# Journal Pre-proof

## Vertical Shareholding During Supply Chain Shocks

Shunlan Fang , Rui-Zhong Zhang

Highlights

- Vertical shareholding (i.e., common ownership along supply chains) is associated with better stock performance of connected firms during supply chain shocks
- Dedicated investors as common owners have the most positive effects, followed by common quasi-indexers
- Common quasi-indexers appear to take a more active role during supply chain disruptions
- Common ownership may help to manage supply chain disruption risks

# Vertical Shareholding During Supply Chain Shocks

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**Abstract**

The paper examines whether common ownership along supply chains (i.e., vertical shareholding) is associated with better firm performance during supply chain shock. We find that supplier-customer dyads with vertical shareholding report higher combined monthly returns since the outbreak of the COVID-19 pandemic. The dedicated common investors have the most positive effects, followed by the common quasi-indexers.

**Keywords:** COVID-19, vertical shareholding, supply chain shocks

**JEL Classification:** G30; G32; G34; L14

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## 1. Introduction

As overlapping institutional ownership becomes more prevalent, it has been heatedly debated whether it plays a positive role in market competition and corporate governance (e.g., Azar et al. 2018; Edmans et al. 2019; Schmalz 2021; Koch et al. 2021; Bebchuk and Hirst 2022). Most studies focus on its effects on industry rivals (i.e., horizontal shareholding). Compared to industry rivals, firms along the supply chain network have more collaborative and interdependent relationships. Hence, overlapping institutional ownership of supplier-customer dyads (i.e., vertical shareholding) [1] may have distinct effects, especially in response to disruptive events that could jeopardize collaboration.

We utilize the COVID-19 pandemic as an exogenous supply chain shock to investigate whether vertical shareholding is associated with stock performance. Supply chain disruptions can be devastating to both upstream and downstream firms (e.g., Carvalho et al. 2021) and significantly exacerbate interfirm conflicts as opportunism and information asymmetry increase. Economic theories predict that cross-ownership can address inherent interfirm conflicts, such as the holdup problem (e.g., Klein et al. 1978; Grossman and Hart 1986). Institutional investors simultaneously holding shares of economically connected firms have incentives to prevent either contracting party from making a move that will hurt the value of their portfolios. Hence, they can influence the management of both upstream and downstream firms and thereby encourage information sharing and balance the bargaining power in supply chain contract renegotiations.

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[1] For example, Berkshire Hathaway owns significant shares in General Motors and is also the largest shareholder of Axalta, the supplier of coatings for General Motors (*BusinessWire* 2017).

For example, institutional investors can influence the supplier firms to prioritize the co-owned customer firms during supply shortages (Sheffi 2020).

We find that supplier-customer pairs with vertical shareholding have significantly better stock market performance than those without since the outbreak of COVID-19 pandemic. From March 2020 to December 2020, the supplier-customer pairs with vertical shareholding report approximately 3.7% higher combined monthly market-adjusted stock returns. Moreover, we show that the differences in stock performance vary with institutional investors' incentives. The proportion of dedicated institutional investors has the most pronounced effects, followed by that of quasi-indexers. Both types of investors are considered to have long-term focus.

Our study adds to the emerging literature on common ownership along the supply chain. Prior studies show that vertical shareholding can reduce the holdup problem (Freeman 2023), improve information sharing (Xia, Kong, Li, and Qin 2021), and encourage innovation (Chen 2020). We further document the distinct effect of vertical shareholding during supply chain shocks. Our evidence also lends support to the debate on whether quasi-indexers may influence corporate decisions. Finally, we provide additional evidence on the impact of the COVID-19 pandemic on supply chain dyads. The evidence implies that ownership structure may help to manage supply chain risks.

## 2. Descriptive Evidence

We use Compustat Segment and Thompson Refinitiv databases to identify supply chain relationships and institutional ownership. Our final sample comprises 1,733 unique supplier-customer pairs of 768 unique suppliers and 484 unique customers with non-missing control variables. For supplier-customer pairs with at least one common institutional investor and those

without any common owners, we first compare the stock market reactions when the United States declared COVID-19 a national emergency in March 2020. Table 1 shows the univariate results on aggregate market reactions of supplier-customer dyads, measured by raw returns minus the two benchmark returns, respectively. The results indicate that the stock performance of supplier-customer pairs with at least one common institutional investor is significantly better than those without during the event month.

## 3. Empirical Models and Main Results

Next, we compare the long-term performance between customer-supplier pairs with and without common institutional investors from June 2019 through December 2020:

$$PAIR\ RET = \beta_0 + \beta_1\ COMMON \times POST + \beta_2\ SUP\_ROA + \beta_3\ CUS\_ROA + \beta_4\ SUP\_LEV$$

$$+ \beta_5\ CUS\_LEV + \beta_6\ SUP\_SIZE + \beta_7\ CUS\_SIZE + \beta_8\ SUP\_BM + \beta_9\ CUS\_BM + Supplier\text{-}$$

$$Customer\ Pair\ Fixed\ Effects + Year\text{-}Month\ Fixed\ Effects + \varepsilon, \tag{1}$$

where the *PAIR RET* is the aggregated stock performance measure. We use the raw aggregated monthly stock returns and the abnormal monthly returns based on two different benchmark returns for robustness checks.[2] The indicator variable, *COMMON*, equals one if a supplier-customer pair shares at least one common owner and zero otherwise. The time period indicator, *POST*, is equal to one if the monthly stock return is from March 2020 to December 2020, and zero otherwise.

To further examine whether the performance differences are associated with institutional investors' incentives, we follow Bushee (1998) to classify common institutional investors into

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[2] Results are robust to additional measures of abnormal returns.

three types: transient investors, quasi-indexers and dedicated investors. Transient investors hold diversified portfolios with high trading turnover. Quasi-indexers hold diversified portfolios with low turnover, and dedicated investors hold concentrated portfolios with low trading turnover. Both quasi-indexers and dedicated investors are considered to have a long-term focus. We replace the indicator of common ownership with the proportions of different types of common institutional owners. Appendix A provides detailed definitions of the variables.

Table 2 presents the regression results. From columns (1) to (3), the coefficients of $COMMON \times POST$ are all positive and statistically significant, suggesting that the customer-supplier pairs with common institutional investor ownership exhibit better stock performance since the outbreak of the pandemic. For example, the presence of vertical shareholding increases $RET\_VWADJ$ by 3.9% relative to the combined stock returns of firm pairs without vertical shareholding on average. Further analyses show that the effects on stock performance are the most pronounced with dedicated common investors ($COMMON\_{\%DED}$), followed by common quasi-indexers ($COMMON\_{\%QIX}$). Common transient institutional investors do not have significant effects on stock performance.

To further investigate the role of common quasi-indexer investors in supply chains, we divide the supplier-customer dyads into three groups based on the sample median: the pairs without common ownership, the ones with high quasi-indexers common ownership, and the ones with low quasi-indexers common ownership. Figure 1 shows that the cumulative abnormal returns were similar for the three groups before the pandemic but diverted afterward. The portfolio with low common quasi-indexers exhibits the best performance, followed by the one with high quasi-indexers common ownership. Both have significantly better performance than

those without any common owners. These results indicate that quasi-indexers seem to take a more active role during supply chain disruptions than during normal periods.

To take into account the effects of common owner concentration level, we rerun our analyses with a continuous measure, *Inner Product*, developed by Azar (2022). This measure is based on the theory initially proposed by Azar (2012) and applied by Azar and Vives (2021).[3] The measure is defined as:

$$Inner\ Product_{ij} = \sum_{g \in G} S_{gi} S_{gj,}$$

where $G$ is the set of common institutional shareholders of firms $i$ and $j$, and $S_{gi}$ $\left(S_{gj}\right)$ is the percentage of firm $i$ (firm $j$) owned by investor $g$. The inner product measure is essentially the Herfindahl measure for the level of shareholding concentration. We also calculate the relative common owner concentration by different types of institutional investors. Results are reported in Table 3. The evidence is consistent with that reported in Table 2.

## 4. Conclusion

We show that supply chain dyads with vertical shareholding have significantly better aggregate stock market performance since the COVID-19 pandemic. The effects vary with the incentives of common institutional shareholders. To our knowledge, we are one of the first empirical studies to show that vertical shareholding mitigates negative consequences of supply chain shocks. Our evidence sheds light on the debates over the roles common institutional investors play in interfirm relationships and supply chain risk management.

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[3] We thank an anonymous reviewer for suggesting this continuous common ownership measure.

# References

Azar, J. 2012. A new look at oligopoly: Implicit collusion through portfolio diversification. In *Ph.D. Thesis, Princeton University*.

Azar, J., 2022. Common shareholders and interlocking directors: The relation between two corporate networks. *J. of Competition Law & Economics*, *18*(1): 75–98. https://doi.org/10.1093/joclec/nhab026.

Azar J., Schmalz M.C., Tecu I., 2018. Anticompetitive effects of common ownership. *J. of Finance* 73(4):1513–1565. https://doi.org/10.1111/jofi.12698.

Azar, J., Vives, X. 2021. General equilibrium oligopoly and ownership structure. *Econometrica*, 89(3): 999–1048. https://doi.org/10.3982/ECTA17906.

Bebchuk, L. and Hirst, S., 2022. Big three power, and why it matters. *BUL Rev.*, *102:* 1547.

*BusinessWire* (2017) Axalta Coating Systems recognized by General Motors as a 2016 Supplier of the Year Winner. *BusinessWire*, April 3. https://www.businesswire.com/news/home/20170403006369/en/Axalta-Coating-Systems-Recognized-General-Motors-2016.

Bushee B.J., 1998. The influence of institutional investors on myopic R&D investment behavior. *Accounting Review* 73(3):305–333.

Carvalho V.M., Nirei M., Saito Y.U., Tahbaz-Salehi A., 2021. Supply chain disruptions: Evidence from the great east Japan earthquake. *Quarterly J. of Economics* 136(2):1255–1321. https://doi.org/10.1287/msom.2019.0777.

Chen X., 2020. Common ownership along the supply chain and supplier innovations. Working Paper.

Edmans A., Levit D., Reilly D., 2019. Governance under common ownership. *Review of Financial Studies* 32(7):2673–2719. https://doi.org/10.1093/rfs/hhy108.

Koch A., Panayides M., Thomas S.,2021. Common ownership and competition in product markets. *J. of Financial Economics* 139(1):109–137. https://doi.org/10.1016/j.jfineco.2020.07.007.

Freeman K. 2023. Overlapping ownership along the supply chain. Freeman, K.M., 2021. Overlapping ownership along the supply chain. *J. of Financial and Quantitative Analysis*: 1–55. https://doi.org/10.1017/S0022109023001266.

Grossman S.J., Hart O.D., 1986. The costs and benefits of ownership: A theory of vertical and lateral integration. *J. of Political Economy* 94(4):691–719. https://doi.org/10.1086/261404.

Klein B., Crawford R.G., Alchian A.A., 1978. Vertical integration, appropriable rents, and the competitive contracting process. *J. of Law & Economics* 21(2):297–326. https://doi.org/10.1086/466922.

Schmalz M.C.,2021. Recent studies on common ownership, firm behavior, and market outcomes. *Antitrust Bulletin* 66(1):12–38. https://doi.org/10.1177/0003603X20985804.

Sheffi Y., 2020. The new (ab) normal: reshaping business and supply chain strategy beyond covid-19. MIT CTL Media.

Xia L., Kong Q., Li Y., Qin J., 2021. Effect of equity holding on a supply chain's pricing and emission reduction decisions considering information sharing. *Annals of Operations Research*: 1–38. https://doi.org/10.1007/s10479-021-03930-7.

**Figure 1.** Cumulative Abnormal Market Returns by Common Quasi-indexer Owners
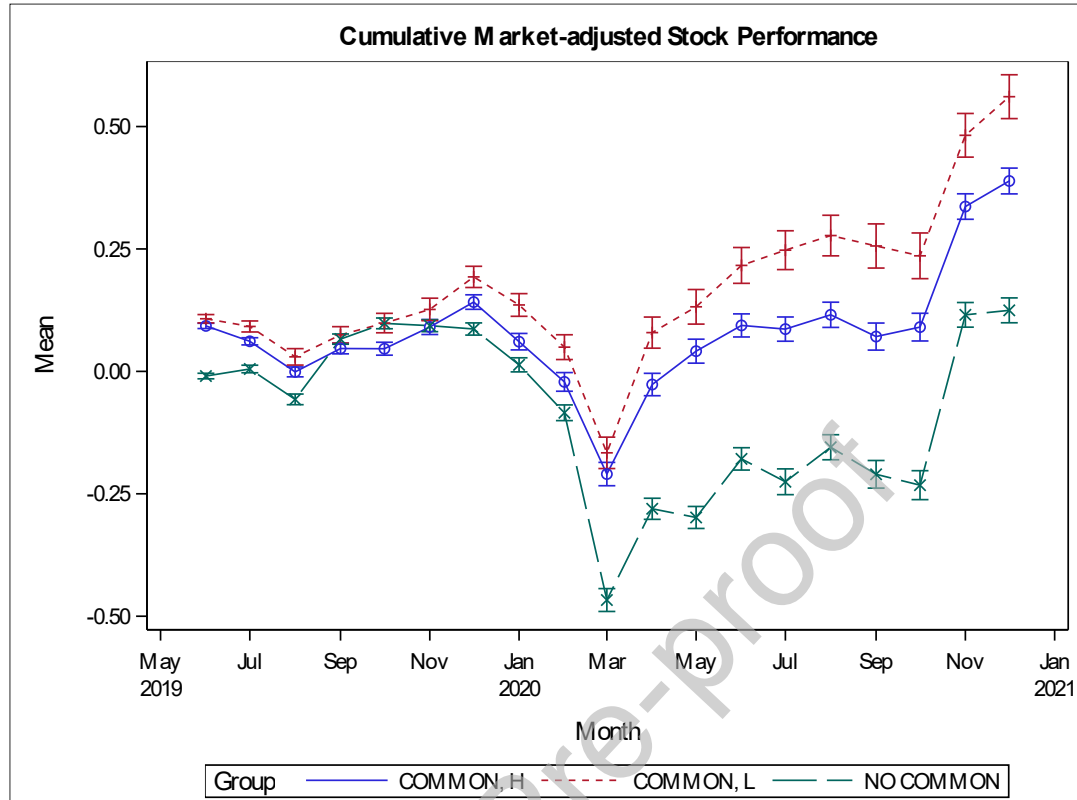


Common, H (L) refers to the supply chain pairs, of which the proportion of common quasi-indexer owners is above (below) the sample median.

**Table 1.** Market Reactions in March 2020

| March 2020 Abnormal Returns | | | |
|---|---|---|---|
| **Aggregated Abnormal Stock Returns** | **Common = 0** | **Common = 1** | **Diff.** |
| Benchmark: Fama-French market capitalization-market-to-book ratio 2×3 | -0.210 | 0.020 | 0.230*** |
| No. of supply chain pairs | 464 | 1194 | *t*-stats = 14.13 |
| | | | |
| Benchmark: CRSP value-weighted market portfolio | -0.451 | -0.218 | 0.233*** |
| No. of supply chain pairs | 507 | 1305 | *t*-stats = 13.62 |

This table reports the univariate test on the stock performance differences. Common=0 refers to the supply chain pairs without any common owners. Common=1 refers to the supply chain pairs with at least one common owner.

**Table 2.** Long-run Performance from June 2019 to December 2020

| Variables | RET (1) | RET_VWADJ (2) | RET_FFADJ (3) | RET (4) | RET_VWADJ (5) | RET_FFADJ (6) |
|---|---|---|---|---|---|---|
| **COMMON × POST** | **0.038*** | **0.039*** | **0.037*** | | | |
| | **(9.41)** | **(9.61)** | **(9.20)** | | | |
| **COMMON_%DED ×POST** | | | | **0.214*** | **0.216*** | **0.146*** |
| | | | | **(3.66)** | **(3.70)** | **(2.66)** |
| **COMMON_%QIX ×POST** | | | | **0.048*** | **0.049*** | **0.059*** |
| | | | | **(3.84)** | **(3.92)** | **(4.81)** |
| COMMON_%TRA ×POST | | | | 0.004 | 0.005 | -0.022 |
| | | | | (0.12) | (0.15) | (-0.67) |
| SUP_ROA | -0.075** | -0.075** | -0.081** | -0.071* | -0.071** | -0.079** |
| | (-2.01) | (-2.03) | (-2.24) | (-1.94) | (-1.96) | (-2.21) |
| CUS_ROA | -0.330*** | -0.337*** | -0.354*** | -0.329*** | -0.335*** | -0.353*** |
| | (-6.89) | (-6.89) | (-7.38) | (-6.82) | (-6.83) | (-7.31) |
| SUP_LEV | 0.109*** | 0.112*** | 0.094*** | 0.102*** | 0.105*** | 0.089*** |
| | (3.15) | (3.28) | (2.86) | (2.94) | (3.06) | (2.71) |
| CUS_LEV | 0.241*** | 0.244*** | 0.194*** | 0.241*** | 0.244*** | 0.193*** |
| | (4.75) | (4.79) | (3.94) | (4.78) | (4.82) | (3.91) |
| SUP_SIZE | -0.070*** | -0.069*** | -0.053*** | -0.066*** | -0.065*** | -0.050*** |
| | (-6.35) | (-6.32) | (-5.07) | (-6.03) | (-6.00) | (-4.81) |
| CUS_SIZE | -0.030** | -0.030** | -0.024** | -0.030** | -0.030** | -0.024** |
| | (-2.50) | (-2.49) | (-2.10) | (-2.52) | (-2.51) | (-2.11) |
| SUP_BM | 0.020*** | 0.021*** | 0.020*** | 0.020*** | 0.021*** | 0.020*** |
| | (8.71) | (8.99) | (8.90) | (8.77) | (9.05) | (8.94) |
| CUS_BM | 0.084*** | 0.084*** | 0.082*** | 0.084*** | 0.084*** | 0.082*** |
| | (11.00) | (10.95) | (10.96) | (10.96) | (10.92) | (10.93) |
| Intercept | 0.615*** | 0.585*** | 0.441*** | 0.590*** | 0.560*** | 0.423*** |
| | (4.16) | (3.94) | (3.08) | (4.02) | (3.80) | (2.96) |
| S.E. Clustered by Sup-Cus Pair | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 30,192 | 30,192 | 29,812 | 30,192 | 30,192 | 29,812 |
| Adjusted $R^2$ | 0.47 | 0.30 | 0.11 | 0.47 | 0.30 | 0.11 |

***, **, * indicate significance at the 1 percent, 5 percent, and 10 percent levels. All models include supplier-customer pair and year-month fixed effects.

**Table 3.** Long-run Performance from June 2019 to December 2020 with a Continuous Measure of Common Ownership

| Variables | RET (1) | RET_VWADJ (2) | RET_FFADJ (3) | RET (4) | RET_VWADJ (5) | RET_FFADJ (6) |
|---|---|---|---|---|---|---|
| **INNER PRODUCT × POST** | **0.887*** | **0.928*** | **0.905*** | | | |
| | **(3.86)** | **(4.03)** | **(3.91)** | | | |
| **INNER PRODUCT_%DED × POST** | | | | **0.048*** | **0.049*** | **0.046*** |
| | | | | **(9.31)** | **(9.51)** | **(9.14)** |

| | | | | | | |
|---|---|---|---|---|---|---|
| ***INNER PRODUCT_%QIX × POST*** | | | | **0.018\*** | **0.018\*** | **0.020\*\*** |
| | | | | **(1.86)** | **(1.90)** | **(2.21)** |
| *INNER PRODUCT_%TRA × POST* | | | | 0.019 | 0.021 | 0.004 |
| | | | | (0.89) | (1.00) | (0.19) |
| *SUP_ROA* | -0.086\*\* | -0.086\*\* | -0.092\*\* | -0.080\*\* | -0.080\*\* | -0.086\*\* |
| | (-2.29) | (-2.32) | (-2.54) | (-2.13) | (-2.16) | (-2.37) |
| *CUS_ROA* | -0.300\*\*\* | -0.307\*\*\* | -0.324\*\*\* | -0.334\*\*\* | -0.340\*\*\* | -0.359\*\*\* |
| | (-6.52) | (-6.54) | (-7.07) | (-6.93) | (-6.94) | (-7.46) |
| *SUP_LEV* | 0.122\*\*\* | 0.125\*\*\* | 0.108\*\*\* | 0.109\*\*\* | 0.112\*\*\* | 0.094\*\*\* |
| | (3.47) | (3.60) | (3.26) | (3.16) | (3.28) | (2.88) |
| *CUS_LEV* | 0.200\*\*\* | 0.202\*\*\* | 0.152\*\*\* | 0.237\*\*\* | 0.240\*\*\* | 0.188\*\*\* |
| | (3.98) | (4.01) | (3.10) | (4.64) | (4.69) | (3.79) |
| *SUP_SIZE* | -0.071\*\*\* | -0.070\*\*\* | -0.054\*\*\* | -0.068\*\*\* | -0.067\*\*\* | -0.051\*\*\* |
| | (-6.32) | (-6.29) | (-5.12) | (-6.17) | (-6.13) | (-4.90) |
| *CUS_SIZE* | -0.035\*\*\* | -0.035\*\*\* | -0.029\*\*\* | -0.030\*\* | -0.030\*\* | -0.025\*\* |
| | (-3.00) | (-3.00) | (-2.58) | (-2.51) | (-2.50) | (-2.15) |
| *SUP_BM* | 0.020\*\*\* | 0.020\*\*\* | 0.020\*\*\* | 0.021\*\*\* | 0.021\*\*\* | 0.020\*\*\* |
| | (8.58) | (8.87) | (8.80) | (8.77) | (9.05) | (8.94) |
| *CUS_BM* | 0.084\*\*\* | 0.085\*\*\* | 0.083\*\*\* | 0.085\*\*\* | 0.085\*\*\* | 0.083\*\*\* |
| | (11.11) | (11.06) | (11.07) | (11.07) | (11.02) | (11.04) |
| *Intercept* | 0.706\*\*\* | 0.678\*\*\* | 0.531\*\*\* | 0.601\*\*\* | 0.571\*\*\* | 0.436\*\*\* |
| | (4.90) | (4.69) | (3.81) | (4.07) | (3.85) | (3.03) |
| *S.E. Clustered by Sup-Cus Pair* | Yes | Yes | Yes | Yes | Yes | Yes |
| *N* | 30,192 | 30,192 | 29,812 | 30,192 | 30,192 | 29,812 |
| *Adjusted R²* | 0.47 | 0.30 | 0.11 | 0.47 | 0.30 | 0.11 |

\*\*\*, \*\*, \* indicate significance at the 1 percent, 5 percent, and 10 percent levels. All models include supplier-customer pair and year-month fixed effects.

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