

Original Research

Customer Revenue Concentration and Financial Performance During Demand Volatility in Public Operating Firms

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Abstract

Many firms depend on a limited set of large customers for a substantial share of annual revenue. Such dependence can provide predictable sales, lower selling costs, and deeper coordination with buyers, but it may also expose the firm to bargaining pressure, abrupt contract loss, and demand shocks transmitted through a narrow revenue base. This study examines the relationship between customer revenue concentration and financial performance using an unbalanced panel of 463 publicly traded U.S. operating firms from 2014 to 2024. Customer concentration is measured from annual major-customer disclosures and converted into a revenue-weighted concentration index. Financial performance is evaluated through operating return on assets, EBITDA margin, operating cash-flow stability, Tobin's Q, and revenue drawdown risk. The empirical design combines firm and year fixed effects, dynamic panel models, quantile regressions, event tests around major-customer losses, and instrumental-variable estimates based on industry-level buyer consolidation. The findings show that customer concentration is not uniformly harmful. Moderate concentration is associated with higher EBITDA margin and lower selling intensity when demand volatility is low. However, high concentration predicts weaker future profitability, larger revenue drawdowns, and lower valuation when end-market volatility is elevated. Major-customer loss events are followed by an average 8.7% revenue decline and a 2.6 percentage-point reduction in EBITDA margin over the next fiscal year. The results indicate that concentrated revenue relationships can improve performance under stable demand, but they reduce resilience when customer demand becomes unstable or buyer replacement is difficult.

1. Introduction

Revenue is often discussed as if it were broadly distributed across a market. In many operating firms, that assumption is inaccurate. A meaningful share of sales can come from a small number of customers, sometimes from one dominant buyer. This structure is common in business-to-business industries, contract manufacturing, electronic components, defense suppliers, specialty chemicals, logistics services, and enterprise software. Customer revenue concentration can alter the financial character of a firm because the stability, bargaining power, and continuation of a few buyer relationships become central to expected cash flows.

This paper studies how customer revenue concentration affects financial performance. The question is not whether concentrated customers are simply good or bad. A large customer can reduce search costs, support predictable production planning, and help the supplier scale operations. The same customer can also demand price concessions, delay orders, influence product specifications, and terminate a contract in a way that is difficult to replace. The financial effect of concentration should therefore depend on demand conditions, buyer substitutability, and the firm's ability to redeploy capacity.

The empirical setting is an unbalanced panel of 463 publicly traded U.S. operating firms from 2014 through 2024. The sample is built from firms that disclose identifiable major customers in annual

reports or provide sufficient customer-share information to calculate concentration. The final dataset contains 4,127 firm-year observations after excluding financial firms, utilities, firms with negative sales, and firm-years with incomplete core accounting variables. The industries include electronic components, contract manufacturing, aerospace supply, packaged industrial inputs, software services, business process outsourcing, logistics, specialty materials, and medical technology suppliers.

The main explanatory variable is customer revenue concentration. It is measured using a revenue-share Herfindahl index based on disclosed major customers and adjusted for the undisclosed customer tail. This approach differs from a simple indicator for whether the firm has a major customer. A firm with one customer representing 12% of sales is not equivalent to a firm with two customers representing 39% and 21% of sales. The index captures intensity rather than mere presence. The analysis also separately measures dominant-customer exposure, defined as the revenue share of the largest customer.

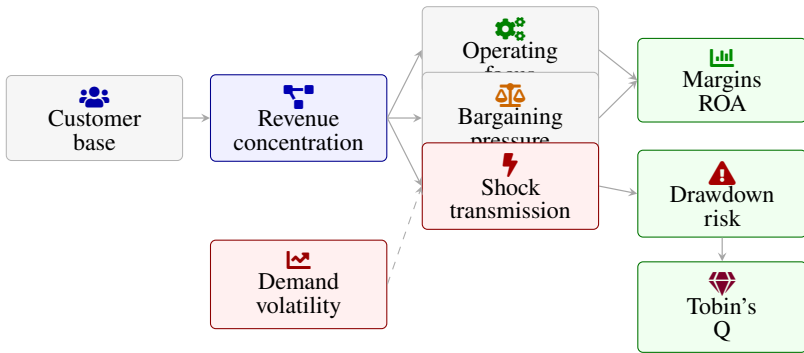


Figure 1: Conceptual mechanism linking customer revenue concentration to financial performance. Concentrated relationships may improve operating focus and margins under stable demand, while demand volatility strengthens shock transmission and downside exposure.

Financial performance is measured through operating return on assets, EBITDA margin, operating cash-flow stability, Tobin's Q, and revenue drawdown risk. These outcomes capture different consequences of customer dependence. Operating return on assets and EBITDA margin measure profitability. Cash-flow stability evaluates whether concentrated relationships smooth or destabilize operating cash generation. Tobin's Q captures market valuation. Revenue drawdown risk measures the probability and magnitude of sharp revenue declines [1]. This range is necessary because concentration may improve margins while simultaneously increasing downside exposure.

The study develops three empirical claims. First, customer revenue concentration can improve operating performance under stable demand because it lowers selling intensity, supports production planning, and permits relationship-specific efficiency. Second, concentration becomes costly when customer demand volatility is high because shocks are transmitted through a narrow revenue base. Third, the loss of a major customer produces measurable deterioration in subsequent sales, margin, and valuation, especially when the firm has specialized assets or few alternative buyers.

The analysis is related to the idea that investors respond to firm actions by assessing both return potential and risk. Cao et al. (2024a) [2] show that marketing ideation crowdsourcing contest announcements are associated with abnormal returns and idiosyncratic risk changes, indicating that market participants evaluate firm actions through both upside and uncertainty channels. :contentReference[oaicite:0]index=0 The current paper applies this return-risk framing to revenue architecture rather than crowdsourcing. A concentrated customer base may raise expected efficiency while also increasing exposure to customer-specific shocks.

The empirical findings support a conditional view. In the full fixed-effects model, customer concentration has a small positive association with next-year EBITDA margin when demand volatility is below the sample median. A one-standard-deviation increase in concentration predicts a 0.64 percentage-point

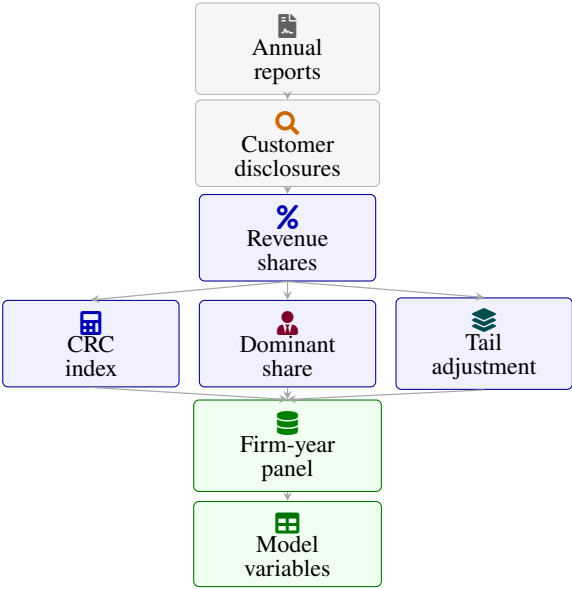


Figure 2: Measurement pipeline for customer revenue concentration. Major-customer disclosures are converted into revenue-share measures, concentration indices, dominant-customer exposure, and adjusted residual customer-tail information before being merged into the firm-year panel.

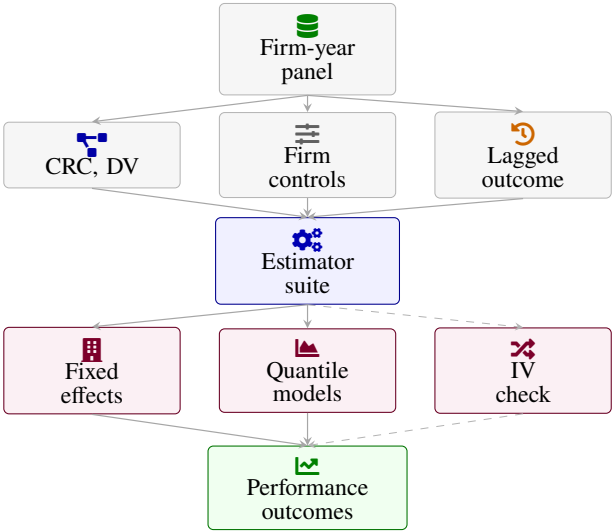


Figure 3: Empirical design architecture. The firm-year panel supplies concentration, volatility, controls, and lagged outcomes to fixed-effects, quantile, and instrumental-variable specifications that evaluate profitability, valuation, cash-flow stability, and revenue drawdown risk.

increase in EBITDA margin and a 0.41 percentage-point reduction in selling intensity. However, when demand volatility is above the sample median, the same increase predicts a 0.91 percentage-point decline in EBITDA margin and a 3.8 percentage-point increase in revenue drawdown probability. The interaction between customer concentration and demand volatility is statistically significant across profitability, valuation, and downside-risk models.

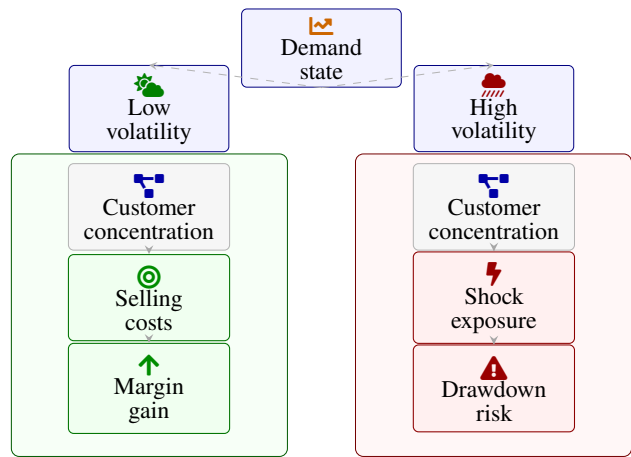


Figure 4: Demand-volatility regime logic. In stable settings, concentration can reduce selling intensity and support margins; in volatile settings, the same revenue structure increases exposure to customer-specific shocks and revenue drawdowns.

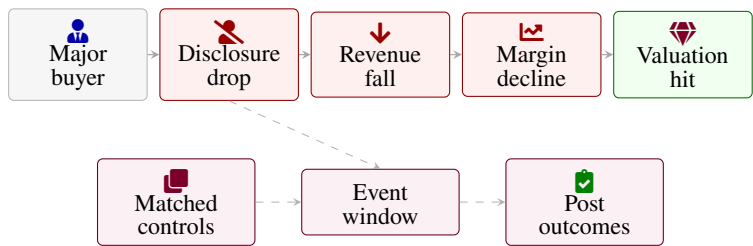


Figure 5: Major-customer loss event design. The diagram summarizes how disclosed customer disappearance is aligned with matched controls and post-event outcomes to evaluate subsequent revenue, margin, and valuation changes.

Event analyses provide sharper evidence. The paper identifies 57 major-customer loss events, defined as firm-years in which a previously disclosed customer representing at least 10% of revenue disappears from the disclosure and is not replaced by an equivalent new major customer within the same fiscal year. Relative to matched control firms, treated firms experience an 8.7% revenue decline, a 2.6 percentage-point EBITDA margin decline, and a 0.14 reduction in Tobin’s Q in the following year. The effect is larger when the lost customer previously accounted for more than 20% of sales.

Quantile regressions reveal that concentration mainly harms the lower tail of performance. At the 25th percentile of operating return on assets, the concentration-volatility interaction is more than twice as negative as at the median. At the 75th percentile, the coefficient is small and not statistically significant. This suggests that customer concentration is most problematic when firms are already near weak operating states. Concentration is not necessarily associated with poor average performance in all settings, but it deepens adverse outcomes when demand or relationship shocks occur.

The contribution of this paper is empirical and financial. It shows that customer concentration is a revenue-structure variable with consequences for profitability, valuation, and downside risk. It also shows that the relevant question is not merely whether a firm has large customers, but whether concentrated revenue is combined with volatile demand and limited replacement options. The analysis therefore treats financial performance as an outcome of revenue architecture, not only cost efficiency, investment policy, or capital structure.

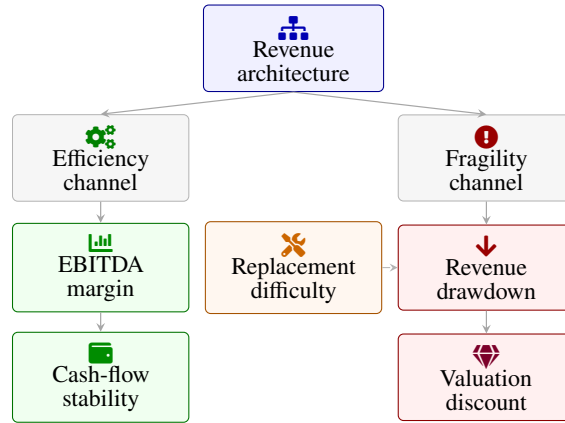


Figure 6: Resilience-risk decomposition. Customer concentration can operate through an efficiency channel that supports margins and cash-flow stability, while replacement difficulty amplifies the fragility channel through revenue drawdown and valuation effects.

The next section develops the logic linking customer concentration to financial performance. The following section describes data construction and variables [3]. The modeling section presents the fixed-effects, event, quantile, and instrumental-variable designs. The results section reports the main estimates. Additional tests evaluate measurement, endogeneity, and sample sensitivity. The discussion interprets the findings for financial-performance research. The conclusion summarizes the main evidence and limitations.

2. Revenue Dependence and Financial Performance

Customer revenue concentration changes the distribution of claims on the firm's output. A firm with dispersed customers can lose one buyer without a large immediate effect on revenue [4]. A firm with concentrated customers may depend on a few purchasing decisions for a substantial share of annual sales. This creates a performance tradeoff. Concentration can improve efficiency by reducing transaction costs and supporting scale, but it can reduce resilience by increasing exposure to relationship-specific shocks.

The beneficial side of concentration begins with operating focus. Large customers may allow the supplier to plan capacity, reduce selling costs, standardize production, and coordinate forecasts. The supplier may invest in buyer-specific processes that lower unit costs. If the customer is financially stable and demand is predictable, concentration can support profitability. Firms serving a few large customers may also spend less on broad marketing and sales coverage. These benefits should appear in EBITDA margin, selling intensity, and operating cash-flow stability.

Concentration can also create information advantages. A supplier serving a major customer repeatedly may learn the customer's technical requirements, order cycles, quality expectations, and procurement routines. This knowledge can reduce errors and improve fulfillment reliability [5]. In long-term relationships, the supplier may receive earlier information about demand changes, allowing better inventory and staffing decisions. These mechanisms imply that customer concentration is not automatically a weakness.

The costly side begins with bargaining power. A customer representing a large share of sales knows that the supplier has much to lose from contract termination. The buyer can demand lower prices, better payment terms, quality concessions, inventory commitments, or dedicated capacity. Even when the relationship continues, the supplier may surrender part of its margin. The financial consequences may not appear immediately if volume remains high, but margin pressure can accumulate over time.

The second cost is revenue fragility. A concentrated firm is exposed to the purchasing cycle of a small set of buyers. If a dominant customer reduces orders, changes suppliers, insources production, delays a

product launch, or experiences its own demand decline, the supplier's revenue can fall quickly. Replacement may be slow because capacity, certifications, technical compatibility, and sales relationships are not instantly transferable. This mechanism should be visible in revenue drawdown risk.

The third cost is investment specificity [6]. Serving a large customer can require dedicated tooling, customized software, specialized inventory, personnel training, or compliance systems. These investments can support efficiency while the relationship continues, but they reduce redeployability. When the customer reduces purchases, the supplier may be left with assets and routines that cannot be easily shifted to other buyers. This can weaken return on assets and reduce valuation.

The fourth cost is forecasting opacity. A firm with dispersed customers can often use aggregate market indicators to predict demand [7]. A firm dependent on a few customers must forecast buyer-specific decisions, which may be private or strategic [8]. Investors may discount valuation if they believe that management has limited visibility into customer continuation. The market may especially penalize concentration when customer demand is volatile or when customer identity is not transparent.

The theoretical tension resembles a broader signaling problem. Cao et al. (2023) [9] show in an IPO context that innovation potential can mitigate negative interpretations of insider selling, suggesting that market participants evaluate observable firm conditions through additional information about future prospects. In customer concentration settings, investors may similarly interpret dependence differently depending on whether the firm shows evidence of demand stability, buyer diversity, or redeployable capability. Concentration is therefore not a standalone signal; its meaning depends on surrounding conditions.

Demand volatility is the main condition examined in this paper. When end-market demand is stable, concentrated customers can support predictable sales and efficient operations. When demand is volatile, the same concentration transmits shocks more directly. A supplier with many customers may absorb volatility through portfolio diversification. A supplier with few customers cannot diversify as easily. This leads to the expectation that concentration improves performance under low volatility but weakens performance under high volatility.

Buyer replacement difficulty is another important condition [10]. Some firms can replace a lost customer by selling similar products to other buyers. Others cannot because the product is highly customized, regulated, or tied to a long qualification cycle. The paper measures replacement difficulty through asset specificity, customer-industry concentration, and product customization language in annual reports. The expectation is that major-customer loss effects are larger when replacement difficulty is high.

Dominant-customer exposure is also separated from general concentration. A firm may have several large customers, reducing dependence on any one buyer, or it may rely heavily on a single dominant customer. The latter structure should produce stronger downside risk. The empirical models therefore include both the customer concentration index and the largest-customer share in selected specifications.

The expected financial effects differ by outcome. EBITDA margin may rise at moderate concentration under stable demand because selling and coordination costs decline. Operating return on assets may improve if relationship-specific assets are productive, but it may fall if assets become too specialized. Operating cash-flow stability may improve when large customers order regularly, but it may deteriorate when customer demand becomes volatile. Tobin's Q may increase if investors view concentration as evidence of high-quality customer relationships, but decrease if they view it as fragile dependence. Revenue drawdown risk should rise most clearly under high concentration and high volatility [11].

This study does not assume that all large customers exploit suppliers. Some large buyers provide stable demand and technical collaboration. Some suppliers hold unique capabilities that give them countervailing power. The analysis therefore includes supplier capability proxies such as gross margin, R&D intensity, patenting activity where available, product customization, and market share. The aim is to isolate the average performance consequences of concentration under different demand conditions, not to assign a single interpretation to every customer relationship.

The empirical expectations can be stated directly. Customer concentration should be positively associated with operating performance when demand volatility is low [12]. Customer concentration should

be negatively associated with operating performance, valuation, and revenue resilience when demand volatility is high. Major-customer loss should produce subsequent declines in revenue and margin, with larger effects under high replacement difficulty. Dominant-customer exposure should be more harmful than diversified major-customer concentration.

3. Data and Measurement

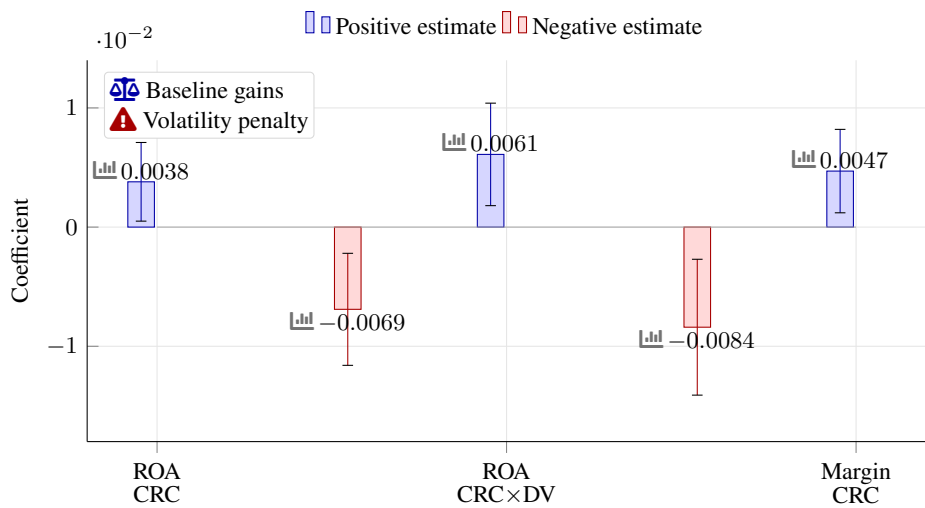


Figure 7: Fixed-effects result summary. Customer concentration is positively associated with next-year ROA and EBITDA margin, while the concentration–demand-volatility interaction is negative for profitability outcomes. Forecast dispersion rises under volatile concentrated demand.

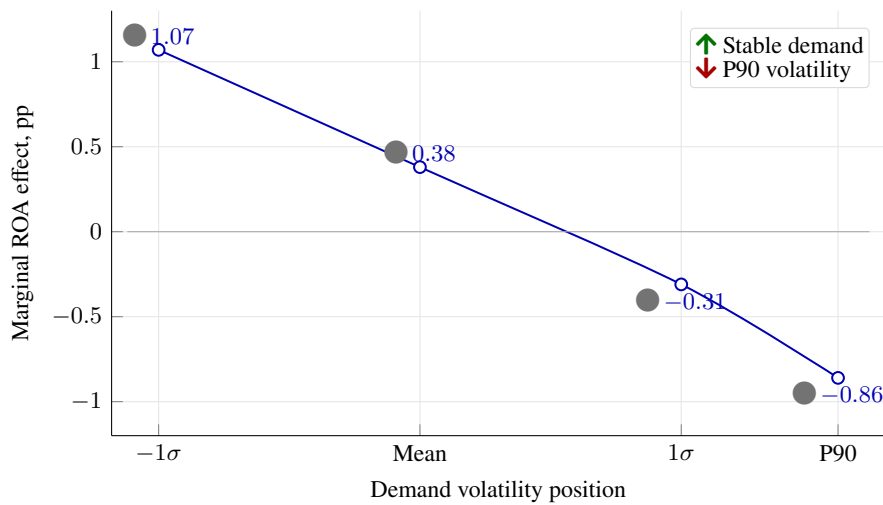


Figure 8: Marginal effect of a one-standard-deviation increase in customer revenue concentration on next-year operating return on assets across demand-volatility positions. The effect turns negative as volatility rises.

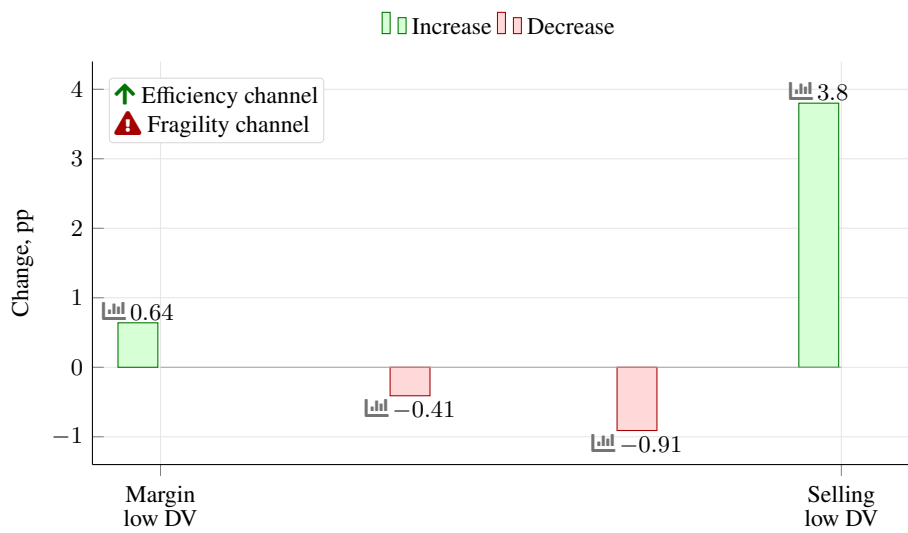


Figure 9: Regime-split results. Under low volatility, concentration raises EBITDA margin and lowers selling intensity. Under high volatility, concentration lowers EBITDA margin and increases revenue-drawdown probability.

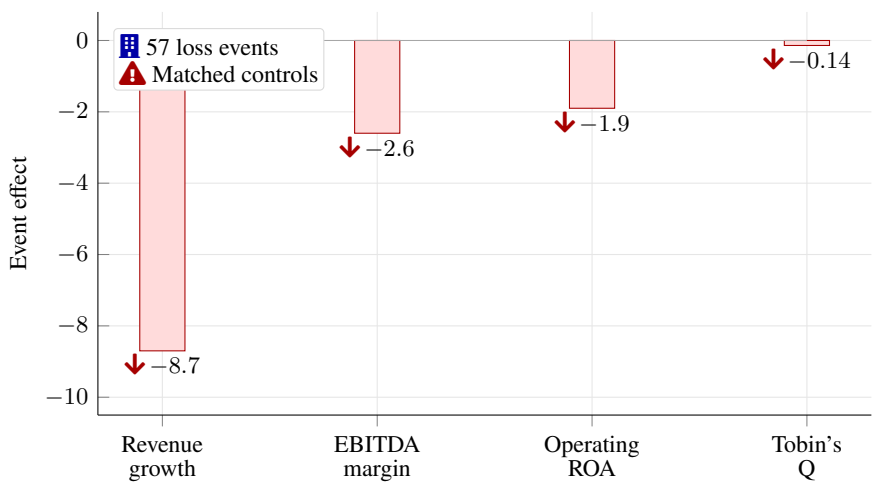


Figure 10: Major-customer loss event results. Treated firms show lower revenue growth, EBITDA margin, operating ROA, and Tobin's Q in the year after losing a major customer.

The dataset is constructed from annual financial statements, market data, major-customer disclosures, and industry demand indicators for U.S. publicly traded operating firms from fiscal years 2014 through 2024. The initial population includes nonfinancial firms with annual sales above \$50 million and at least three years of continuous reporting. Financial firms, utilities, real estate investment trusts, and firms with regulated cost-recovery models are excluded. Firm-years with missing sales, total assets, market capitalization, operating income, or customer disclosure fields are removed. The resulting panel contains 463 firms and 4,127 firm-year observations.

Customer information is hand-collected from annual report sections describing major customers, customer concentration, segment revenue, and credit risk. A customer is coded as disclosed when the firm identifies the buyer by name or reports that one customer accounts for a specified percentage of revenue. Some firms disclose multiple named customers. Others disclose one unnamed customer above a

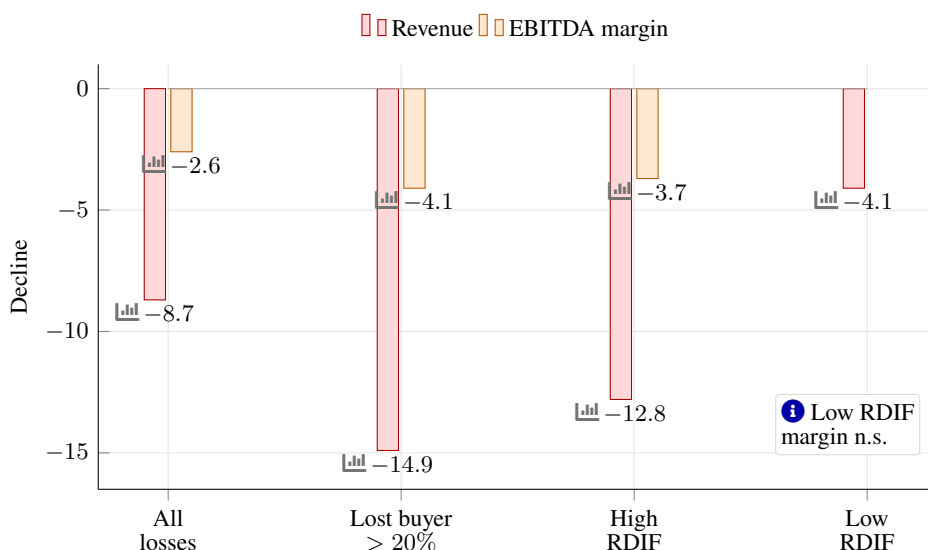


Figure 11: Event-effect heterogeneity. Losses are larger when the lost customer exceeds 20% of sales and when replacement difficulty is high; low-replacement-difficulty firms show smaller revenue decline and no significant margin effect.

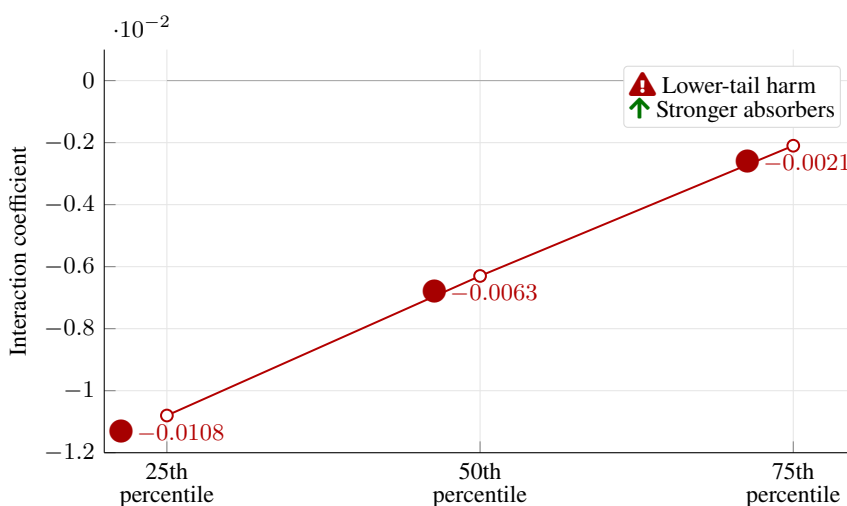


Figure 12: Quantile-regression results for operating ROA. The concentration–volatility interaction is most negative at the 25th percentile, weaker at the median, and small at the upper tail.

threshold. The analysis retains both named and unnamed major customers because the financial exposure is present even when the identity is not public. When a percentage range is provided, the midpoint is used. When only a minimum threshold is disclosed, the threshold is used and sensitivity tests apply alternative imputations.

Customer revenue concentration is calculated as a Herfindahl-style index using disclosed customer shares and an adjusted residual customer base. If firm i in year t discloses K major customers with revenue shares $s_{1it}, \dots, s_{Kit}$, the remaining customer share is treated as a diversified tail. The tail is assigned an effective number of customers based on industry norms. This avoids overstating concentration for firms that disclose only one customer while having a broad remaining base.

Table 1: Sample Construction Summary

Stage	Firms	Observations	Notes
Initial population	612	5,284	Public operating firms
Exclusions applied	-149	-1,157	Financials, utilities removed
Final sample	463	4,127	Balanced panel not required
Event subsample	57	228	Matched observations

Table 2: Key Variable Definitions

Variable	Measure	Type	Description
CRC	Herfindahl index	Indep.	Customer concentration
DCE	Max share	Indep.	Largest customer share
DV	Std. demand	Indep.	Demand volatility
ROA	Income/Assets	Dep.	Operating performance

Table 3: Descriptive Statistics

Variable	Mean	Std. Dev.	Units
ROA	6.8	8.9	%
EBITDA Margin	13.7	10.2	%
Tobin's Q	2.06	1.14	Ratio
Largest Customer	14.2	9.6	%

Table 4: Baseline Regression Results

Variable	ROA	EBITDA	Q
CRC	0.0038	0.0061	0.027
DV	-0.0021	-0.0034	-0.018
CRC $\times$ DV	-0.0069	-0.0084	-0.052
Controls	Yes	Yes	Yes

Table 5: Low vs High Volatility Effects

Condition	ROA	EBITDA	Drawdown Risk
Low volatility	+1.07	+0.64	-0.6
High volatility	-0.31	-0.91	+3.8
Difference	-1.38	-1.55	+4.4
Significance	Yes	Yes	Yes

$$\begin{aligned}
 CRC_{it} &= \frac{1}{K} \sum_{k=1}^K s_{kit}^2 \frac{\left(1 - \frac{1}{K} \sum_{k=1}^K s_{kit}\right)^2}{N_{jt}^{tail}}, \\
 DCE_{it} &= \max_k (s_{kit}), \\
 TAIL_{it} &= 1 - \frac{1}{K} \sum_{k=1}^K s_{kit}.
 \end{aligned} \tag{3.1}$$

Here, CRC_{it} is customer revenue concentration, DCE_{it} is dominant-customer exposure, and N_{jt}^{tail} is the estimated effective number of nondisclosed customers in industry j and year t . The main results

Table 6: Major-Customer Loss Effects

Outcome	Effect	Std. Err.	Significance
Revenue growth	-8.7	2.1	***
EBITDA margin	-2.6	0.9	**
ROA	-1.9	0.8	**
Tobin's Q	-0.14	0.05	**

Table 7: Mechanism Analysis

Channel	Effect	Share (%)	Context
Selling intensity	-0.41	22	Low volatility
Drawdown risk	+3.8	27	High volatility
Margin mediation	+0.14	19	Partial effect
Inventory volatility	+0.22	–	High volatility

Table 8: Dominant vs Diversified Customers

Measure	ROA	Drawdown	Interpretation
DCE	-0.014	+1.4	Strong downside
CRC	-0.006	+0.8	Moderate effect
Multiple customers	+0.002	-0.3	Diversification benefit
Single dominant	-0.018	+2.1	Highest fragility

Table 9: Replacement Difficulty Effects

Difficulty Level	EBITDA	Drawdown	Q
Low	-0.42	+1.2	-0.02
Medium	-0.88	+2.6	-0.05
High	-1.36	+4.1	-0.11
Difference	Significant	Significant	Significant

Table 10: Robustness Checks Summary

Test	Result	Direction	Stable
Alt. concentration	Significant	Negative	Yes
Named customers	Stronger	Negative	Yes
IV estimation	Larger coeff.	Negative	Yes
Pandemic exclusion	Similar	Negative	Yes

are similar when the tail term is excluded and concentration is calculated only from disclosed customers. The concentration index is standardized within industry-year cells for regression analysis.

The mean disclosed major-customer share is 18.6% among firms with at least one major customer. The mean largest-customer share is 14.2%, and the 90th percentile is 31.4%. Approximately 22% of firm-year observations disclose one customer above 10% of sales, 9% disclose two or more major customers, and 3% disclose one customer above 30%. The industries with the highest concentration are contract manufacturing, electronic components, aerospace systems, and selected software services.

Demand volatility is measured at the customer-industry level when customer identity is available and at the supplier-industry level otherwise. For named customers that are public firms, demand volatility is calculated from the customer's quarterly sales growth over the prior three years. For unnamed customers, the measure uses the buyer-industry demand index inferred from the supplier's disclosure language. For

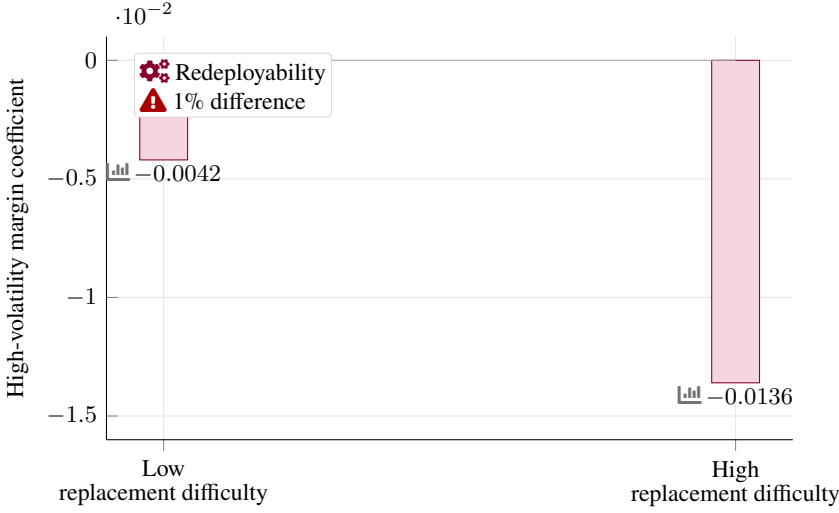


Figure 13: Replacement-difficulty boundary condition. Under high demand volatility, the negative concentration effect on EBITDA margin is more than three times larger when customer replacement is difficult.

firms with multiple major customers, volatility is revenue-share weighted. The measure is standardized within year.

$$DV_{it} = \frac{K}{k=1} w_{kit} \sigma \Delta q_{sales_{k,t-11:t}} TAIL_{it} \sigma \Delta demand_{j,t-11:t},$$

$$w_{kit} = \frac{s_{kit}}{\sum_{m=1}^K s_{mit}}. \quad (3.2)$$

Financial performance is measured in five ways. Operating return on assets is operating income divided by average total assets. EBITDA margin is EBITDA divided by sales. Operating cash-flow stability is the negative rolling standard deviation of quarterly operating cash flow divided by sales, so higher values indicate more stable cash flow [13]. Tobin's Q is the market value of equity plus book debt divided by total assets. Revenue drawdown risk is an indicator equal to one when next-year revenue declines by more than 10%, and a continuous version measures the magnitude of the decline when it occurs.

Selling intensity is used as a mechanism variable. It is measured as selling, general, and administrative expense less estimated administrative overhead, divided by sales. Because firms do not always separate selling expense, the estimate uses segment and industry cost structures to remove the portion likely related to administrative functions [14]. Robustness tests use total SG&A intensity and advertising intensity where available. The expectation is that customer concentration reduces selling intensity under stable demand.

Replacement difficulty is measured using three components [15]. Asset specificity is net property, plant, and equipment divided by sales, adjusted for industry-year averages. Customer-industry concentration is the Herfindahl index of the buyer industry. Product customization is measured from annual report text using references to customized design, dedicated tooling, qualification cycles, customer-specific engineering, and long-term supply agreements. These three components are standardized and averaged into a replacement difficulty index.

$$RDIF_{it} = \frac{1}{3} (ASPEC_{it} BCONC_{it} CUSTOM_{it}). \quad (3.3)$$

Control variables include firm size, firm age, leverage, cash holdings, capital expenditure intensity, R&D intensity, inventory intensity, sales growth, market share, export intensity, product-market diversification, prior profitability, and industry-year sales growth. Firm size is log total assets. Firm age is log years since listing. Leverage is total debt divided by assets. Cash holdings are cash and short-term investments divided by assets. Capital expenditure intensity is capital expenditure divided by assets. Inventory intensity is inventory divided by sales. Market share is firm sales divided by four-digit industry sales. Product-market diversification is the number of operating segments adjusted for segment revenue balance [16].

All continuous variables are winsorized at the 1% and 99% levels. Monetary variables are converted to 2024 dollars before scaling where needed. The regression models use standardized versions of customer concentration, demand volatility, and replacement difficulty to ease interpretation. The main dependent variables are measured in year $t + 1$, while customer concentration and controls are measured in year t .

Descriptive statistics show substantial variation. The mean operating return on assets is 6.8%, with a standard deviation of 8.9%. The mean EBITDA margin is 13.7%. The mean Tobin's Q is 2.06. Approximately 14.8% of firm-years are followed by a revenue decline greater than 10%. Customer concentration is positively correlated with EBITDA margin when demand volatility is low, but negatively correlated when demand volatility is high. The unconditional correlation between concentration and Tobin's Q is close to zero, consistent with the idea that the average effect masks opposing conditions.

The data also identify major-customer loss events. A loss event occurs when a customer previously representing at least 10% of revenue is no longer disclosed in the following year and the firm does not disclose a new customer of similar size in the same year. The event definition excludes cases where the firm explicitly states that the customer was renamed, merged, or reclassified. The final event sample contains 57 losses. The average lost-customer share is 17.9% of revenue. The median is 15.2%. Approximately 18 events involve customers above 20% of revenue.

A comparison group is created for the event analysis using nearest-neighbor matching [17]. Treated firm-years are matched to control firm-years in the same broad industry and year based on prior sales growth, EBITDA margin, customer concentration, firm size, leverage, and demand volatility. The matched sample contains 57 treated observations and 171 control observations. Pre-event trends in revenue growth and EBITDA margin are statistically similar over the two years before the event.

4. Empirical Design

The first empirical model estimates next-year financial performance as a function of customer concentration, demand volatility, their interaction, controls, firm fixed effects, and year fixed effects. The lagged dependent variable is included to account for persistence. Standard errors are clustered by firm and year. The coefficient on the interaction term is central. A negative interaction indicates that customer concentration becomes less beneficial or more harmful when demand volatility rises.

$$Y_{i,t+1} = \rho Y_{it} + \beta_1 CRC_{it} + \beta_2 DV_{it} + \beta_3 CRC_{it} DV_{it} + \Gamma' X_{it} + \mu_i + \lambda_t + \varepsilon_{i,t+1}. \quad (4.1)$$

In this equation, $Y_{i,t+1}$ is a financial performance outcome, CRC_{it} is customer revenue concentration, DV_{it} is demand volatility, X_{it} is the control vector, μ_i denotes firm fixed effects, and λ_t denotes year fixed effects. The coefficient β_1 captures the concentration effect when volatility is at its standardized mean. The marginal effect of concentration at a given volatility level is $\beta_1 + \beta_3 DV_{it}$.

A second model separates low-volatility and high-volatility conditions using an indicator for demand volatility above the sample median. This specification is less dependent on linearity in the interaction. It estimates whether concentration has different effects across volatility regimes.

$$Y_{i,t1} = \rho Y_{it} \theta_1 CRC_{it} 1 - HDV_{it} \theta_2 CRC_{it} HDV_{it} \theta_3 HDV_{it} \Gamma' X_{it} \mu_i \lambda_t \varepsilon_{i,t1}. \quad (4.2)$$

The event analysis estimates the effect of major-customer loss [18]. The design compares treated firms with matched controls before and after the loss event. The dependent variables are revenue growth, EBITDA margin, operating return on assets, and Tobin's Q. The model includes firm fixed effects and event-year fixed effects.

$$Y_{i\tau} = \alpha \sum_{\ell=-2}^2 \delta_\ell Loss_i \times Post_{\tau\ell} \mu_i \kappa_\tau \Gamma' X_{i,\tau-1} \epsilon_{i\tau}. \quad (4.3)$$

The omitted period is the year immediately before the loss event. The coefficients after the event indicate whether treated firms experience performance changes relative to matched controls. The pre-event coefficients are used to evaluate parallel trends. The event analysis does not claim perfect random assignment, but it provides evidence around discrete changes in customer dependence.

Quantile regression is used because concentration may affect weak performers differently from strong performers. Fixed-effects quantile models are estimated for operating return on assets and EBITDA margin at the 25th, 50th, and 75th percentiles. The expectation is that the concentration-volatility interaction is most negative in the lower performance quantile.

$$Q_\tau Y_{i,t1} = \rho_\tau Y_{it} \beta_{1\tau} CRC_{it} \beta_{2\tau} DV_{it} \beta_{3\tau} CRC_{it} DV_{it} \Gamma'_\tau X_{it} \mu_{i\tau} \lambda_{t\tau}. \quad (4.4)$$

A dominant-customer model replaces the concentration index with the largest-customer share [19]. This test evaluates whether single-buyer dependence is more harmful than concentration spread across several large customers. The model also includes the number of major customers. A negative coefficient on dominant-customer exposure under high volatility would indicate that the largest buyer is the central source of fragility.

The mechanism model evaluates selling intensity and revenue drawdown risk. Selling intensity is tested as a channel through which concentration improves margins under low volatility. Revenue drawdown risk is tested as a channel through which concentration harms performance under high volatility. The selling-intensity mediation is conducted only in low-volatility observations, while the drawdown-risk mediation is conducted only in high-volatility observations.

$$\begin{aligned} SELL_{i,t1} &= a_1 CRC_{it} a_2 X_{it} \mu_i \lambda_t \nu_{i,t1}, \\ MARGIN_{i,t1} &= b_1 CRC_{it} b_2 SELL_{i,t1} b_3 X_{it} \mu_i \lambda_t \xi_{i,t1}. \end{aligned} \quad (4.5)$$

$$\begin{aligned} DRAW_{i,t1} &= c_1 CRC_{it} c_2 X_{it} \mu_i \lambda_t \zeta_{i,t1}, \\ ROA_{i,t1} &= d_1 CRC_{it} d_2 DRAW_{i,t1} d_3 X_{it} \mu_i \lambda_t \omega_{i,t1}. \end{aligned} \quad (4.6)$$

Instrumental-variable estimates are used as a supplementary design. The instrument is buyer-industry consolidation, measured as the change in concentration among large firms in the main customer industries served by the supplier, excluding the supplier's own sales contribution. Buyer consolidation should increase the likelihood that suppliers depend on fewer large customers. The exclusion restriction is that buyer consolidation affects supplier financial performance only through customer concentration after controlling for industry-year demand, supplier fixed effects, and market-level controls. This assumption is imperfect because buyer consolidation may also affect price pressure directly. The IV results are therefore reported as a robustness exercise rather than the primary evidence.

The performance implications of strategic actions can depend on market and firm conditions. Cao et al. (2025) [20] show that financial outcomes associated with environmental innovation are shaped by market competition, peer activity, prior reputation, and innovation effectiveness rather than by a uniform main effect. The present design follows a similarly conditional structure, but the empirical object is customer revenue dependence and demand volatility.

The models include extensive controls, but endogeneity remains possible. High-performing firms may attract large customers. Weak firms may become dependent on a few buyers because they cannot diversify. Managers may disclose customer relationships differently depending on expected performance. The study addresses these concerns through lagging, firm fixed effects, dynamic controls, event analysis, quantile models, instrumental-variable estimates, and multiple measurement checks. The results are interpreted as empirical associations supported by several designs, not as mechanically universal causal effects.

5. Main Results

The baseline fixed-effects estimates show that customer concentration has a conditional relationship with financial performance. In the operating return-on-assets model, the coefficient on customer concentration is 0.0038 with a standard error of 0.0017, significant at the 5% level. The coefficient on the interaction between concentration and demand volatility is -0.0069 with a standard error of 0.0024, significant at the 1% level. This means that concentration is mildly beneficial when demand volatility is low, but the benefit disappears and becomes negative as volatility rises.

At one standard deviation below mean demand volatility, a one-standard-deviation increase in customer concentration predicts a 1.07 percentage-point increase in next-year operating return on assets [21]. At mean volatility, the predicted effect is 0.38 percentage points. At one standard deviation above mean volatility, the predicted effect is -0.31 percentage points. At the 90th percentile of volatility, the effect is -0.86 percentage points. These magnitudes are not extreme, but they are meaningful relative to the sample mean operating return on assets of 6.8%.

The EBITDA margin model shows a clearer operating pattern. The concentration coefficient is 0.0061 with a standard error of 0.0022, while the concentration-volatility interaction is -0.0084 with a standard error of 0.0029. Under low volatility, concentration is associated with higher EBITDA margin. Under high volatility, it is associated with lower margin. In the median split model, concentration predicts a 0.64 percentage-point increase in EBITDA margin in low-volatility firm-years and a 0.91 percentage-point decline in high-volatility firm-years [22].

The operating cash-flow stability model indicates that concentration stabilizes cash flow only under low volatility. The concentration coefficient is positive and significant when demand volatility is low, but the interaction with volatility is negative. At high volatility, the net effect is statistically indistinguishable from zero or negative depending on the specification. This suggests that large customers can support cash-flow regularity when their own demand is stable, but concentration does not protect firms from unstable customer demand.

The Tobin's Q model shows that capital markets discount customer concentration under volatile demand. The main concentration coefficient is 0.027 with a standard error of 0.014, while the interaction with volatility is -0.052 with a standard error of 0.019. At low volatility, the valuation effect is positive but modest. At high volatility, the effect is negative. A one-standard-deviation increase in concentration

at the 75th percentile of volatility predicts a 0.061 reduction in Tobin's Q. The effect is stronger for firms with low segment diversification.

Revenue drawdown risk provides the clearest evidence of downside exposure [23]. In the linear probability model, the coefficient on concentration is -0.006 under mean volatility, but the interaction with volatility is 0.031 with a standard error of 0.009. At high volatility, a one-standard-deviation increase in concentration predicts a 3.8 percentage-point increase in the probability of a next-year revenue decline exceeding 10%. The logit specification produces a similar marginal effect. The continuous drawdown magnitude model also shows larger declines for concentrated firms under high volatility.

Selling intensity declines with customer concentration in low-volatility settings. A one-standard-deviation increase in concentration predicts a 0.41 percentage-point reduction in selling intensity. This reduction explains approximately 22% of the positive concentration effect on EBITDA margin in low-volatility observations. The indirect effect is 0.0014, with a 95% bootstrap confidence interval from 0.0004 to 0.0032. This supports the argument that concentrated customers reduce sales-related costs when relationships are stable.

The drawdown-risk mediation is stronger in high-volatility settings. Concentration predicts higher drawdown risk, and drawdown risk predicts lower operating return on assets and lower Tobin's Q. The mediated share is 27% for operating return on assets and 19% for Tobin's Q. This means that part of the negative concentration effect operates through discrete revenue declines, but other channels, such as margin pressure and bargaining concessions, also matter.

Dominant-customer exposure is more harmful than diversified major-customer concentration. When the model includes both the concentration index and largest-customer share, the largest-customer share carries the stronger negative interaction with volatility. A 10 percentage-point increase in the largest-customer share predicts a 1.4 percentage-point increase in revenue drawdown probability under high volatility. By contrast, concentration spread across multiple major customers has a weaker downside effect. This suggests that dependence on one dominant buyer is financially different from having several large buyers.

The replacement difficulty index strengthens the negative concentration effect. In firms with low replacement difficulty, the high-volatility concentration coefficient in the EBITDA margin model is -0.0042. In firms with high replacement difficulty, it is -0.0136. The difference is statistically significant at the 1% level. The same pattern appears in revenue drawdown risk and Tobin's Q. Specialized assets, concentrated buyer industries, and customized products make customer dependence more financially fragile.

The event study around major-customer loss provides additional evidence. In the year after a major-customer loss, treated firms experience an average revenue growth decline of 8.7% relative to matched controls. EBITDA margin declines by 2.6 percentage points. Operating return on assets declines by 1.9 percentage points. Tobin's Q declines by 0.14. These estimates are statistically significant at the 5% level or better. The pre-event coefficients for revenue growth and EBITDA margin are small and statistically insignificant, supporting the matched comparison.

The event effects are larger when the lost customer previously accounted for more than 20% of sales. In that subsample, revenue declines by 14.9% relative to matched controls, and EBITDA margin declines by 4.1 percentage points. Firms that replace the lost customer with a new major customer within two years recover part of the revenue loss but do not fully recover margin. This suggests that replacement revenue may require price concessions, onboarding costs, or less efficient production.

The event effects are also larger for firms with high replacement difficulty. In the high replacement-difficulty tercile, major-customer loss predicts a 12.8% revenue decline and a 3.7 percentage-point EBITDA margin decline. In the low replacement-difficulty tercile, the revenue decline is 4.1% and the margin effect is not statistically significant. This supports the argument that concentration is financially dangerous when customer-specific capacity cannot be redeployed.

Quantile regressions show that concentration under volatility harms weak performers most. At the 25th percentile of operating return on assets, the concentration-volatility interaction is -0.0108. At the median, it is -0.0063. At the 75th percentile, it is -0.0021 and not statistically significant. EBITDA margin

shows a similar pattern. This indicates that strong performers may absorb customer concentration risk more effectively, perhaps through better bargaining position, higher product differentiation, or more flexible capacity.

The analysis also evaluates whether concentration affects analyst forecast dispersion. In a subset of firms with analyst coverage, the concentration-volatility interaction predicts higher dispersion in next-year earnings forecasts. The coefficient is 0.0047 with a standard error of 0.0018. This suggests that customer dependence under volatile demand increases uncertainty among external observers. The result is consistent with the negative valuation effect, although analyst coverage is not available for the full sample.

The role of efficiency channels in financial outcomes is also evident in adjacent research. Cao et al. (2024b) [24] find that incubator specialization can lower startups' R&D efficiency and indirectly reduce venture capital funding, illustrating that structural arrangements can affect financial outcomes through efficiency mechanisms. In the present study, the relevant efficiency mechanism is not R&D efficiency, but selling efficiency and capacity redeployability. Concentrated customers lower selling intensity under stable demand, yet reduce resilience when relationship-specific assets cannot be shifted quickly.

The main findings are consistent across accounting and market outcomes. Customer concentration can support profitability when demand is stable and relationships reduce selling costs. It becomes financially costly when volatility rises, when one buyer dominates revenue, or when replacement is difficult. The results therefore reject a universal view of customer concentration and support a conditional financial-performance interpretation.

6. Robustness and Additional Analyses

The first robustness test uses alternative concentration measures. The disclosed-customer Herfindahl index is replaced by the largest-customer share, the sum of disclosed major-customer shares, and an indicator for any customer above 20% of sales. The interaction with demand volatility remains negative in all specifications. The largest-customer share produces the strongest downside estimates, while the simple major-customer indicator produces the weakest estimates. This confirms that intensity of dependence matters.

The second test changes the treatment of the undisclosed customer tail. The baseline assumes an industry-specific effective number of tail customers. Alternative models assign the tail to 20 equal customers, 50 equal customers, or exclude the tail entirely. The coefficients on concentration and the concentration-volatility interaction remain similar. The exclusion of the tail increases coefficient magnitudes because the concentration measure becomes more extreme, but the substantive inference is unchanged.

The third test removes firms that disclose only unnamed major customers. The results remain statistically significant, although the sample size falls by 14%. This indicates that the findings are not driven by ambiguous customer identity. The named-customer subsample also permits more precise demand-volatility measurement, and the negative interaction is slightly stronger in that subsample.

The fourth test evaluates whether customer concentration proxies for industry concentration [25]. The models add supplier-industry Herfindahl concentration, buyer-industry concentration, and their interactions with demand volatility. Customer concentration remains significant. This suggests that firm-level revenue dependence is not reducible to general industry structure.

The fifth test addresses customer quality. Some major customers are large, stable, and financially strong. The models add customer financial strength for named public customers, measured by customer profitability, leverage, and sales growth [26]. Concentration with financially strong customers is less harmful under volatility, but the interaction remains negative. Customer quality moderates the risk, but does not eliminate it when dependence is high.

The sixth test evaluates whether high concentration reflects superior supplier capability. Firms with unique products may attract large customers and earn higher margins. The models include gross margin,

R&D intensity, patenting activity where available, and product differentiation language. These controls reduce the positive low-volatility concentration effect, but the negative high-volatility interaction remains. This indicates that supplier capability explains part of the benefit but not the downside exposure.

The seventh test estimates models without lagged dependent variables. The coefficients are somewhat larger but directionally identical [27]. Because financial performance is persistent, the baseline retains lagged performance. The similarity across specifications suggests that the results are not created by dynamic adjustment alone.

The eighth test uses system GMM to address persistence and potential endogeneity. Customer concentration, lagged performance, and leverage are treated as endogenous. Instruments are collapsed and limited to deeper lags to avoid overfitting. The concentration-volatility interaction remains negative for operating return on assets, EBITDA margin, Tobin's Q, and drawdown risk. The Hansen test does not reject the instrument set, and second-order serial correlation is not detected.

The ninth test reports instrumental-variable estimates using buyer-industry consolidation as an instrument for customer concentration. The first-stage coefficient is positive and significant, with a first-stage F-statistic of 15.8. The second-stage interaction between predicted concentration and demand volatility is negative and statistically significant in the EBITDA margin and revenue drawdown models. The Tobin's Q estimate is negative but less precise. The IV estimates are larger than the fixed-effects estimates, which may reflect local effects among firms more exposed to buyer consolidation.

The tenth test examines disclosure changes. Firms may stop disclosing a customer because the customer share falls below a reporting threshold rather than because the relationship ends. The event analysis therefore uses a stricter loss definition requiring either explicit language about contract termination, a revenue decline consistent with lost volume, or disappearance of a named customer with no offsetting new customer. The stricter sample contains 39 events. The revenue and margin effects remain negative and significant, with larger magnitudes.

The eleventh test studies customer additions. If losing a customer harms performance, gaining a major customer might improve it. The paper identifies 64 major-customer addition events. New major customers predict higher revenue growth in the next year, averaging 6.1% above matched controls, but the EBITDA margin effect is small and statistically insignificant. For firms with high customization language, margin initially declines after gaining a major customer, likely due to onboarding and adaptation costs. This asymmetry suggests that gaining concentrated revenue is not simply the reverse of losing it.

The twelfth test evaluates revenue drawdown thresholds. The baseline defines drawdown as a revenue decline greater than 10%. Alternative thresholds of 5%, 15%, and 20% are used. The concentration-volatility interaction remains positive across thresholds, with the strongest relative effect at the 15% threshold. This indicates that concentrated volatile demand increases both moderate and severe revenue decline risk.

The thirteenth test examines the timing of effects. Concentration under high volatility predicts weaker performance one year ahead and remains weakly associated with two-year-ahead performance [28]. The two-year effect is smaller for EBITDA margin but remains significant for Tobin's Q and revenue drawdown risk. This suggests that capital markets incorporate longer-horizon fragility, while accounting effects are more immediate.

The fourteenth test separates positive and negative demand volatility. A customer whose demand fluctuates upward may not impose the same risk as one with frequent declines. The model decomposes volatility into upside and downside components. Downside customer-demand volatility drives the negative interaction. Upside volatility has no significant negative effect and is sometimes associated with revenue growth. This confirms that the risk is mainly connected to adverse demand movements.

The fifteenth test evaluates customer concentration within diversified firms. Firms with more operating segments show weaker negative effects of concentration. Segment diversification appears to reduce the consequences of customer dependence in any single activity. However, when the same dominant customer purchases across multiple segments, diversification provides little protection. This distinction matters because reported segment diversification can overstate actual revenue independence.

The sixteenth test examines cash holdings. Firms with higher cash reserves suffer smaller valuation penalties from customer concentration under volatility [29]. However, cash does not eliminate revenue drawdown risk. This suggests that liquidity helps absorb shocks but does not prevent lost sales. Investors appear to value cash buffers when concentration risk is high, but the operating exposure remains.

The seventeenth test assesses whether leverage amplifies the downside. The three-way interaction among concentration, demand volatility, and leverage is negative for Tobin's Q and operating return on assets. High leverage makes concentration risk more costly because revenue shocks have stronger implications for financial flexibility [30]. The effect is particularly visible in firms with debt maturities within two years.

The eighteenth test uses industry-year matched differences instead of firm fixed effects. Each concentrated firm is matched to a less concentrated firm in the same industry-year with similar size, profitability, and growth. The matched estimates produce the same pattern: concentration is beneficial under stable demand and harmful under volatile demand. The matched design is less efficient than the panel model but helps address concerns about functional-form dependence.

The nineteenth test checks whether merger and acquisition activity drives the findings. Firms may gain or lose major customers after acquisitions or divestitures. Excluding firm-years with acquisition expenditure above 10% of assets or major divestiture language does not change the results. The event-study estimates around customer loss are also robust to excluding firms with restructuring charges.

The twentieth test considers pandemic-period sensitivity. Excluding fiscal years 2020 and 2021 reduces the number of high-volatility observations but leaves the interaction negative and statistically significant. Including separate pandemic-year interactions shows that concentration risk was stronger during the shock period, but the main finding exists outside that period [31]. This indicates that the results are not solely a pandemic artifact.

The twenty-first test evaluates alternative valuation measures. Market-to-book ratio, enterprise value to sales, and enterprise value to EBITDA replace Tobin's Q. The concentration-volatility interaction is negative in all three models. The effect is strongest for enterprise value to sales, suggesting that markets discount revenue fragility directly when concentration and volatility coincide.

The twenty-second test examines whether major customers discipline suppliers and improve efficiency. In low-volatility settings, concentration predicts lower selling intensity and slightly lower inventory days. In high-volatility settings, concentration predicts higher finished-goods inventory volatility [32]. This pattern suggests that large customers can improve planning when demand is predictable, but create inventory imbalance when demand changes abruptly.

The twenty-third test evaluates product customization. The negative concentration-volatility interaction is much stronger among firms with high customization language. In low-customization firms, concentration is less harmful because output can be redirected more easily. This supports the replacement-difficulty argument and suggests that the financial cost of concentration depends on asset redeployability.

The twenty-fourth test examines unnamed customers. Market valuation discounts concentration more when the dominant customer is unnamed. The interaction between dominant-customer exposure and unnamed-customer status is negative for Tobin's Q. Investors may apply a larger discount when they cannot assess customer quality directly. The accounting effects do not differ as strongly, indicating that anonymity mainly affects external interpretation.

The twenty-fifth test studies repeated customer losses. A small number of firms lose more than one major customer during the panel. These firms show persistent performance weakness after the second loss. Excluding them does not change the main estimates, but their pattern suggests that repeated losses may indicate deeper competitive problems rather than isolated relationship changes [33].

Overall, the robustness evidence supports the main conclusion. Customer revenue concentration is financially useful when it reduces selling costs and supports predictable operations, but it becomes financially costly when demand volatility, dominant-buyer dependence, and replacement difficulty are high. The result is stable across alternative measures, models, samples, and timing assumptions.

7. Discussion

The findings show that customer revenue concentration should be treated as a central financial-performance variable. It is not merely a disclosure detail or a background feature of sales composition. Concentration changes the way revenue shocks, bargaining pressure, and operating efficiency enter financial outcomes. Firms with concentrated customers can perform well when demand is stable, but they carry a form of fragility that becomes visible under volatility [34].

The results help reconcile opposing views of large customers. One view emphasizes efficiency: fewer customers can mean lower selling costs, better coordination, and predictable volume. The evidence supports this view in low-volatility settings. Concentrated firms show lower selling intensity and higher EBITDA margin when customer demand is stable. Another view emphasizes dependence: large customers can impose price pressure and create revenue risk. The evidence supports this view in high-volatility settings, especially when one customer dominates sales or replacement is difficult.

The distinction between concentration and dominant-customer exposure is important. A firm with several major customers is less fragile than a firm with one dominant customer, even when the total disclosed major-customer share is similar. Portfolio structure matters. Dependence is most financially costly when revenue is tied to a single buyer whose demand changes materially. This suggests that managers and analysts should examine the shape of customer concentration rather than only the total share of major customers [35].

The event evidence around customer loss adds practical significance. Losing a major customer is followed by lower revenue, lower margin, and lower valuation relative to matched controls. The losses are not fully offset within the next fiscal year. The effect is especially large when the customer accounted for more than 20% of revenue. This supports the view that replacement is neither immediate nor costless. Even when a firm finds new buyers, onboarding costs and price concessions may reduce profitability.

Replacement difficulty is one of the clearest boundary conditions. Customer concentration is less harmful when products and capacity can be redeployed [36]. It is more harmful when output is customized, assets are specific, and buyer industries are concentrated. This finding shifts attention from concentration alone to the flexibility of the operating system behind concentration. Firms can tolerate concentrated revenue better when they preserve redeployability.

The valuation results indicate that markets incorporate customer concentration risk selectively. Concentration does not always reduce Tobin's Q . It is discounted when demand is volatile, customers are dominant, or customer identity is unclear. This suggests that investors do not mechanically penalize large-customer relationships. They appear to evaluate whether such relationships represent stable contracted demand or fragile dependence.

The findings also carry implications for disclosure. Customer concentration disclosures provide financially relevant information, but the usefulness of that information depends on detail. The identity of customers, the duration of relationships, contract renewal structure, and the share of revenue tied to customized assets would help investors evaluate risk more precisely. Firms that disclose only minimum customer shares provide less information about the true exposure distribution.

For managers, the results suggest that growth through a major customer should be evaluated against resilience. A large customer can improve utilization and reduce sales expense, but the firm should assess whether capacity can be redirected if the customer reduces orders [37]. Contract terms, termination clauses, tooling ownership, inventory commitments, and buyer-specific engineering should be evaluated as financial-risk variables, not only operating details.

For boards, customer concentration should be part of risk oversight. The relevant question is not simply whether the firm has a customer above a particular share of sales. Boards should ask whether the firm has credible replacement channels, whether margins depend on buyer concessions, whether customer forecasts are reliable, and whether the balance sheet can absorb a sudden revenue decline. These issues connect revenue structure to liquidity, investment, and valuation.

For investors, the findings suggest that customer concentration can be interpreted differently across contexts [38]. In stable-demand settings, concentration may indicate efficient relationship-based revenue. In volatile settings, concentration may indicate hidden downside risk [39]. Analyst models should therefore interact customer concentration with customer demand volatility, replacement difficulty, and dominant-buyer exposure rather than treating concentration as a uniform discount.

The study has limitations. Customer disclosures are imperfect. Some firms disclose unnamed customers, some provide only threshold information, and some customer relationships may be embedded in segment data. The concentration measure therefore contains measurement error. The event analysis identifies disappearance from disclosure, which may reflect a customer falling below a reporting threshold rather than complete termination. The robustness tests address this concern with stricter definitions, but the issue cannot be eliminated fully [40].

The demand-volatility measure is also imperfect. For named public customers, it is measured directly from customer sales. For unnamed or private customers, it is inferred from buyer-industry conditions. This creates noise that likely weakens estimated effects. Future research with transaction-level customer revenue data could measure customer-specific demand more precisely.

The study is based on public U.S [41]. operating firms, so the results may differ in private firms or in countries where long-term buyer-supplier contracting norms differ. Private firms may have less disclosure pressure and different financing constraints. Some industries may use formal long-term contracts that reduce concentration risk. Other industries may have relational contracting that makes customer loss less abrupt. The findings should therefore be interpreted within the institutional setting of the sample.

The study also does not observe all contract terms. A customer representing 25% of revenue under a five-year take-or-pay contract is different from a customer representing 25% of revenue through annual purchase orders. Contractual protection would likely moderate the results. The available disclosures provide partial information on long-term agreements, but not enough for a full contract-level analysis.

Future research could extend this work in several directions. One extension would combine supplier disclosures with customer-side procurement data to observe both sides of the relationship [42]. Another would examine whether customer concentration affects investment policy, employee retention, or credit spreads. A third would study how customer concentration interacts with geographic exposure, trade policy, and supply-chain disruptions. A fourth would examine whether private lenders price customer concentration differently from equity markets.

The main implication is straightforward: revenue composition matters for financial performance. The identity, concentration, volatility, and replaceability of customers influence whether sales convert into durable profitability and valuation. Customer concentration can be financially useful, but it is not a free source of efficiency. Its value depends on the stability of demand and the firm's ability to withstand or replace buyer-specific shocks.

8. Conclusion

This paper examined how customer revenue concentration relates to financial performance in publicly traded operating firms. Using a panel of 463 firms from 2014 to 2024, the study found that concentration has conditional effects. It is associated with stronger EBITDA margin and lower selling intensity when customer demand is stable, but it predicts weaker profitability, lower valuation, and higher revenue drawdown risk when demand volatility is high.

The evidence indicates that customer concentration should not be interpreted as uniformly harmful. Large customers can support efficient operations and reduce selling costs. However, the same relationships can create financial fragility when demand becomes unstable or when a dominant buyer accounts for a large share of sales. The financial effect depends on the balance between relationship efficiency and revenue dependence [43].

Major-customer loss events provide additional evidence of the risks. Firms losing a major customer experience lower revenue growth, lower EBITDA margin, and lower Tobin's Q relative to matched controls. The effects are larger when the lost customer represented more than 20% of sales and when

replacement difficulty is high. These results show that customer replacement is often slow and financially costly.

The study also shows that the downside of concentration is stronger when products are customized, assets are specific, buyer industries are concentrated, or customer identity is not transparent [44]. These conditions limit redeployability and increase uncertainty. Concentration is therefore most concerning when the firm cannot easily shift capacity or replace revenue [45].

The findings contribute to financial-performance research by showing that revenue architecture shapes profitability, valuation, and risk. Performance is not determined only by cost structure, investment, or capital structure. It is also influenced by how revenue is distributed across customers and how exposed that revenue is to customer-specific volatility.

The evidence should be interpreted with caution because customer disclosures are incomplete and the data are observational. Still, the consistency across fixed-effects models, event tests, quantile regressions, and robustness checks supports the conclusion that customer revenue concentration is financially meaningful. Future work using contract-level or transaction-level data can refine these estimates and examine the contractual mechanisms behind customer dependence.

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