Supplier Concentration and Earnings Management

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In this paper, I empirically examine the association between supplier concentration and earnings management. A firm's major suppliers use its accounting performance to evaluate its ability to fulfill trading obligations and honor implicit claims, giving rise to its stronger incentives to manipulate earnings. However, the firm may face punishment and termination of relationships if major suppliers detect its earnings management with their information and bargaining advantages. Employing a comprehensive sample of firms with supply chain data, I find a negative association between a firm's supplier concentration and earnings management using discretionary accruals and real activities. My results suggest that customer firms are concerned about major suppliers' close monitoring and bargaining power, thereby decreasing their earnings management practices.

INTRODUCTION

Suppliers and customers are exchanges partners and directly participate in each other's operating activities. One side's economic performance and ability to fulfill obligations will significantly influence the function of supply chain and the performance of another side (Raman and Shahrur 2008; Hui et al. 2012). Previous literature documents that a firm's suppliers will consider its financial performance and evaluate its long-term financial viability, especially when it is heavily dependent on a few major suppliers with higher distress risk (Bowen et al. 1995; Hui et al. 2012; Chen et al. 2021). At the same time, a firm's frequent transactions with major suppliers will contribute to suppliers' better knowledge of its operations and financial reporting, resulting in suppliers' close monitoring on it. If earnings management helps a firm to influence its prospects perceived by major suppliers but may be detected, then the impact of a firm's supplier concentration on its earnings management decisions is unclear. This paper aims to solve this puzzle by investigating the association between supplier concentration and earnings management.

Prior studies find that a firm's accounting numbers will be used by stakeholders to assess its potential to fulfill trading obligations in the short term and honor implicit claims over the long run (Bowen et al. 1995; Raman and Shahrur 2008; Hui et al. 2012). For example, a financially healthy firm is considered to be more likely to make cash payments after purchasing products or services and continue to order in the future. After evaluating the firm's accounting performance, suppliers will decide whether they should maintain the relationship and undertake transaction-specific investments (Raman and Shahrur 2008; Hui et al. 2012). Specifically, when a firm is operated with a concentrated supplier base, the preservation of its ability to remain financially viable becomes of vital importance.[1] A concentrated supplier base indicates

that a firm purchases upstream products and services from a few major suppliers. If a firm generates poor performance and is perceived to be with weak prospects, major suppliers may choose to terminate the relationship. Consequently, it will face large switching costs because it has to find a new supplier with great uncertainty about the quality of products and services offered (Hui et al. 2012). Therefore, with a concentrated supplier base, a firm may have stronger incentives to manage earnings to influence the perception of suppliers about its prospects and maintain the existing relationships.

However, major suppliers may reduce a firm's earnings management practices through their information and bargaining advantages. A firm and its major suppliers are involved in frequent exchange transactions with each other. As such, major suppliers could develop and possess a better understanding of the customer firm's operating environment and accounting practices, which allows them to monitor its real transactions and financial reporting closely. In addition, major suppliers have superior bargaining power with significant influence on contracts with customers (Hui et al. 2012). A firm may face punishment and termination of the relationship if its earnings management is detected by major suppliers. Therefore, a firm may be concerned about major suppliers' strict monitoring and potential penalty, thereby decreasing its earnings management activities.

Given the two arguments above, it is unclear whether and how a firm's reliance on major suppliers affects its accounting decisions. In this paper, I answer this question by investigating the association between a firm's supplier concentration and earnings management. A large stream of literature has documented the existence of accrual and real earnings management in the context of CEO compensation, capital market, and covenant violations (Healy and Wahlen 1998; DeFond and Jiambalvo 1994; Sweeney 1994). Accrual earnings management indicates the changes of accounting methods and estimates to obscure true economic performance, while real earnings management refers to the adaption of the timing or structuring of real transactions to alter reported earnings (Roychowdhury 2006; Graham, Harvey, and Rajgopal 2005; Zang 2012). In this paper, I consider both accrual and real earnings management when a firm transacts with major suppliers.

To examine the association between supplier concentration and earnings management, I start with a sample of firm-year observations with available information on supply chain from Compustat Customer Segment Files. I follow Zang (2012) and Cohen and Zarowin (2010) to use discretionary accruals to measure accrual-based earnings management. Moreover, I follow Roychowdhury (2006) to use abnormal cash flows, abnormal production costs, and abnormal discretionary expenses to proxy for real activities manipulation. After removing observations with missing data on required variables, I obtain a final sample of 13,908 observations from 1987 to 2017.

First, I find that a firm's supplier concentration is negatively associated its discretionary accruals, suggesting that it is concerned about major suppliers' strong monitoring and bargaining power and hence will reduce its discretion over accruals. Next, I find a negative association between a firm's supplier concentration and real earnings management, indicating that a firm with great reliance on major suppliers will also decrease its real activities manipulation of earnings. In particular, my results shows that the impact of supplier concentration on real earnings management is stronger than that on accrual earnings management. This may be due to the frequent transactions between major suppliers and customers. If a firm alters real transactions (i.e., purchase of materials) to influence earnings, major suppliers' superior information on its operating environment will enable them to detect it immediately. As such, a firm with high supplier concentration will avoid conducting real earnings management. Lastly, I use three individual measures of real earnings management and find that major suppliers can restrain a firm's real earnings manipulation in terms of overproduction and reduction of discretionary expenses.

This study contributes to two streams of literature. First, it adds to the literature of accrual and real earnings management. Although the evidence on capital market (Teoh et al. 1998) or compensation motives (Healy and Wahlen 1998)) for earnings management is abundant, few studies have investigated the role of supply chain relationship in determining a firm's financial decisions. Raman and Shahrur (2008) consider how relationship-specific investments along the supply chain affects earnings management, but do not focus on the concentration of supplier base. I contribute to this line of literature by documenting the impact of major suppliers' information and bargaining advantages on a firm's accounting decisions. Second, previous

literature on supply chain management primarily focuses on the influence of major customers, such as major customer power and types. For example, Patatoukas (2012) and Irvine et al. (2016) investigates the influence of customer concentration on supplier profitability, while Cohen and Li (2020) shows that major government and corporate customers have different impact on suppliers' demand uncertainty and investment efficiency. One exception is Chen et al. (2021) by showing that firms with a concentrated supplier base tend to choose a more elastic cost structure to address increased supply disruption risk. My study contributes to research on supply chain by showing that a firm's reliance on major suppliers will decrease its earnings management activities and improve the quality of financial reporting.

The study proceeds as follows. Section 2 discusses the related literature and develops the hypothesis. Section 3 describes the sample and empirical methodology. Section 4 presents the empirical results. Section 5 concludes.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Earnings Management

A large stream of literature has documented that firms may engage in accrual earnings management and real earnings management to influence their economic performance. For example, managers may exercise their discretion over accounting methods or estimates to inflate earnings (Healy and Wahlen 1999) or to provide incremental information about future cash flows (Bowen et al. 1987; Barth et al. 1999). The existing literature has documented evidence on the opportunistic use of accrual earnings management in the settings of initial public offerings (Teoh et al. 1998), executive compensation (Healy and Wahlen 1998), debt covenant violations (DeFond and Jiambalvo 1994; Sweeney 1994), and insider trading (Darrough and Rangan 2005).

In addition to accrual earnings management, recent studies show that managers could manipulate accounting numbers through real transactions. Roychowdhury (2006) define real earnings management as manipulation of operational activities that deviate from normal corporate practices. Specifically, previous studies identify three methods of real activities manipulation: sales manipulation, reduction of discretionary expenses, and overproduction (Roychowdhury 2006; Skinner and Sloan 2002; Bartov, Givoly and Hayn 2002; Lopez and Rees 2002). Zang (2012) focus on the trade-off between accrual and real earnings management and document that managers use these two methods as substitutes based on their relative costs. In particular, real earnings management adapts the timing or structuring of actual transactions and results in direct cash flow consequences, making it harder to be detected by external auditors and regulators (Zang 2012).

Although the evidence on earnings management in the context of CEO compensation and capital market events is abundant, little evidence is available on the role of suppliers in determining their customers' earnings management practices. One exception is Raman and Shahrur (2008) with a primary concentration on relationship-specific investments along the supply chain. Raman and Shahrur (2008) document that suppliers' relationship-specific investments will induce customers to manipulate earnings with higher levels of discretionary accruals. As a result, customers could be perceived to be with better future prospects to fulfill obligations and continue the supply chain relationship. However, Raman and Shahrur (2008) investigate a particular dimension of supplier-customer relationship: relationship-specific investments. In contrast, my paper focuses on the overall supplier power captured by supplier-based concentration and examine if major suppliers' information and bargaining advantages will influence customers' financial reporting decisions.

Hypothesis Development

A firm's suppliers will rely on its accounting numbers to evaluate its financial status and economic performance for three reasons. First, it is important for suppliers to determine if this firm can fulfill its short-term trading obligations (Hui et al. 2012). A firm's accounting performance is indicative of its financial ability to make cash payments to suppliers and purchase from suppliers continuously. If the firm is in financial distress and breaches its contractual obligations, supply chain will be disrupted and suppliers will

suffer losses. Second, suppliers are concerned about customer firms' reputation for honoring stakeholders' implicit claims over the long term (Bowen et al. 1995; Burgstahler and Dichev 1997). Suppliers tend to transact with a firm with higher reported earnings, because it is more likely to remain financially viable and fulfill implicit claims in long-term transactions. Lastly, suppliers often undertake significant relationship-specific investments. For instance, suppliers may invest in specialized assets to tailor products for a particular customer firm, while these investments will be recovered as the supplier-customer relationship matures (Irvine et al. 2016). Therefore, suppliers prefer to sell to a firm with better prospects for long-term financial viability and hence extend the supply chain relationships (Hui et al. 2012; Raman and Shahrur 2008).

Given the importance for a firm's suppliers to assess its accounting performance, I argue that a firm's supplier concentration may influence its incentives to manage earnings. On the one hand, a concentrated supplier base indicates that a firm purchases inputs from a limited number of major suppliers. Maintaining these supplier-customer relationships is essential to the firm's operation due to its heavy dependence on major suppliers. If the firm generates poor performance and is perceived by major suppliers to be with weak prospects, the relationship may be terminated by suppliers. Consequently, it will be forced switch to a new supplier with uncertainty and incur large switching costs (Hui et al. 2012). Therefore, to preserve its ability to meet obligations and continue its supply chain relationship with existing major suppliers, a firm with high supplier concentration will exhibit stronger incentives to manage earnings. In other words, firms will manage earnings more when they have a concentrated supplier base.

On the other hand, major suppliers may influence a firm's earnings management decisions through their information and bargaining advantages. Major suppliers have frequent transactions with a firm and thus possess better knowledge of the firm's operating environment. This superior knowledge allows major suppliers to impose more strict monitoring on the firm's financial reporting. Moreover, as supplier concentration increases, major suppliers' power also becomes greater and enables them to enforce implicit or explicit contracts (Chen, Su, Tian, Xu, and Zuo 2021). Once detecting a firm's earnings management, major suppliers can utilize their bargaining power to punish it or terminate the trading relationship. Therefore, with strict monitoring and severe punishment, major suppliers may reduce a firm's incentives to manipulate earnings.

Given these two competing predictions discussed above, the association between a firm's supplier concentration and earnings management is ex-ante unclear. This study examines the following null hypothesis:

H1 (null): *There is no association between a firm's supplier concentration and earnings management.*

SAMPLE AND EMPIRICAL METHODOLOGY

Sample Selection

Table 1, Panel A reports my sample selection procedures. I start my sample with 19,919 firm-year observations with available information on major suppliers from Compustat Customer Segment Files.[2] Consistent with studies on earnings management and supply chain (Roychowdhury 2006; Raman and Shahrur 2008; Patatoukas 2012; Irvine et al. 2016), 523 firm-year observations in the financial industries (SIC codes 6000 – 6500) are removed. Next, I obtain required data from Compustat, CRSP, Thomson Financial database, and I/B/E/S. I drop observations with missing data on earnings management and control variables, resulting in a final sample of 13,908 firm-year observations from 1987-2017.

Table 1, Panel B reports the sample distribution by sectors. In accordance with prior literature on earnings management and supply chain (Roychowdhury 2006; Raman and Shahrur 2008; Patatoukas 2012; Irvine et al. 2016; Hui et al. 2018), manufacturing firms take the largest faction of the full sample (58.31%). After that, services (15.64%), wholesale (6.27%), and mining firms (6.23%) also tend to purchase from major suppliers.

Measure of Supplier Concentration

Following previous literature on supplier concentration (Chen et al. 2021), I employ the Herfindahl-Hirschman Index (HHI) to measure a firm i's supplier concentration ($SC_{i,t}$) with j major suppliers in year t as:

$$SC_{i,t} = \sum_{j=1}^{J} \left(\frac{PROCUREMENT_{i,j,t}}{TOTAL\ PROCUREMENT_{i,t}}\right)^2 \qquad (1)$$

where $PROCUREMENT_{i,j,t}$ indicates firm i's procurement from major supplier j in year t, and $TOTAL$ $PROCUREMENT_{i,t}$ is firm i's total procurement in year t. Two factors are captured in this measure: the number of major suppliers that account for more than 10% of a firm's total procurement and the percentage procurement from each major supplier. This measure ranges between zero and one. It equals zero if the firm does not rely on any major suppliers, and equals one if the firm purchase all inputs from one major supplier.

Measures of Earnings Management

In this paper, I consider both accrual and real earnings management. I use discretionary accruals ($AEM_{i,t}$) to proxy for accrual earnings management, which are the estimated residuals from the following modified Jones (1991) model :

$$\frac{TA_{i,t}}{ASSETS_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{ASSETS_{i,t-1}} + \alpha_2 \frac{\Delta SALES_{i,t}}{ASSETS_{i,t-1}} + \alpha_3 \frac{PPE_{i,t}}{ASSETS_{i,t-1}} + \varepsilon_{i,t}, \qquad (2)$$

where $TA_{i,t}$ is firm i's total accruals calculated as net income before extraordinary items minus net cash flow from operating activities in year t; $ASSETS_{i,t-1}$ is the total assets in year t-1; $\Delta SALES_{i,t}$ is the change in sales from year t-1 to year t; and $PPE_{i,t}$ is firm i's gross property, plan, and equipment in year t. I estimate model (2) for each industry (2-digit SIC codes) in a given year with at least 15 observations. All variables are winsorized at one percent level. A higher value of $AEM_{i,t}$ indicates a higher level of accrual earnings management to inflate earnings.

I follow Roychowdhury (2006) to use abnormal cash flow from operations, abnormal production costs, and abnormal discretionary expenses to proxy for three methods of real earnings management. First, I use the following cross-sectional regression in each industry-year group with at least 15 firm-year observations to estimate normal cash flow from operations:

$$\frac{CFO_{i,t}}{ASSETS_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{ASSETS_{i,t-1}} + \alpha_2 \frac{SALES_{i,t}}{ASSETS_{i,t-1}} + \alpha_3 \frac{\Delta SALES_{i,t}}{ASSETS_{i,t-1}} + \varepsilon_{i,t} \qquad (3)$$

where $CFO_{i,t}$ is firm i's cash flow from operations in year t; $ASSETS_{i,t-1}$ is total assets in year t-1; $SALES_{i,t}$ is firm i's total net sales in year t; and $\Delta SALES_{i,t}$ is the change in sales from year t-1 to year t. Abnormal $CFO_{i,t}$ is calculated as actual $CFO_{i,t}$ minus the normal level of $CFO_{i,t}$ estimated from model (3). Roychowdhury (2006) document that sales manipulation through price discounts and credit terms will cause cash flow to be abnormally low. Therefore, I multiply abnormal CFO by negative one ($REMCFO_{i,t}$). As such, A higher value of it indicates that firm I manage earnings more though sales manipulation.

TABLE 1
SAMPLE SELECTION AND SAMPLE DISTRIBUTION

Panel A: Sample Selection

	Number of Observations
Unique observations with available information on major suppliers from 1987 to 2017	19,919
Drop observations in the utilities and financial industries	-523
Drop observations with missing data on earnings management	-3,795
Drop observations with missing data on other required variables	-1,693
Final Sample	13,908

Panel B: Sample Distribution by Sectors

Two-digit SIC Industry Sectors	Percent in the Sample	Number of Observations
Agriculture, Forestry, and Fishing (01-09)	0.25%	35
Mining (10-14)	6.23%	866
Construction (15-17)	0.50%	70
Manufacturing (20-39)	58.31%	8,110
Wholesale Trade (50-51)	6.27%	872
Retail Trade (52-59)	15.64%	2,175
Services (70-78)	8.37%	1,164
Other	4.43%	616
Total	100.00%	13,908

Notes: This table reports the sample selection procedures in Panel A and sample distribution by sectors in Panel B. The full sample consists of 13,908 firm-year observations, spanning from 1987 to 2017.

Next, I use the following regression to calculate the normal level of production in each industry-year group with at least 15 observations:

$$\frac{PROD_{i,t}}{ASSETS_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{ASSETS_{i,t-1}} + \alpha_2 \frac{SALES_{i,t}}{ASSETS_{i,t-1}} + \alpha_3 \frac{\Delta SALES_{i,t}}{ASSETS_{i,t-1}} + \alpha_4 \frac{\Delta SALES_{i,t-1}}{ASSETS_{i,t-1}} + \varepsilon_{i,t} \qquad (4)$$

where $PROD_{i,t}$ is the sum of *COGS* in year *t* and the change in inventory from year *t-1* to year *t*; and $\Delta SALES_{i,t-1}$ is the change in sales from year *t-2* to year *t-1*. I calculate residuals from model (4) to proxy for abnormal production costs ($REMPROD_{i,t}$). In accordance with Roychowdhury (2006), a higher value of $REMPROD_{i,t}$ suggests more real earnings management in overproduction.

Lastly, I estimate the normal level of discretionary expenses using the following model in each industry and year with at least 15 observations:

$$\frac{DISEXP_{i,t}}{ASSETS_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{ASSETS_{i,t-1}} + \alpha_2 \frac{SALES_{i,t}}{ASSETS_{i,t-1}} + \varepsilon_{i,t} \qquad (5)$$

where $DISEXP_{i,t}$ is the total of R&D, advertising, and SG&A expenditures for firm *i* in year *t*. I use actual discretionary expenses minus normal discretionary expenses derived from model (5) and multiply the result

by minus one ($REMDISEXP_{i,t}$). As in Roychowdhury (2006), a higher value of $REMDISEXP_{i,t}$ is indicative of a larger reduction of discretionary expenses to boost earnings.

Following Zang (2012) and Cohen and Zarowin (2010), I capture the total effects of real earnings management by aggregating the three measures discussed above. Specifically, I calculate $REM1_{i,t}$ as the sum of $REMPROD_{i,t}$ and $REMDISEXP_{i,t}$, and $REM2_{i,t}$ as the total of $REMCFO_{i,t}$ and $REMDISEXP_{i,t}$.[3]

Empirical Methodology

To examine the association between a firm's supplier concentration and earnings management, I employ the following Ordinary Least Square (OLS) regression model:

$$EM_{i,t} = \beta_0 + \boldsymbol{\beta_1 RANK(SC)_{i,t}} + \beta_2 Controls_{i,t} + Year\ Fixed\ Effects + \\ + Industry\ Fixed\ Effects + \varepsilon_{i,t} \tag{6}$$

where $EM_{i,t}$ is supplier i's accrual ($AEM_{i,t}$) or real earnings management activities ($REM1_{i,t}$ or $REM2_{i,t}$); $RANK(SC)_{i,t}$ is the decile rank of SC for firm i in year t.[4] The coefficient on $RANK(SC)_{i,t}$, β_1, captures the association between firm i's supplier concentration and the level of earnings management through discretionary accruals or real transactions.

I include a set of control variables as in prior studies (Roychowdhury 2006; Cohen, Dey, and Lys 2008; Raman and Shahrur 2008; Cohen and Zarowin 2010; Zang 2012): firm profitability ($ROA_{i,t-1}$), size ($SIZE_{i,t-1}$), growth potential ($MB_{i,t-1}$), book leverage ($LEV_{i,t-1}$), Altman z-score ($ALTMAN_{i,t}$), operating loss ($DLOSS_{i,t}$), net operating assets ($NOA_{i,t-1}$), number of shares outstanding ($SHARES_{i,t-1}$), age ($AGE_{i,t}$), institutional ownership ($INSOWN_{i,t}$), number of analysts following ($ANACOV_{i,t}$), auditor ($BIG4_{i,t}$), auditor tenure ($TENURE_{i,t}$), litigation risk ($LITIGATION_{i,t}$), SOX ($SOX_{i,t}$), and issuance of shares ($ISSUE_{i,t}$). Year and industry fixed effects based on two-digit SIC codes are included. Standard errors are clustered at the firm level. Details of variable definitions are presented in Appendix. All continuous variables are winsorized at the 1st and 99th percentiles to reduce the effect of outliers. Hereafter, I omit the subscript for expositional ease.

Summary Statistics

Table 2 provides summary statistics for the full sample. The mean (median) value is 0.035 (0.028) for discretionary accruals (AEM). For the two metrics of real earnings management, the mean (median) values are 0.107 (0.099) for $REM1$ and 0.049 (0.046) for $REM2$. My variable of interest is supplier concentration (SC) with a mean (median) value of 0.057 (0.000). The average ROA is 0.035 with a median value of 0.057. In addition, around 20.1% of firms in the full sample report a loss ($DLOSS$). Overall, the summary statistics of the sample are comparable to those reported in prior studies on earnings management (Roychowdhury 2006; Cohen, Dey, and Lys 2008; Cohen and Zarowin 2010; Zang 2012) and supply chain (Patatoukas 2012; Irvine et al. 2016; Chen et al. 2021).

Table 3 presents the Spearman correlations between key variables in the full sample. I find negative correlations between supplier concentration *(SC)* and earnings management measures *(AEM, REM1, and REM2)*, suggesting that firms with a concentrated supplier base may engage in less accrual and real earnings management due to major suppliers' stronger monitoring and bargaining power.

TABLE 2
SUMMARY STATISTICS

Variable	N	Mean	25%	Median	75%	Std. Deviation
AEM	13,908	0.035	-0.026	0.028	0.097	0.151
REM1	13,908	0.107	-0.119	0.099	0.346	0.492
REM2	13,908	0.049	-0.103	0.046	0.204	0.328
SC	13,908	0.057	0.000	0.000	0.010	0.453
ROA	13,908	0.035	0.015	0.057	0.103	0.332
SIZE	13,908	7.728	6.481	8.006	9.337	2.069
MB	13,908	3.290	1.382	2.264	3.856	5.534
LEV	13,908	1.560	0.638	1.142	1.910	3.376
ALTMAN	13,908	4.284	2.189	3.366	5.161	6.920
DLOSS	13,908	0.201	0.000	0.000	0.000	0.401
NOA	13,908	1.327	0.566	0.877	1.303	3.935
SHARES	13,908	4.595	3.582	4.618	5.737	1.470
AGE	13,908	2.984	2.398	3.045	3.689	0.763
INSOWN	13,908	0.427	0.005	0.504	0.775	0.346
ANACOV	13,908	1.828	0.000	2.565	2.565	1.143
BIG4	13,908	0.843	1.000	1.000	1.000	0.364
TENURE	13,908	2.271	1.792	2.398	2.944	0.870
LITIG	13,908	0.280	0.000	0.000	1.000	0.449
SOX	13,908	0.491	0.000	0.000	1.000	0.500
ISSUE	13,908	0.635	0.000	1.000	1.000	0.481

Notes: This table reports the summary statistics for the full sample. The full sample consists of 13,908 firm-year observations, spanning from 1987 to 2017.

TABLE 3
CORRELATIONS BETWEEN MAIN VARIABLES

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	AEM									
(2)	REM1	0.38*								
(3)	REM2	0.41*	0.87*							
(4)	SC	-0.01	-0.06*	-0.04*						
(5)	ROA	0.31*	0.35*	0.24*	-0.13*					
(6)	SIZE	0.07*	0.09*	0.03*	-0.21*	0.20*				
(7)	MB	0.04*	0.02*	0.01*	0.00	0.07*	0.11*			
(8)	LEV	0.03*	0.06*	0.04*	-0.02*	0.08*	0.06*	0.50*		
(9)	ALTMAN	0.21*	0.16*	0.09*	-0.06*	0.37*	0.22*	0.15*	0.05*	
(10)	DLOSS	-0.20*	-0.09*	-0.02*	0.11*	-0.26*	-0.38*	-0.00	-0.06*	-0.14*

Notes: This table reports the Spearman correlations between main variables for the full sample. Appendix provides variable definitions with details. * indicates significant levels of less than 1%.

EMPIRICAL RESULTS

Supplier Concentration and Accrual Earnings Management

In this section, I investigate the association between supplier concentration and accrual earnings management. Table 4 reports the regression results. When the dependent variable is discretionary accruals (*AEM*), the coefficient on *RANK(SC)* is negative and significant at ten percent level (coefficient = -0.008, t-statistic = -1.68). This result suggests that, when firms make procurement purchases from a few major suppliers, they will engage in less accrual earnings management. That is, major suppliers have information and bargaining advantages over customers, so they can better detect customers' discretion over accounting methods and estimates and impose stronger monitoring on customers.

TABLE 4
ASSOCIATION BETWEEN SUPPLIER CONCENTRATION AND ACCRUAL EARNINGS MANAGEMENT

	Dependent Variable = *AEM*	
	Coefficients	t-statistic
RANK(SC)	**-0.008***	**(-1.68)**
ROA	0.045**	(2.06)
SIZE	-0.009***	(-2.76)
MB	-0.001	(-0.84)
LEV	0.001	(1.47)
ALTMAN	0.000	(0.02)
DLOSS	-0.085***	(-16.19)
NOA	-0.000	(-0.34)
SHARES	0.005	(1.58)
AGE	0.009***	(3.47)
INSOWN	-0.022***	(-3.36)
ANACOV	0.006***	(2.85)
BIG4	-0.005	(-1.07)
TENURE	-0.001	(-0.52)
LITIG	-0.029***	(-4.68)
SOX	0.072***	(7.97)
ISSUE	0.000	(0.21)
Intercept	0.042	(1.42)
Industry F.E.	Yes	
Year F.E.	Yes	
N	13,908	
Adjusted R^2	0.1668	

Notes: This table reports the results of estimating the association between a firm's supplier concentration and accrual earnings management. The industry and year fixed effects are included. T-statistics are based on standard errors clustered at the firm level. All continuous variables are winsorized at the 1% and 99% levels. Appendix provides variable definitions with details. *, **, and *** denote significance based on two-tailed t-tests at or below the 10%, 5%, and 1% levels, respectively.

Supplier Concentration and Real Earnings Management

In this section, I focus on the impact of supplier concentration on real earnings management. Table 5 presents the estimation results of model (6) when the dependent variable is the aggregate measures of real

earnings management. Column (1) shows that, when the dependent variable is *REM1*, the coefficient on *RANK(SC)* is negative and significant (coefficient = -0.072, t-statistic = -2.63). Furthermore, when I use *REM2* as the dependent variable in column (2), the coefficient on *RANK(SC)* remains significantly negative (coefficient = -0.044, t-statistic = -2.67). These results suggest that firms with heavy dependence on major suppliers engage in less real earnings management because they are concerned about major suppliers' detection and penalty.

Previous literature argue that real earnings management includes alternation of real transactions, making it harder to be detected by outsiders, such as auditors and regulators (Zang 2012). However, my results shows that the impact of supplier concentration on real earnings management is stronger than that on accrual earnings management. This may be because suppliers are closely related to customers' daily operations. For example, customers order upstream products from suppliers and then enter these purchases into the manufacturing process. In addition, suppliers may request information on market demand from customers for capacity planning (Ozer and Wei 2006). If customers manipulate earnings through overproduction or oversale, suppliers' superior information on customers' operating environment will enable them to discover and detect it timely. As such, the impact of supplier concentration on real earnings management is more pronounced than that on accrual earnings management.

TABLE 5
ASSOCIATION BEWEEN SUPPLIER CONCENTRATION AND REAL EARNINGS MANAGEMENT

	(1) REM1		(2) REM2	
	Coefficients	t-statistic	Coefficients	t-statistic
RANK(SC)	**-0.072*** **	**(-2.63)**	**-0.044*** **	**(-2.67)**
ROA	0.083	(1.57)	0.038	(1.19)
SIZE	0.009	(0.98)	-0.004	(-0.74)
MB	-0.019***	(-8.94)	-0.014***	(-9.94)
LEV	0.027***	(9.44)	0.019***	(9.78)
ALTMAN	-0.006***	(-3.21)	-0.006***	(-5.27)
DLOSS	0.006	(0.42)	0.033***	(3.61)
NOA	0.005***	(2.73)	0.005***	(3.68)
SHARES	0.009	(0.71)	0.011	(1.45)
AGE	0.014	(0.90)	0.023***	(2.58)
INSOWN	-0.063*	(-1.75)	-0.067***	(-3.10)
ANACOV	0.002	(0.20)	0.006	(1.07)
BIG4	0.003	(0.12)	0.000	(0.01)
TENURE	-0.015	(-1.50)	-0.010*	(-1.67)
LITIG	-0.210***	(-5.45)	-0.132***	(-5.55)
SOX	0.216***	(5.07)	0.126***	(4.68)
ISSUE	-0.009	(-0.84)	-0.019***	(-2.87)
Intercept	-0.314**	(-2.43)	-0.166**	(-2.30)

Industry F.E.	Yes		Yes
Year F.E.	Yes		Yes
N	13,908		13,908
Adjusted R^2	0.1755		0.1772

Notes: This table reports the results of estimating the association between a firm's supplier concentration and real earnings management. The industry and year fixed effects are included. T-statistics are based on standard errors clustered at the firm level. All continuous variables are winsorized at the 1% and 99% levels. Appendix provides variable definitions with details. *, **, and *** denote significance based on two-tailed t-tests at or below the 10%, 5%, and 1% levels, respectively.

To further validate the impact of supplier concentration on real earnings management, I investigate the three individual real earnings management measures. Table 6 reports the estimation results. When the dependent variable is *REMCFO*, column (1) shows an insignificant coefficient on *RANK(SC)* (coefficient = 0.003, t-statistic = 0.36). Roychowdhury (2006) and Zang (2012) argue that sales and production manipulation will decrease cash flow from operations to be abnormally low, while management of discretionary expense will increase it. Consequently, the net effect of supplier concentration on abnormal cash flow may be ambiguous. More importantly, I find negative and significant coefficients on *RANK(SC)* when the dependent variable is *REMPROD* in column (2) (coefficient = -0.026, t-statistic = -1.92) or *REMDISPEX* in column (3) (coefficient = -0.047, t-statistic = -2.50). These results provide supporting evidence that a firm's supplier concentration is negatively associated with its real earnings management.

TABLE 6
ASSOCIATION BETWEEN SUPPLIER CONCENTRATION AND REAL EARNINGS MANAGEMENT COMPONENTS

	(1)		(2)		(3)	
	REMCFO		*REMPROD*		*REMDISEXP*	
	Coefficients	t-statistic	Coefficients	t-statistic	Coefficients	t-statistic
RANK(SC)	**0.003**	**(0.36)**	**-0.026***	**(-1.92)**	**-0.047****	**(-2.50)**
ROA	-0.066**	(-2.29)	-0.021***	(-2.87)	0.104**	(2.14)
SIZE	-0.011**	(-2.54)	0.002	(0.41)	0.007	(1.10)
MB	-0.004***	(-3.95)	-0.009***	(-9.00)	-0.010***	(-6.56)
LEV	0.005***	(4.12)	0.012***	(8.61)	0.014***	(7.78)
ALTMAN	-0.004***	(-2.76)	-0.003***	(-3.97)	-0.002	(-1.50)
DLOSS	0.058***	(9.32)	0.030***	(4.97)	-0.024**	(-2.23)
NOA	0.000	(0.07)	0.001	(0.90)	0.005**	(2.47)
SHARES	-0.007	(-1.23)	-0.009	(-1.55)	0.017**	(2.04)
AGE	0.011***	(2.84)	0.001	(0.19)	0.012	(1.27)
INSOWN	-0.008	(-0.76)	-0.004	(-0.24)	-0.059**	(-2.41)
ANACOV	-0.002	(-0.70)	-0.007	(-1.37)	0.008	(1.25)
BIG4	-0.004	(-0.56)	-0.001	(-0.10)	0.004	(0.24)
TENURE	-0.000	(-0.08)	-0.005	(-1.06)	-0.010	(-1.48)
LITIG	-0.047***	(-3.98)	-0.124***	(-7.02)	-0.086***	(-2.99)
SOX	-0.087***	(-6.26)	0.003	(0.17)	0.213***	(6.50)
ISSUE	-0.005	(-1.34)	0.006	(1.15)	-0.014**	(-2.06)
Intercept	0.104***	(2.94)	-0.044	(-0.86)	-0.270***	(-3.00)

Industry F.E.	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes
N	13,908	13,908	13,908
Adjusted R^2	0.3996	0.2243	0.2741

Notes: This table reports the results of estimating the association between a firm's supplier concentration and real earnings management proxied by three individual measures. The industry and year fixed effects are included. T-statistics are based on standard errors clustered at the firm level. All continuous variables are winsorized at the 1% and 99% levels. Appendix provides variable definitions with details. *, **, and *** denote significance based on two-tailed t-tests at or below the 10%, 5%, and 1% levels, respectively.

CONCLUSION

A firm's suppliers rely on its accounting performance to assess its ability to fulfill short-term trading obligations and its prospects to honor implicit claims in long-term transactions. Therefore, when transacting with a few major suppliers, it is critical for a firm to preserve its financial viability and maintain a stable supply chain relationship. To improve major suppliers' perception about its prospects, a firm may use earnings management opportunistically to inflate earnings. However, with better knowledge of its operations, a firm's major suppliers could detect its earnings management timely and impose punishment. Taken together, it is unclear how a firm's dependence on major suppliers affects its earnings management practices.

In this paper, I use a comprehensive sample of firms with available information on their major suppliers. I find a negative association between a firm's supplier concentration and accrual-based earnings management. In addition, I find that firms with a concentrated supplier base also manage earnings less through real activities. These results suggest that customer firms are concerned about major suppliers' information and bargaining advantages, thereby decreasing their earnings manipulation. This study extends the research on earnings management to the setting of supply chain and highlight the role of supply chain relationships in determining firms' accounting decisions. Furthermore, it provides broad implications to the literature on supply chain management with a primary focus on the influence of major and powerful suppliers.

ENDNOTES

[1] Recent literature documents an increasing prevalence of supplier concentration (Choi and Krause 2006; Kim and Henderson 2015). For example, Trent and Monczka (1998) find a decrease of around 50 percent in the number of suppliers for firms from 1990 to 1997.

[2] Compustat Customer Segment Files provide information on suppliers and their sales to external customers in a given year. I utilize this information to identify a customer's major suppliers that individually account for at least 10% of its total purchase.

[3] Consistent with Cohen and Zarowin (2010), I do not aggregate *REMCFO* and *REMPROD* because both sales manipulation and overproduction will result in abnormally low cash flow from operations.

[4] Following prior studies on supplier concentration (Chen et al. 2021) and customer concentration (Patatoukas 2012; Irvine et al. 2016; Hui et al. 2018), I use the annual decile rank of *SC* to relieve the effect of skewness in the raw measure.

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APPENDIX

Variable Definitions

AEM

Discretionary accruals estimated as residuals from the following modified Jones (1991) model:

$$\frac{TA_{i,t}}{ASSETS_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{ASSETS_{i,t-1}} + \alpha_2 \frac{\Delta SALES_{i,t}}{ASSETS_{i,t-1}} + \alpha_3 \frac{PPE_{i,t}}{ASSETS_{i,t-1}} + \varepsilon_{i,t},$$

where $TA_{i,t}$ is firm i's total accruals calculated as net income before extraordinary items minus net cash flow from operating activities in year t; $ASSETS_{i,t-1}$ is the total assets in year t-1; $\Delta SALES_{i,t}$ is the change in sales from year t-1 to year t; and $PPE_{i,t}$ is firm i's gross property, plan, and equipment in year t.

REMCFO

Abnormal cash flow from operations multiplied by minus one. Abnormal cash flow from operations are residuals estimated from the following model:

$$\frac{CFO_{i,t}}{ASSETS_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{ASSETS_{i,t-1}} + \alpha_2 \frac{SALES_{i,t}}{ASSETS_{i,t-1}} + \alpha_3 \frac{\Delta SALES_{i,t}}{ASSETS_{i,t-1}} + \varepsilon_{i,t},$$

where $CFO_{i,t}$ is firm i's cash flow from operations in year t; $SALES_{i,t}$ is firm i's total net sales in year t; and other variables are previously defined.

REMPROD

Abnormal production costs estimated as residuals from the following model:

$$\frac{PROD_{i,t}}{ASSETS_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{ASSETS_{i,t-1}} + \alpha_2 \frac{SALES_{i,t}}{ASSETS_{i,t-1}} + \alpha_3 \frac{\Delta SALES_{i,t}}{ASSETS_{i,t-1}} + \alpha_4 \frac{\Delta SALES_{i,t-1}}{ASSETS_{i,t-1}} + \varepsilon_{i,t},$$

where $PROD_{i,t}$ is the sum of $COGS$ in year t and the change in inventory from year t-1 to year t; and other variables are previously defined.

REMDISEXP

Abnormal discretionary expenses multiplied by minus one. Abnormal discretionary expenses are residuals estimated from the following model:

$$\frac{DISEXP_{i,t}}{ASSETS_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{ASSETS_{i,t-1}} + \alpha_2 \frac{SALES_{i,t}}{ASSETS_{i,t-1}} + \varepsilon_{i,t},$$

where $DISEXP_{i,t}$ is the sum of R&D expense, advertising expense and SG&A expense for firm i in year t; and other variables are previously defined.

REM1

The total of *REMPROD* and *REMDISEXP*.

REM2	The total of *REMCFO* and *REMDISEXP*.
SC	Supplier concentration calculated as follows:

$$SC_{i,t} = \sum_{j=1}^{J} (\frac{PROCUREMENT_{i,j,t}}{TOTAL\ PROCUREMENT_{i,t}})^2$$

where $PROCUREMENT_{i,j,t}$ indicates firm *i*'s procurement from major supplier *j* in year *t*, and $TOTAL\ PROCUREMENT_{i,t}$ is firm *i*'s total procurement in year *t*.

ROA	Income before extraordinary items lagged by total assets.
SIZE	Natural log of market capitalization.
MB	Market value of equity divided by book value of equity.
LEV	Book value of total debts divided by book value of equity.
ALTMAN	1.2 * (Current Assets – Current Liabilities) / Total Assets + 1.4 * Retained Earnings / Total Assets + 3.3 * Earnings before Interest and Taxes / Total Assets + 0.6 * Market Value of Equity / Total Liabilities + 0.999 * Sales / Total Assets.
DLOSS	A dummy variable equal to one if report a net loss, and zero otherwise.
NOA	Shareholders' equity minus cash and marketable securities and plus total debts, lagged by total sales.
SHARES	Natural log of number of shares outstanding.
AGE	Natural log of firm age since the first year appears in Compustat.
INSOWN	The percentage of institutional ownership.
ANACOV	Natural log of number of analysts following plus one.
BIG4	A dummy variable equal to one if auditor is one of the Big 4, and zero otherwise.
TENURE	Natural log of auditor tenure in years.
LITIG	A dummy variable equal to one if SIC code is 2833 – 2836, 8731 – 8734, 7371 – 7379, 3570 – 3577, 3600 – 3674, and zero otherwise.
SOX	A dummy variable equal to one if the fiscal year is after 2003, and zero otherwise.
ISSUE	A dummy variable equal to one if shares outstanding are more than shares outstanding in the last year, and zero otherwise.