



# Customer-base concentration and the transmission of idiosyncratic volatility along the vertical chain<sup>☆</sup>



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## ABSTRACT

This paper investigates the link between a firm's customer-base concentration and stock return volatility. We find that firms with more concentrated customer bases have higher idiosyncratic volatility. Further, we show significant variation in customer-base concentration effects across customer and supplier firm dimensions, including customer type, customer default probability, customer idiosyncratic volatility, customer customer-base concentration, extended trade credit, and industry product market competition. Our results are robust to potential endogeneity concerns, different estimation methodologies and volatility measures, among numerous other robustness checks. Overall, our results contribute to the understanding of idiosyncratic volatility sources in firm stock returns and provide new evidence on the transmission of firm-specific shocks in a supply-chain network environment.

## 1. Introduction

An important stylized fact is the increasing supply chain connectivity of firms that spend trillions of dollars annually seeking products and services from other companies. While these complex buyer-supplier connections serve as an important production backbone of the global economy, such network linkages and their disruptions also create firm-level idiosyncratic as well as potentially systemic economic risks. Understanding the nature of economically linked firms that are stakeholders in each other's operations is therefore important as a shock to one firm frequently has a resulting effect to its partners and potentially broader economic implications. This paper examines the extent to which a firm's customer-base concentration affects its firm-specific volatility.<sup>1</sup> We ask several questions. Do large, influential customers increase a supplier firm's risk, or do they stabilize business by acting as product demand anchors? Do customer and supplier characteristics play a role in supply chain contagion? Does the nature of economic shocks matter for the transmission of risk in a network environment? The answers to such questions are relevant given the importance of idiosyncratic volatility for a firm's corporate financial policy as well as for investment considerations (Hoberg and

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<sup>1</sup> We primarily focus on firm-level idiosyncratic return volatility (instead of firm-level total return volatility) in our tests because we are interested in the transmission of firm-specific shocks in a network setting that are unrelated to market risk. However, since the majority of total return volatility is accounted for by the idiosyncratic component (as shown in Fig. 1), our results are very similar if we use total return volatility instead of idiosyncratic volatility.

Prabhala, 2009; Chay and Suh, 2009; Bates et al., 2009; Merton, 1987; Fu, 2009, and Huang et al., 2010).

Focusing on well-defined customer-supplier links between firms, Cohen and Frazzini (2008) provide evidence of return predictability across economically linked companies. In particular, they document that a monthly strategy of buying firms whose customers (suppliers) experienced the most positive returns in the previous month, and selling short firms whose customers (suppliers) had the most negative returns, yields significantly positive abnormal returns. These findings illustrate that stock price shocks to one firm translate into stock price shocks to its customers and suppliers.<sup>2</sup> Economic links are also a natural channel for the transmission of firm-specific volatility along the vertical chain.

In this article we argue that customer-base concentration plays an important role in a supplier firm's idiosyncratic volatility profile. We posit that, in much the same way that portfolio diversification works, customer-base diversification smooths out idiosyncratic return shocks passed along by customer firms. If a company has a highly concentrated customer base, it will potentially be significantly exposed to the idiosyncratic return shocks experienced by its customers. In turn, its own returns will exhibit higher volatility. Alternatively, if a supplier has a customer base that consists of many companies accounting for small portions of the supplier's sales, much of the company-specific return shocks passed along will be diversified away, and the supplier company will have less exposure to the idiosyncratic return shocks of its customers. This logic motivates our main empirical hypothesis: stock returns of firms that have more concentrated customer bases should exhibit higher idiosyncratic volatility than those of firms that have less concentrated customer bases, *ceteris paribus*.<sup>3</sup>

As some visual motivation, Fig. 1A and 1B provide plots of the average and median return volatilities of firms split by customer-base concentration. Based on the figures, firms with more concentrated customers experience higher return volatilities over most of the sample from 1980 through 2012, except for portions of the recent financial crisis period. While this visual evidence is not fully identified, nor deterministic, the figures provide evidence consistent with a positive relation between customer-base concentration and firm stock return volatility.

From a theoretical perspective, we first develop a simple framework and a simulation to provide some intuition and understanding of why customer-base concentration could result in increased idiosyncratic volatility. In an industry with fixed demand, higher customer-base concentration, as proxied by a wider distribution of zero-sum shocks to competitor firms, results in a lower correlation of the industry constituents' profits, and therefore, greater idiosyncratic volatility.

Using data on U.S. companies from 1980 through 2012, we empirically address our hypothesized relation by testing the link between a firm's customer-base concentration and its idiosyncratic volatility. Similar to Patatoukas (2012), we measure customer-base concentration using a Herfindahl-Hirshman index defined as the sum of the squares of the share of sales to each reported customer, where the shares are expressed as a percentage of total sales. For robustness, we also use an alternative measure calculated as the cumulative percentage of sales to important customers. We examine the effect of these customer-base concentration measures on idiosyncratic stock volatility in various settings, providing extensive robustness checks, testing alternative hypotheses, and investigating the channels through which the effects manifest themselves.

Our results show that firms with more concentrated customer bases have higher idiosyncratic volatility. The explanatory power of both customer concentration proxies is statistically and economically significant, even after controlling for conventional firm-level characteristics associated with idiosyncratic volatility. Consolidating the customer base of a firm from being perfectly diversified to perfectly concentrated increases idiosyncratic volatility by 10–14%, with a one standard deviation increase in customer-base concentration resulting in a 2–3% increase in idiosyncratic volatility.

To further understand the nature of our documented relationship, we use the heterogeneity in customer-base concentration effects to identify mechanisms through which firms have differing extents of idiosyncratic volatility. Our results show that there are customer-type effects, with corporate customers being the key source of the idiosyncratic volatility link and government customers having a limited effect on average. These results are consistent with Banerjee et al. (2008), who argue that government customers can potentially represent a more stable source of demand than other types of principal customers. In further tests, we find that the positive effect of customer-base concentration on idiosyncratic volatility increases with the probability of customer default, customer idiosyncratic volatility, customer customer-base concentration, the amount of trade credit extended to customers, and the competitiveness of the supplier's industry.

Arguably, an alternative interpretation of our results could potentially be that firms with diversified customer bases have lower idiosyncratic volatilities in general because they have characteristics that make them more stable or better aligned with the entire domestic equity market. Underlying differences, not customer-base concentration, could thus explain differences in idiosyncratic volatility. To address such endogeneity concerns, we employ two strategies. First, we employ non-parametric nearest neighbor matching methods using observable characteristics to match firms that do not report being in a relationship with influential customers to comparable firms that do. We again find that firms with big, influential customers have higher idiosyncratic volatilities than firms without such customers. Second, we also present results from estimating a treatment effect model that endogenizes the

<sup>2</sup> Anecdotal evidence also suggests customer-supplier links serve as conduits for the transmission of stock price effects along the vertical chain. A case in point is the customer-supplier relationship of Coastcast Corporation and Callaway Golf Corporation. In 2001, Coastcast was a golf club head manufacturer, while Callaway was a retailer specializing in golf equipment. As of 2001, Callaway was Coastcast's major customer, accounting for 50% of Coastcast's total sales. On June 8, 2001 Callaway issued a press release lowering second-quarter revenue projections from \$300 million to \$250 million. Shortly after the announcement, Coastcast revised its revenue projections as well and its stock price adjusted to the new information. The strong dependence of Coastcast on Callaway's product demand exposed Coastcast to the shocks incurred by its major customer, Callaway.

<sup>3</sup> In contrast to our hypothesized relation, one could argue that supplying to a big and stable concentrated customer base could possibly serve as a mechanism to stabilize a firm's revenues and growth opportunities, resulting in potentially reduced firm-level return volatility.

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