

Using Economic Links between Firms to Detect Accounting Fraud

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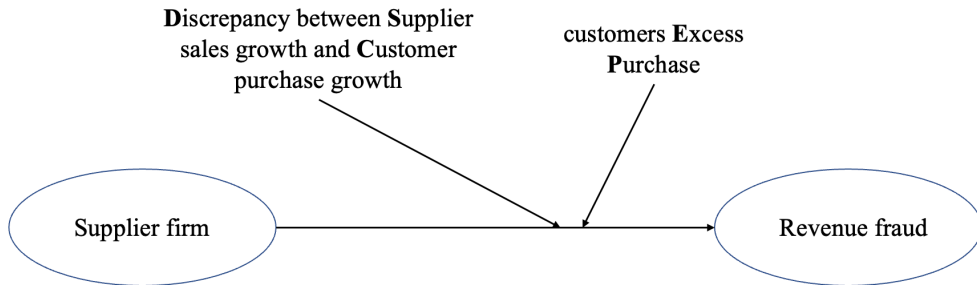
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Summary



Research Question

Whether customer information disclosed by a supplier firm, combined with customers' accounting information, helps to detect the supplier' s revenue fraud?

Motivation

1. Accounting fraud is a major threat to well-functioning capital markets, Prior studies typically use a firm' s own information to detect fraud.
2. Whether the publicly available customer information can help detect revenue fraud?
 - firm' s revenue equals the sum of purchases by all customers
3. Empirical question for several reasons.
 - firms are required to disclose only sales to and identities of major customer
 - firms withhold about 40 percent of the identities of major customers
 - customers' purchase information is aggregated on their financial statements
4. This paper construct customer-related variables
 - when the supplier overstates revenue by cooking the books, its sales growth will exceed customer purchase growth
 - customers experience abnormally high changes in inventory and accounts payable.

Contribution

1. Expands the literature on the detection of accounting fraud
 - Prior: focus on information of the focal firm itself to detect accounting fraud.
 - Extend: using supplier-customer relationships to detect accounting fraud'
2. Literature on the supplier-customer relationship.
 - Prior: customer information is useful in predicting supplier stock price, forecasting future earnings.
 - Extend: customer information can be used to detect supplier financial misreporting

Hypothesis

1. The discrepancy between supplier sales growth and customer purchase growth is positively associated with the likelihood of supplier revenue fraud.
 - firms can overstate revenue by cooking the books without changing real business activities.
2. Customer excess purchases are positively associated with the likelihood of supplier revenue fraud.
 - firms can overstate revenue by manipulating real transactions and accelerating revenue recognition through channel stuffing.

Variable Measurement: Discrepancy Indicator (DSC)

- Supplier i sales growth in year t :

$$\text{Supp_SG}_{i,t} = \frac{\text{Sales}_{i,t} - \text{Sales}_{i,t-1}}{\text{Sales}_{i,t-1}}$$

- Customer j 's purchase growth from supplier i :

$$\text{Cust_PG}_{ij,t} = \frac{(\text{Cost} + \text{Inventory})_{ij,t} - (\text{Cost} + \text{Inventory})_{ij,t-1}}{(\text{Cost} + \text{Inventory})_{ij,t-1}}$$

- Weighted customer purchase growth for supplier i :

$$\text{Cust_PG}_{i,t} = \sum_j \text{Cust_PG}_{ij,t} \times \text{PctSale}_{ij,t}$$

where $\text{PctSale}_{ij,t}$ is the percentage of supplier i 's sales to customer j .

- Discrepancy indicator:

$$\text{DSC}_{i,t} = 1\{\text{Supp_SG}_{i,t} \text{ top } 20\% \ \& \ \text{Cust_PG}_{i,t} \text{ bottom } 20\%\}$$

Variable Measurement: customer excess purchases (EP)

- Customer-Level Abnormal Changes For each supplier i , customer j , and year t :

$$\text{ExcessInv}(\text{AP})_{ijt} = \frac{\Delta \text{INV}(\text{AP})_{ijt}}{\text{PURCHASE}_{ijt}} - \frac{\Delta \text{INV}(\text{AP})_{ij,t-1}}{\text{PURCHASE}_{ij,t-1}}$$

Scaled by the sales-share weight, INV is inventory, AP is accounts payable.

- Aggregate to Supplier Level

$$\text{ExcessInv}_{it} = \sum_j w_{ijt} \text{ExcessInv}_{ijt}, \quad \text{ExcessAP}_{it} = \sum_j w_{ijt} \text{ExcessAP}_{ijt}$$

- Final Indicator

$$\text{Customer Excess Purchases}_{it} = \frac{1}{2} (\text{ExcessInv}_{it} + \text{ExcessAP}_{it})$$

Interpretation: Higher values indicate stronger evidence that supplier i may have pulled revenue forward through customer inventory build-up and delayed payments.

Model and Sample

- Sample period is from 1976 to 2018, consists of 29,757 supplier-year observations.
- Logit regression

$$\text{RevFraudit}_{i,t} = \beta_0 + \beta_1 \text{CustomerInfo}_{i,t} + \beta_2 \text{Fscore}_{i,t} + \text{Controls} + \text{Industry FE} + \text{Year FE} + \varepsilon_{i,t}$$

	N	Mean	STD	Min	25th	Median	75th	Max
<i>RevFraud</i>	29,757	0.004	0.060	0.000	0.000	0.000	0.000	1.000
<i>DSC</i>	29,757	0.034	0.181	0.000	0.000	0.000	0.000	1.000
<i>ExcessPurchase</i>	29,757	-0.002	0.047	-0.192	-0.017	-0.001	0.015	0.159
<i>ExcessInv</i>	29,757	-0.003	0.054	-0.236	-0.016	0.000	0.015	0.182
<i>ExcessAP</i>	29,757	-0.002	0.062	-0.277	-0.019	-0.001	0.017	0.233
<i>Supp_SG</i>	29,757	0.168	0.481	-0.617	-0.045	0.082	0.252	3.000
<i>Cust_PG</i>	29,757	0.104	0.220	-0.445	0.000	0.077	0.167	1.119

The Economic Link between Suppliers and Customers

- Supplier sales growth co-moves with customer purchase growth

Association between Supplier Sales Growth and Customer Purchase Growth

	Dependent Variable: $Supp_SG_{i,t}$		
	1	2	3
$Cust_PG_{i,t}$	0.2398*** (7.02)	0.1975*** (7.10)	0.1914*** (7.11)
$MB_{i,t-1}$	0.0389*** (13.55)	0.0421*** (15.50)	0.0594*** (14.09)
$Size_{i,t-1}$	-0.0019 (-0.87)	0.0010 (0.64)	-0.0720*** (-7.66)

H1 and H2: Predictive Ability of DSC and ExcessPurchase

- DSC and ExcessPurchase provide additional information to predict supplier revenue fraud.

The Predictive Ability of *DSC* and *ExcessPurchase* for Supplier Revenue Fraud

	Dependent Variable: <i>RevFraud</i>					
	1	2	3	4	5	6
<i>DSC</i>	0.0036*** (2.98)	0.0027** (2.31)			0.0038*** (3.14)	0.0029** (2.57)
<i>ExcessPurchase</i>			0.0142*** (2.97)	0.0144*** (2.83)	0.0152*** (3.19)	0.0153*** (3.01)
<i>Fscore</i>		0.0033*** (4.42)		0.0035*** (4.57)		0.0033*** (4.37)
<i>DisRev</i>		0.0004 (0.08)		0.0001 (0.02)		0.0002 (0.03)

The Volatility of the Customer-Supplier Relationship

- DSC to have stronger predictive power when the fraction of a customer's purchases from the supplier is more stable.

Volatility of Customers' Percentage of Purchase from the Supplier and the Predictive Ability of DSC

	Dependent Variable: <i>RevFraud</i>	
	1	2
<i>LowVol</i>	-0.0027* (-1.88)	-0.0012 (-0.85)
<i>DSC</i>	0.0025* (1.90)	0.0018 (1.43)
<i>DSC</i> × <i>LowVol</i>	0.0053** (2.48)	0.0046** (2.30)

The Role of Supplier Bargaining Power

- The predictive power of *ExcessPurchase* to be lower when the suppliers have lower bargaining power over their customers.

Supplier Bargaining Power and the Predictive Ability of *ExcessPurchase*

	Dependent Variable: <i>RevFraud</i>	
	1	2
<i>LowPower</i>	-0.0015 (-1.35)	0.0006 (0.47)
<i>ExcessPurchase</i>	0.0159*** (2.74)	0.0172*** (2.67)
<i>ExcessPurchase</i> × <i>LowPower</i>	-0.0156 (-1.59)	-0.0184** (-2.18)

Out-of-Sample Test

- A higher AUC and NDCG@k indicates a better prediction performance.
- Use 1997 to 2018 as the testing period, and expand the window from 1976 to two years before the testing year as the training period.

Out-of-Sample Prediction

	Average AUC over 1997-2018		Average NDCG@k over 1997-2018	
	w/o Industry Dummies	w/ Industry Dummies	w/o Industry Dummies	w/ Industry Dummies
F-score model	0.6523	0.6630	0.0177	0.0089
Add <i>DSC</i> and <i>ExcessPurchase</i>	0.6694	0.6741	0.0254	0.0289
Improvement	0.0171	0.0111	0.0077	0.0200
One-tailed p-value	0.07	0.05	0.16	0.08

Idea

- Economic link
 - 企业在供应链网络中的位置, 客户和供应商越分散越分散风险, 受到外部冲击适应力能力强
 - 关联方财务健康、负面事件的冲击
- Geography-based Contagion Risk
- Cross-Industry Spillover Effects