for decision-making purposes.
2. By focusing on a particular type of information that should be directly relevant to suppliers' investment decisions (i.e. customer information about end-user demand), I hold constant the relevance of customers' information and focus on the precision of that information.

3. If high-quality customer information widens the gap between the suppliers' actual uncertainty and my proxy for uncertainty, then the observed relation between investment and uncertainty will be weaker.
4. Examples include compensation schemes, financial distress, patent protection, and political institutions (Panousi and Papanikolaou, 2012; Eisdorfer, 2008; Czarnitzki and Toole, 2011; Julio and Yook, 2012)
5. The theoretical literature identifies several mechanisms that can affect this relation, including risk aversion, opportunity costs, the value of waiting for better information, cost to adjustment, irreversibility, risk preferences, and others. While a mixture of these different aspects can lead to ambiguous predictions about the effect of uncertainty on investment, the majority of the empirical literature finds a negative relation between the two (Goodman *et al.*, 2014).
6. While these hypotheses do establish a theoretical causal chain between my variables of interest, I acknowledge that most of my tests are association tests. I test for associations that the causal links imply.
7. I rely on a linking table provided through Wharton Research Data Services (Cen *et al.*, 2017; Cohen and Frazzini, 2008)
8. The disclosure rule states that a supplier must disclose a customer if it makes up more than 10% of sales, but a supplier can opt to disclose important customers that make up less than 10% of sales. I also eliminate 170 observations where sales to the customer are more than total sales for the supplier. Conclusions remain unchanged when requiring the sales percentage to be greater than 10%.
9. Accounting Standard Codification 280 requires firms to disclose customers that make up at least 10% of total revenue. This requirement leads to a sample that has unique supplier-customer-years. Some suppliers disclose multiple customers during the same year and several large customers have multiple suppliers report them as a principle customer. Results are robust to limiting the sample to the largest reported customer.
10. In untabulated tests, I exclude Walmart with no significant change to the main results.
11. Other potential measure of uncertainty include analyst dispersion (Barron and Stuerke, 1998) and implied volatility (Bozanic *et al.*, 2018). These measures require multiple analysts following the firm and publicly traded options, respectively, both of which substantially reduce my sample size because the supplier firms in my sample tend to be smaller firms with relatively low analyst following and without traded options.
12. The conclusions are robust to using a one year window.
13. In fact, analysts are more likely to understand macroeconomic and industry information than managers (Hutton *et al.*, 2012).
14. In untabulated tests I exclude the analysts' accuracy from tests. Consistent with the analysts' accuracy overcontrolling for determinants of the management forecast accuracy, the coefficients on CIQ are larger when excluding the analysts' accuracy. However, this choice does not alter the statistical significance of most tests.
15. This test is performed at the supplier-year level. Some observations are dropped for suppliers that report multiple important customers in the same year.
16. This is taken from the coefficient on Rev in Table 4 panel b and the descriptive statistics for working capital in Table 2.
17. In untabulated results, I find significant mediation through a significant indirect effect (Zhao *et al.*, 2010). Results are robust to using Sobol or bootstrapped standard errors (Preacher and Hayes, 2004).
18. Some studies in accounting and economics focus on the effect of uncertainty on responsiveness to growth opportunities (Badertscher *et al.*, 2013; Bloom *et al.*, 2007; Guiso and Parigi, 1999). These studies rely on investment as a purchase of capital to have returns over multiple future periods. This view is not appropriate when using working capital as a measure of investment. Additionally, the literature that is most closely related to my question examines the direct effect of uncertainty on investment and how the relation between uncertainty and investment may be altered (Czarnitzki and Toole, 2011; Wellman, 2017)

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