The Effect of Major Customer Concentration on Firm Profitability: Competitive or Collaborative?*

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Abstract: We test two potential hypotheses regarding the effects of major customer concentration on firm profitability. Under the collaboration hypothesis, customer power facilitates collaboration and both the supplier firm and its major customers obtain benefits. Under the competition hypothesis, customer power results in rent extraction and the major customers benefit at the expense of the supplier firm. We document that major customer concentration is negatively associated with the supplier firm's profitability but positively associated with the major customers' profitability. We demonstrate that these effects weaken as the supplier firm's own power grows over its relationship with major customers, supporting the competition hypothesis. We carefully reconcile our results with prior findings that focus only on the supplier firm's profitability and identify their research design and interpretation problems. We obtain similar inferences in a setting of major customers' horizontal mergers and when we use an alternative measure of major customer power.

Keywords: *Fundamental analysis; Customer concentration; Supply-chain competition; Firm profitability; Merger and acquisition.*

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1. Introduction

There is a surging interest on the effects of major customer concentration on firm performance (e.g., Patatoukas 2012; Irvine, Park and Yildizhan 2016). Customer concentration is not random, reflecting an equilibrium outcome from firm profit maximization. Therefore, studying the effects of customer concentration on firm performance sheds light on the manner in which the profits of the supplier firm and its customer firms are maximized. Our study identifies shortcomings in prior studies' research designs and uses new settings to re-examine the effects of major customer concentration on firm performance.

Classic theory maintains that suppliers and customers compete for economic profits. As high customer concentration reflects customer power, it should negatively affect a supplier firm's profitability because powerful customers have the ability to bargain for and enforce favorable contract terms at the expense of the supplier firm (Galbraith 1952; Stigler 1964; Snyder 1996).[1] This view is consistent with the evidence in early industry-level studies in the industrial organization literature that shows the negative impact of alternative measures of customer power on firm profitability (e.g., Lustgarten 1975).

On the other hand, the aforementioned recent accounting studies document that major customer concentration is positively associated with firm profitability. Their results suggest that supply-chain collaboration prevails with the presence of powerful customers. Under this collaboration hypothesis, more concentrated customer-base facilitates operational collaboration (e.g., cost sharing). Thus, the profits of both the supplier firm and its major customers would be higher.

In our empirical analyses, we first establish that major customer concentration is negatively associated with the supplier firm's profitability, consistent with the competition hypothesis. This result is

[1] Casual evidence confirms that powerful customers tend to squeeze the supplier firm and that supplier firms are deeply concerned about powerful customers. For instance, Dou (2016), "Apple squeeze parts suppliers to protect margins," *The Wall Street Journal;* Strom (2015), "Big companies pay later, squeezing their suppliers," *The New York Times*; Cimilluca, Mattioli and Mathews (2015), "UnitedHealth, Anthem seek to buy smaller rivals," *The Wall Street Journal*; Mann (2015), "Big manufacturers tighten supply chain as low growth forecasts spread," *The Wall Street Journal*.

robust to alternative samples, model specifications, and measures of profitability. We then show that the positive association documented by Patatoukas (2012) is driven by sample truncation bias. Once this bias is corrected, the association turns negative. Lastly, we point out that Irvine et al. (2016) misinterpret their results. They conclude that "*[i]nitially, major customer relationships tend to negatively affect firm profitability and increase costs, but as the relationship matures, these results reverse and customer concentration is significantly positively related to firm profitability*" (p. 897). However, we show that, although the negative association attenuates over time, it does not turn positive when the relationship matures.

Specifically, Patatoukas (2012) removes firms with negative operating margins from his sample based on the justification that it is a standard research design choice in prior research (e.g., Fairfield and Yohn 2001). Unfortunately, profitability is the dependent variable in Patatoukas' (2012) analysis but appears as an independent variable in Fairfield and Yohn's (2001). Thus, eliminating unprofitable firms uniquely introduces a truncation bias for Patatoukas (2012). Using a Tobit model, we demonstrate that the positive associations between customer concentration and firm profitability measures observed in the truncated sample turn negative once this dependent variable truncation bias is mitigated.

Irvine et al. (2016) extend Patatoukas (2012) and posit an investment-based "collaboration relationship life-cycle" hypothesis, which predicts that customer concentration is negatively associated with firm profitability when the relationship is relatively new but positively associated when it matures. The rationale is that collaboration requires the supplier firm to make large initial relationship-specific investments, which reduce the supplier firm's profitability. The required investments decline as the relationship matures, leading to an improvement in the supplier firm's profitability. The supplier firm eventually benefits from these investments, suggesting a positive association between major customer concentration and supplier firm profitability when the relationship reaches a mature stage.

We note that, however, Irvine et al. (2016) do not directly test the predicted positive association conditioned on relationship maturity. Although they show that the negative association attenuates over time, they do not test whether it is positive when the relationship matures. When we test this directly, we

fail to find evidence of the predicted positive effect of major customer concentration even among the most mature supplier-customer relationships. As opposed to collaboration, we further show that the attenuation in the negative association is attributable to the growth of the supplier firm's own countervailing power as this result is completely driven by the supplier's size. After controlling the size effect, the supplier-customer relationship *per se* plays no role.[2]

We further examine the performance of major customer firms, which has not been examined by prior studies and allows us to draw inferences that cannot be obtained by merely testing the supplier firm's profitability. Under both competition and collaboration hypotheses, customer concentration should be positively associated with these major customers' performance. However, the competition hypothesis predicts that the supplier firm's countervailing power would reduce major customers' profitability over time as the supplier grows, whereas the collaboration hypothesis predicts that major customers' profitability improves over time as they gradually benefit from the collaboration.

We find that as the supplier grows over the relationship, the positive effect of major customer concentration on major customer performance attenuates, consistent with the competition hypothesis. As a further support, we document that major customer concentration is positively associated with major customers' days of payables (at the expense of longer days of receivables of the supplier). As the supplier grows, major customers' days of payables (and the supplier's days of receivables) are shortened. Note also that the results regarding supply-chain financing cannot be predicted by the investment-based collaboration life-cycle hypothesis.

While our main analyses follow the prior work (i.e., cross-sectional tests), we also use difference-in-difference tests to examine the effect of major customers' horizontal mergers on the supplier firm's profitability. We expect customer concentration to increase after horizontal mergers for two reasons.

[2] Irvine et al. (2016) does not eliminate unprofitable firms, so their analyses do not suffer from the truncation bias. However, Irvine et al. (2016) do not tabulate the average effect of customer concentration on firm profitability. The reported interaction results in their Table 5 (as well as our replication analyses tabulated in Appendix B2) suggest that it is negative.

First, this type of mergers could directly increase the supplier firm's total sales to these customers as they acquire the supplier firm's other customers. Second, acquisitions reduce the number of customers with whom the supplier firm can potentially transact. Empirically, we find that major customers' horizontal mergers indeed increase major customer concentration, which reduces the supplier firm's profitability.

A major limitation in this literature on major customer concentration is that these studies have to rely on firms' disclosures about their major customers. In additional tests, we demonstrate that our inferences are the same when we include firms without disclosed major customers in our analyses or when we explicitly attempt to control for the self-selection. Another limitation of focusing on customer concentration is that it is just one metric that captures customer power. However, given the findings of prior studies that our paper builds on, we choose to focus only on customer concentration and do not intend to study more broadly the construct of customer power. Nevertheless, in additional tests we show that our inferences are similar when we use the ratio of customers' total purchases to the supplier firm's sales as an alternative measure of customer power.

This paper contributes to the literature by clarifying the manner in which firms' profits are maximized under more concentrated customer-base. Note that a more concentrated customer-base is likely endogenously determined by the firms' profit maximization decisions (e.g., mergers among customers). Addressing the question of how their profits are maximized (i.e., through rent extraction or collaboration) can help us better understand the economics of these decisions. Our evidence suggests that more concentrated customer-base allows these powerful customers to extract profits away from the supplier firm. We demonstrate that recent studies' evidence that major customer concentration is positively associated with firm profitability is driven by the sample truncation bias (Patatoukas 2012). We also provide an alternative explanation to the attenuating negative effect of customer concentration over time (Irvine et al. 2016): Our evidence supports the notion that the increases in the supplier firm's profitability over the supplier-customer relationship is due to the growth of the supplier firm's own countervailing power as opposed to relationship-specific collaboration.

Our study continues as follows. Section 2 discusses prior work; Section 3 defines the main variable of interest and describes the sample; Section 4 explains our empirical analyses and discusses the findings; Section 5 discusses supplemental analyses; Section 6 concludes.

2. Related Literature

We refer to customer power as the ability of a customer to reduce price below a supplier's normal selling price, or more generally the ability to obtain terms of supply more favorable than a supplier's normal terms (Galbraith 1952; Chen 2008).[3] For instance, Porter (1974, 423) points out that where retailer power is high, a manufacturer's rate of return will be bargained down. Also, Snyder (1996; 1998) argues that customer power can intensify competition among suppliers and lead to lower prices, which negatively affects suppliers' profits. Besides lower selling prices, common examples of customers exercising their power include direct influence over transaction volume, more favorable trade credit terms, better product quality and logistics (Landeros and Monczka 1989; Scherer and Ross 1990; Balakrishnan, Linsmeier and Venkatachalam 1996; Yoshino and Rangan 1995; Borghesani, Peter and Berry 1997).

Empirically, early studies in the industrial organization literature show that industry-level customer concentration is on average negatively associated with supplier profits (e.g., Lustgarten 1975; McGuckin and Chen 1976; Clevenger and Campbell 1977; Schumacher 1991). In the finance literature, researchers have focused on the effects of horizontal mergers in the customers' industry (Fee and Thomas 2004; Shahrur 2005; Bhattacharyya and Nain 2011). Collectively, the results from these studies suggest that customer power reduces the above-competitive profits earned by the suppliers.

Interestingly, several recent studies offer evidence suggesting the contrary. Patatoukas (2012) finds a positive association between major customer concentration and accounting rates of return. Specifically, he documents that supplier firms with more concentrated customers experience not only higher profit

[3] In the textbook case of perfect competition among the supplier firms, the normal selling price of a supplier is the competitive price, and the customer power is monopsony power.

margins, but also enhanced asset turnover. He interprets the results as supporting the hypothesis that the supplier firm's collaboration with its major customers yields *net positive* benefits to the supplier firm.

Note, however, that Patatoukas (2012) eliminates unprofitable firms from his sample. He justifies this sample truncation by following Fairfield and Yohn (2001). Unfortunately, it appears that Patatoukas (2012) misinterprets their approach. Fairfield and Yohn (2001) eliminate unprofitable firms in *prior* periods (for which profitability is an independent variable), but, importantly, do not truncate loss firms in the next period (for which the dependent variable is calculated). In other words, Fairfield and Yohn (2001) do not have a truncation problem, but Patatoukas (2012) does because profitability that is truncated is his dependent variable.

Irvine et al. (2016) propose a "collaboration relationship life-cycle" hypothesis, which predicts that the association between major customer concentration and firm profitability is negative when the relationship is relatively new but turns positive as the relationship matures. They argue that a supplier firm tends to make significant initial investments to maintain its relationship with major customers, which leads to poor performance early in the relationship life-cycle. As this relationship matures, they argue that the initial relationship-specific investments decline and generate significant benefits to the firm, which leads to higher profitability later in the relationship life-cycle. Irvine et al. (2016) show that the supplier firm's performance improves as the length of the supplier-customer relationship increases.

However, Irvine et al.'s (2016) interpretation of their results as supporting the collaboration hypothesis is prone to two problems. First, Irvine et al. (2016) do not directly test the prediction from the collaboration hypothesis that customer concentration is positively associated with firm profitability when the relationship reaches a mature stage (i.e., improvement does not imply a positive effect). Second, their results of improving supplier profitability can be attributable to the alternative hypothesis: The countervailing power of supper firm grows over time. If major customers in the relationship earn non-competitive rents, the supplier's growing economic power can reduce these rents, which also predicts an attenuating negative effect of customer power on supplier profitability over time.

Related to major customer power, Gosman, Kelly, Olsson and Warfield (2004) find that major customer firms report higher accounting profitability compared to their industry peers. However, their analyses do not focus on major customer concentration and use a small sample of retail firms. It is also unclear from their study whether the economic benefits that accrue to the customer firms are at the expense of supplier firms.

A couple of studies focus on the effects of customer concentration on firm risks. Dhaliwal, Judd, Serfling and Shaikh (2016) provide evidence for the negative implications of a concentrated customer-base on supplier firms' cost of capital. They find that a more concentrated customer-base increases a supplier's risk, which results in a higher cost of capital.[4] Thus, a supplier firm with more concentrated major customers may report lower profitability due to higher financing costs. Similarly, Campello and Gao (2017) find that customer concentration increases interest rate spreads and the number of restrictive covenants in bank loans. Note that Campello and Gao (2017) follow Patatoukas' (2012) sample truncation procedure when they replicate Patatoukas' (2012) results using their own sample, so their replication results are also subject to the sample truncation bias.

3. Measures of Customer Concentration, Sample and Descriptive Statistics

3.1 Measure of Major Customer Concentration

Following prior research (e.g., Patatoukas 2012), the major customer concentration (*CC*) is defined as the sum of the fraction of a firm's sales made to its major customers, weighted by this fraction itself. Specifically, the supplier firm *i*'s *CC* in year *t* across its *J* major customers is constructed as:

$$CC_{it} = \sum_{j=1}^{J} \left(\frac{Sales_{ijt}}{Sales_{it}} \times \frac{Sales_{ijt}}{Sales_{it}} \right) \quad (1)$$

where $Sales_{it}$ is the supplier firm *i*'s total sales in year *t,* and $Sales_{ijt}$ is supplier firm *i*'s sales to customer *j* in year *t*.

[4] The finding of higher cost of capital may explain the positive associations between stock returns and customer concentration observed by Patatoukas (2012) and Irvine et al. (2016). We do not analyze stock returns because customer concentration has both numerator and denominator effects.

3.2 Sample and Descriptive Statistics

Following prior work, we compile a sample of annual supplier-customer firm-level observations over the 37-year period from 1977 to 2013.[5] We start with publicly traded firms in the Compustat segment customer file, which disclose the names and sales amount of major customers required by the SEC. As in Patatoukas (2012), we exclude financial firms and firm-year observations with missing values of customer concentration, market value of equity, annual percentage sales growth, or accounting rates of return. However, different from Patatoukas (2012), we do not exclude firm-year observations with operating losses. These procedures leave us with a "full sample" of 73,856 firm-year observations. Next, as in Irvine et al. (2016), we require firm-year observations with *identifiable* customers to construct the length of major customer relationship, resulting in 32,751 observations. Finally, in our analysis on major customers' performance, we eliminate customers in financial services, which results in a sample of 32,085 observations.[6]

In Panel A of Table 1, we report the descriptive statistics of key variables for the three testing samples: the full sample, the sample with identifiable major customers, and the sample with non-financial identifiable major customers. The distribution of *CC* is highly skewed and exhibits significant cross-sectional variation. Because all regression analyses rely on decile ranks of *CC*, the skewness in the data should not be a concern in drawing inferences. Notably, supplier firms on average have a *ROA* of -0.03, which is comparable to that in Irvine et al. (2016) (= -0.01), but is lower than that in Patatoukas (2012) (= 0.06) due to his sample truncation on firm profitability. The average relationship length with major customers (*LINKAGE*) is 4.06 years, which is comparable to that in both Patatoukas (2012) and Irvine et al. (2016). Not surprisingly, on average, a major customer firm is much bigger and older, and experiences lower sales growth than a supplier firm. Untabulated statistics indicate that market value (*MV*), age (*AGE*), sales growth (*SG*), financial leverage (*FLEV*) and degree of diversification (*CONGLO*) of supplier firms are similar to those of Compustat firms.

[5] We closely replicate Patatoukas (2012) and Irvine et al. (2016) using their respective sample period in Appendix B.
[6] This follows the same procedure to remove supplier firms in financial services.

Panel B of Table 1 shows the industry distribution for our main sample. We observe that our sample tilts heavily towards manufacturing firms (63% vs. 42%), which reflects manufacturing firms' tendency to transact with large corporate customers. Data also indicate that mining companies tend to have the most powerful customers. In contrast, consistent with expectation, retailers in our sample have the least powerful customers. Panel C of Table 1 presents pairwise correlations among main variables. The correlations between *CC* and other key independent variables are in general low.

4. Empirical Results

4.1 The Effect of Customer Concentration on Supplier Firm Profitability

Following prior research, we investigate the cross-sectional association between the level of customer concentration and accounting rates of return using the Fama and MacBeth (1973) annual Ordinary Least Square (OLS) regressions of the following form:

$$Performance_t = a + b \times CC_t + \Sigma c_i \times Controls + e \quad (4)$$

The main dependent variable in Equation (4) is supplier firm performance, which is proxied by return on assets (*ROA*).[7] Similar to Patatoukas (2012), we also examine the components of *ROA*, including assets turnover (*ATO*), profit margin (*PM*), gross margin (*GM*), and selling, general, and administrative expenses (*SG&A*). The primary explanatory variable is the decile rank of customer concentration measure (*CC*) converted into [0, 1].[8] Thus, the estimated regression coefficients capture the difference in performance between firms ranked in the top and bottom deciles of major customer concentration.

In our regression, we also include control variables that may explain accounting rates of return, as in Patatoukas (2012). These include market capitalization (*MV*), firm age (*AGE*), annual percentage sales

[7] Results are similar if return on equity (*ROE*) is the dependent variable. We consider the *ROE* results redundant because we control for financial leverage (*FLEV*) in the regression of *ROA*.
[8] Specifically, firms are ranked annually and assigned to deciles. The raw rankings are replaced by the corresponding annual decile ranks scaled to be between 0 (lowest rank) and 1 (the highest rank). Inferences are similar when we use unranked *CC*.

growth (*SG*), degree of diversification (*CONGLO*), and financial leverage (*FLEV*). We further include indicator variables based on two-digit SIC codes to control for industry fixed effects.[9]

In Table 2, we show the estimates of Equation (4). In Panel A, we show the regression results using the full sample (i.e., without sample truncation bias). Column (1) indicates that *CC* is negatively associated with *ROA*. More specifically, *CC* is negatively associated with both assets turnover (*ATO*) and profit margin (*PM*). We also find that *CC* is negatively associated with gross margin (*GM*) and positively associated with *SG&A*, the two major components of *PM*. Overall, the results in Panel A indicate that customer concentration is negatively associated with the supplier firm's profitability.[10]

Next, we follow Patatoukas (2012) and truncate the dependent variable by removing firm-years with negative operating margin, which reduces the full sample by 23%. In Panel B, we report the regression results after this sample truncation. Our findings are similar to those reported in Panel A of Table 2 in Patatoukas (2012). Specifically, we find positive associations between *CC* and firm return on assets (*ROA*) and profit margin (*PM*). For the components within profit margin, we find negative associations between *CC* and *SG&A*. The magnitudes of the coefficients are comparable to those reported in Patatoukas (2012). It is clear from the results in Panels A and B that the positive association documented by Patatoukas (2012) is driven by sample truncation.

A sample truncation based on a dependent variable removes observations that are informative about the true distribution. This results in a biased non-random sample and erroneous estimations (Tobin 1958). Because the results in Panel B are biased, they cannot be interpreted as evidence supporting positive effects of *CC* in a sub-sample of profitable firms.

To further demonstrate that the biases introduced by sample truncation cause the signs of estimated coefficients to flip, we run Tobit models by using the full sample, while censoring the dependent variable

[9] Similar to Patatoukas (2012), we report the time-series means of the estimated coefficients and statistical inferences based on Fama and MacBeth (1973) *t*-statistics with Newey and West (1987) adjustment at three-lags. Inferences are similar if we run pooled regressions with two-way clustered standard errors by firm and year.
[10] Following prior work, we measure the dependent variable using data from the same year. Results are similar when all dependent variables are measured using one-year-ahead data.

at zero (i.e., forcing a negative *ROA* to be zero in the regression). The Tobit model should provide unbiased estimates when dependent variables are censored (Tobin 1958). As expected, results of the Tobit model reported in Column (1) of Panel C show negative effects of *CC* on supplier profitability, even though we censor the dependent variable at zero, similar to the results in Panel A. We also run OLS models by using the full sample, while censoring the dependent variable at zero. Because the OLS does not correct the effects related to censoring dependent variables, we expect the OLS models to produce biased results. Indeed, results reported in Column (2) of Panel C show positive effects of *CC* on supplier profitability, similar to the biased results we reported in Panel B. As a robustness check, we find similar results in the Tobit regression when we censor negative operating margin and use it as the dependent variable.

In summary, we show that major customer concentration is negatively associated with the supplier firm's profitability. In addition, the findings in Patatoukas (2012) are driven by the bias resulting from truncating dependent variable. We show that sample truncation based on the sign of a firm's profitability (i.e., the dependent variable) creates a large bias that favors a positive association between customer concentration and supplier firm profitability. In turn, this bias masks the underlying negative associations between customer bargaining power and supplier firm profitability, as economic theory predicts. Note that we use a longer sample period to replicate Patatoukas' (2012) results. Appendix B1 provides a similar analysis by replicating his original sample.

4.2 Re-Interpret Prior Evidence Supporting the Collaboration Relationship Life-cycle Hypothesis

Irvine et al. (2016) emphasize that the benefits of supply-chain collaboration should be realized at the later stages of a supplier-customer relationship. Thus, this collaboration relationship life-cycle hypothesis predicts that the association between customer concentration (*CC*) and firm profitability should turn *positive* when the supplier-customer relationship passes the initial investment stage. To test this prediction, we sort our sample into quintiles based on relationship age (i.e., *LinkageQ1* to *LinkageQ5*) and re-estimate regression Equation (4) by adding their interaction terms with *CC*. If the collaboration

relationship life-cycle hypothesis is descriptive, then we would expect positive associations between *CC* and profitability measures for sub-samples in the high quintiles of *LINKAGE*.

Our results in Panel A of Table 3 do not support the collaboration relationship life-cycle hypothesis. Specifically, we do not observe a significantly positive coefficient for *CC* even for the most mature supplier-customer relationships (i.e., *LinkageQ4* and *LinkageQ5*) (F-tests $p = 0.646$ and 0.762 for *LinkageQ4* and *LinkageQ5*, respectively), which contradicts the collaboration hypothesis. Note that Irvine et al. (2016) do not test this prediction. They claim that these results are consistent with the collaboration hypothesis simply because the interaction terms in Column (1) are positive. However, an interaction effect is not equal to the total effect, which is shown in the F-test. Inferences from Panel B of Table 3 are similar when we use t-tests. Specifically, we interact each *LINKAGE* quintile with *CC* such that each interaction term captures each quintile's own total effect.[11] Because we use a longer sample period, we provide a closer replication of Irvine et al.'s (2016) results in Appendix B2.

4.3 Re-examine the Declining Negative Effects of Customer Concentration Over Time

We next show that the attenuation of competitive effects is explained by the growth in the supplier firm's own countervailing power over time. Specifically, a supplier firm tends to become larger as its relationship with major customers matures, which countervails the power of these major customers. Results in Panel A of Table 4 provide initial support for this countervailing power explanation. Specifically, as a supply-chain relationship matures, the supplier grows bigger (in terms of both market value and total sales). For instance, the market value of a supplier firm increases monotonically from the shortest *LINKAGE* quintile (= 776 million) to the longest *LINKAGE* quintile (= 1,476 million), and the

[11] Although the estimated coefficients in Panel B of Table 3 are the same as the sum in the F-tests, the statistical significances are different in the Fama-MacBeth framework, which assumes that estimated coefficients from yearly regressions represent independent draws from a single distribution and that there is no cross-variable dependence. While the F-test follows this assumption (i.e., independence between the estimated coefficient of the *CC*'s main effect and that of the *CC*'s interaction with *LINKAGE* quintile), the t-test does not. Thus, the inferences from t-tests and F-tests are not exactly the same in the Fama-MacBeth regressions for the total effects of *CC* in each *LINKAGE* quintile as F-tests generate higher standard errors in our sample (i.e., more conservative inferences).

difference is significant. We also find similar increases in each of the *CC* quintiles, indicating that the increase in supplier countervailing power does not concentrate at a particular level of *CC*.

To provide more direct support for the countervailing power explanation, we use regression analyses to show that the attenuating effect of customer concentration over *LINKAGE* is explained by the growth of the supplier firm's power. Specifically, we first orthogonalize *LINKAGE* on two measures of supplier firm size (i.e., log of market value and log of sales) and obtain the predicted values (*pred_LINKAGE*) and residuals (*res_LINKAGE*). We test whether the attenuating effect is attributable to *pred_LINKAGE* as opposed to *res_LINKAGE*. Untabulated results show that the supplier firm sales and market value collectively explain only 20% of the variation in *LINKAGE*. If the stage of the supply-chain relationship per se really matters, we expect *res_LINKAGE* to drive significant variations as this measure captures this relationship orthogonal to the effects of supplier firm size.

We summarize the findings in Table 4 Panel B. In Column (1), we first replicate the attenuating effect presented in Table 3 Panel A by using a single interaction *CC*×*LINKAGE* in the regression.[12] Consistent with the results in Table 3 Panel A, the F-test does not support a positive effect of *CC* on *ROA*, even among relationships in the highest *LINKAGE* decile ($p = 0.166$).

We then replace *LINKAGE* with *pred_LINKAGE* in Column (2). We find a significantly negative coefficient for *CC* and a significantly positive coefficient for *CC*×*pred_LINKAGE*, both of which are consistent with the attenuating effect of *CC* on *ROA* over *pred_LINKAGE*. Importantly, the F-test indicates a positive effect of *CC* on *ROA* when the relationship is in the highest *pred_LINKAGE* decile ($p = 0.009$). In other words, the attenuating effect of *LINKAGE* in Column (1) can be attributed to *pred_LINKAGE* (i.e., *LINKAGE* explained by the supplier firm's size).

In contrast, when replacing *LINKAGE* with *res_LINKAGE* in Column (3), we find insignificant coefficient for *CC*×*res_LINKAGE*. In other words, once we remove the influence of supplier size from

[12] For ease of interpreting the coefficients, decile ranks of *LINKAGE*, *pred_LINKAGE*, and *res_LINKAGE* are converted between zero and one.

LINKAGE, the remaining portion of this variable has no effect on the negative association between *CC* and *ROA*.[13] The F-test indicates a *negative* effect of *res_LINKAGE* on *ROA* when the relationship is in the highest *res_LINKAGE* decile, confirming that after removing the effect of supplier firm power, the *CC* is still negatively associated with *ROA* even when the relationship is in its most mature stage. Taken the results in Columns (2) and (3) together, the attenuating effect over the duration of supply-chain relationship is completely driven by the growth in the supplier's own power.

Next, we examine the effects of *LINKAGE* on the association between *CC* and selling, general, and administrative expenses (*SG&A*). Examining *SG&A* is particularly interesting because the collaboration hypothesis predicts that the supplier firm's relationship-specific investments (as captured by *SG&A* associated with *CC*) should decrease over time, regardless of the degree of the supplier firm's power. On the other hand, the competition hypothesis predicts that a decrease in the supplier firm's relationship-specific investments can be explained by the supplier firm's growing power.

Results presented in Panel C of Table 4 support the competition hypothesis. We find that the decrease in *SG&A* associated with *CC* over *LINKAGE* is completely explained by *pred_LINKAGE* (i.e., *LINKAGE* predicted by the supplier firm's size). Column (1) show a negative interaction between *CC* and *LINKAGE*, while Columns (2) and (3) indicate that this negative interaction is driven by the interaction *CC* × *pred_LINKAGE* but not by *CC* × *res_LINKAGE*. Thus, the decrease in relationship-specific investments is explained by growth in the supplier firm's power during its relationship with its major customers, consistent with the competition effect.

Consistent with prior work, we do not control for major customers' firm characteristics (i.e., major customers' market value, sales growth, etc.) in the regression analyses. Our results are robust to controlling them. In sum, we find no evidence to support the hypothesized positive association between customer concentration and the supplier firm's profitability even among the most mature supplier-

[13] The insignificant results cannot be explained by the low power of *res_LINKAGE*, because supplier firm sales and market value collectively explain only 20% of the variation in *LINKAGE*. If the relationship life-cycle really matters (i.e., the stage of the relationship is important beyond simply supplier firm size), then we should still observe a significant impact of *res_LINKAGE*.

customer relationships. We do find that the proxy for the relationship life-cycle captures an increase in the supplier firm's own bargaining power over time, as evidenced by its increasing size. After removing the influence of size, the relationship life-cycle has no effect on the negative effects of customer power with respect to supplier firm profitability. Thus, the stage of a supplier-customer relationship—in and of itself—does not matter.

4.4. Analysis of Major Customers' Operating Performance

To further demonstrate that the effects of growth in supplier size on supplier profitability reflect the supplier's increasing power as opposed to collaboration, we examine the effect of customer concentration on major customers' firm performance over *LINKAGE*. Under the competition hypothesis, major customers are expected to benefit *less* from customer concentration when supplier firms develop countervailing power over the relationship. On the other hand, the relationship-specific collaboration would predict the opposite, because major customers benefit from the relationship-specific investments over time.

Panel A of Table 5 provides baseline results regarding major customers' performance. Columns (1) and (2) show that major customers' gross margin (*Customer GM*) and days of payables (*Customer Days Payable*) are both positively associated with *CC*, while Columns (3) and (4) show that *CC* is negatively associated with the supplier's gross margin (*GM*) and positively associated with the supplier's days of receivable (*Days Receivable*).[14] These results suggest that major customers benefit from being a more concentrated customer-base (i.e., higher gross margin and longer days of payables) at the expense of the supplier firm (i.e., lower gross margin and longer days of receivables). These findings thus provide strong support for the competition hypothesis.

Columns (1) to (3) in Panel B of Table 5 show that the interaction between *CC* and *LINKAGE* is significantly negative, and this negative interaction is driven by *pred_LINKAGE*. This result is consistent

[14] Note that the coefficient of *CC* on *Customer GM* (0.029) is much smaller in magnitude than that on *GM* (-0.304), which is not surprising given that major customers are much larger than the average supplier firm.

with the supplier's countervailing power under the competition hypothesis but inconsistent with the collaboration hypothesis, which predicts positive coefficients due to collaboration. Results in Columns (4) to (6) suggest that the adverse effect of customer concentration on the supplier's gross margin is attenuated along *LINKAGE*, and that this attenuation is entirely driven by *pred_LINKAGE*, which is consistent with our main findings reported in Table 4.

As shown in Panel C of Table 5, results of *LINKAGE* on major customers' days of payables as well as supplier's days of receivables are also consistent with the competition hypothesis. In particular, the collaboration hypothesis focuses on the improvement in operational efficiency from initial investments, which cannot explain the change in the terms of supply-chain *credit terms* over the relationship (i.e., payables and receivables). Collectively, these findings support the hypothesis that the supplier's countervailing power, rather than relationship-specific collaboration, explains the attenuating negative effect of customer concentration on firm performance along the relationship life-cycle.

4.5 Analysis of Major Customers' Horizontal Mergers

We next supplement the cross-sectional regression approach used in prior studies with difference-in-difference tests to analyze the change in major customer concentration as well as the change in the supplier firm's profitability around major customers' horizontal mergers. We do not view mergers as exogenous to firms' decision to maximize profits. However, this analysis provides more direct evidence on the consequences of corporate events that lead to more concentrated customer-base.

Following the merger literature (e.g. Fee and Thomas 2004; Shahrur 2005; Bhattacharyya and Nain 2011), we first identify a sample of horizontal mergers with the additional requirement that the acquirer must be one major customer in our sample. Specifically, i) the major customer must have purchased at least 20% of the target in the merger and owns at least 51% of the target after the merger, and ii) the target must be in the same four-digit SIC code industry as the major customer.[15] We then define a

[15] The 20% cutoff is used following Ahern and Harford (2014). Results are similar when we use other cutoffs (0, 15%, or 50%).

"merger-treated" firm-year as those firms whose major customers have at least one horizontal merger completed in the year. In our sample, there are a total of 2,070 merger-treated firm-years.

For each treated firm-year, we identify a "match" firm-year from the non-treated firm-years. The match firm must be in the same one-digit SIC industry as the treated firm during the same year. We then use the propensity score matching based on *CC*, *ROA*, and total assets. As a result, 185 merger-treated firm-years are dropped due to unsuccessful matching. The sample in this analysis consists of 1,885 merger-treated firm-years and 1,885 match firm-years.[16]

Panel A of Table 6 shows that the matching is quite successful in the sense that the average assets (*AssetSize*), major customer concentration (*CC*), and performance (*ROA*) are similar across the merger-treated and match samples in the year before the merger. Untabulated results indicate that differences in median are also statistically insignificant.

Panel B presents the results regarding the changes in the supplier firm's *CC* and *ROA* before and after the major customers' horizontal mergers. Change in *CC* (ΔCC) is defined as *CC* in the year after the merger subtracts *CC* in the year before the merger. Similarly, change in *ROA* (ΔROA) is defined as *ROA* in the year after the merger subtracts *ROA* in the year before the merger. Because ΔCC is highly skewed, we focus on the decile rank of this variable.[17] The results indicate that average change in major customer concentration in the merger-treated sample is significantly higher than that in the match sample ($t = 2.50$). In addition, the average change in *ROA* in the merger-treated sample is significantly lower than that in the match sample ($t = -2.33$).

Panel C presents the regressions of difference-in-difference. Specifically, the dependent variables ΔCC and ΔROA are regressed on an indicator variable *Treat*, which is equal to one if the observation is in the merger-treated sample and zero if otherwise. The control variables included in these regressions are

[16] One-digit SIC industry is used because narrower industry classification sharply decreases the pool of match candidates.

[17] Because of ties in the value of ΔCC in this sample, the average rank is 0.488 instead of 0.500.

the change form of the control variables in Equation (4).[18] The results indicate that the univariate results reported in Panel B also hold in the regressions after including these control variables.

In sum, we expect customer concentration to increase after horizontal mergers. Consistent with these expectations, we find that major customers' horizontal mergers indeed increase customer concentration. We also find that major customers' horizontal mergers decrease the supplier firm's profitability.

5. Additional Analyses

5.1. Change Specification

In Table 7, we report regression results for the associations between changes in supplier firm one-year-ahead *ROA* and changes in *CC*. The advantage of change specification is that it controls for possible time-invariant omitted variables.[19] Consistent with our results of level regressions reported in Panel A of Table 3, Column (1) shows that ΔCC is negatively associated with ΔROA (t = -2.19). Also consistent with the level regression results reported in Table 5, Column (2) shows that ΔCC is not positively associated with *LINKAGE* even among the most mature *LINKAGE* decile (F-test p = 0.673). Columns (3) and (4) show that the significant coefficient on the interaction term between ΔCC and *LINKAGE* is driven by *pred_LINKAGE* (i.e., the length of supplier-customer relationship predicted by the supplier's size).

5.2 Analysis of Including Firms without Major Customer

One limitation in examining the effects of major customer concentration is that firms without disclosed major customers have to be eliminated. We conduct additional analyses to gauge the sensitivity of our main results to the inclusion of those observations. Specifically, we conduct the following two analyses. First, we include firms without major customers in the sample and replace the missing value of *CC* with i) zero, which is the lower bound of *CC* (i.e., infinite number of customer firms and each accounts for very small proportion of the firm's sales), ii) 0.1, which is the upper bound of CC for firms

[18] The first-difference of variable *AGE* is not meaningful, so we continue to use log(*AGE*) in these regressions.
[19] To facilitate the comparison with prior studies (Patatoukas 2012; Irvine et al. 2016), we control for *PM*, *ATO*, and their respective annual changes (ΔPM and ΔATO) in this intertemporal change test. Results are similar when we control for the first-difference of the control variables in Equation (4).

without major customers (i.e., ten customer firms and each accounts for 10% of the firm's sales, which is the minimum disclosure threshold), or iii) a number randomly distributed between 0 and 0.1. Untabulated results indicate that both ranked and unranked *CC* are negatively associated with the supplier firm's performance ($p < 0.01$). Second, we conduct a Heckman self-selection analysis where we include inverse Mills ratio as a control in the second stage regression. The first stage is the prediction model that predicts firms with and without major customers using the determinants suggested by Ellis, Fee, and Thomas (2012) (a small business dummy, a retailer industry dummy, a large sales dummy) in addition to our control variables. Untabulated results indicate that *CC* is negatively associated with the supplier firm's performance ($p < 0.01$).

5.3 Analysis of Alternative Measure of Customer Power

Our paper builds on the literature on 'customer concentration', and the research question focuses on the empirical relation regarding the effects of customer concentration on firm profitability. Conceptually, customer concentration is just one measure of the underlying construct (i.e., customer power). Although our paper is not motivated more broadly to address the issue of whether customer power increases or decreases firm profitability, we conduct additional analyses using an alternative measure of customer power (relative to that of the supplier firm) and provide evidence consistent with the inferences relying on customer concentration.

Specifically, we use the ratio of major customers' total purchases to the supplier firm's sales as the alternative measure of customer power (i.e. *Purchase-to-Sales*). Intuitively, a large buyer is in a powerful position if its purchases represent a greater importance of a seller's revenues and the seller cannot easily replace the buyer (Snyder 1998; Ellison and Snyder 2010; Hui, Klasa, and Yeung 2012). Large buyers also impose a more credible threat of vertical integration (Perry 1988). Additionally, because large buyers are likely to produce more generalized products with lower switching costs, they have higher incentive and the ability to switch to suppliers with lower purchase prices (Porter 1979). Results reported in Table 8 show that our main inferences are similar (i.e., *Purchase-to-Sales* is

negatively associated with the supplier firm profitability, and such negative association declines over time due to the supplier firm's own growing power).

6. Conclusion

Our study tests two potential competing hypotheses regarding the effects of major customer concentration on firm profitability. Under the collaboration hypothesis, both the supplier firm and its major customers obtain benefits. Under the competition hypothesis, the major customers benefit at the expense of the supplier firm. While recent studies report results consistent with the collaboration hypothesis, we show that they either suffer from sample truncation bias or overstate their results. We closely replicate prior samples and demonstrate their problems regarding research designs and interpretations. Using a more recent sample, we document that major customer concentration is negatively associated with the supplier firm's profitability but positively associated with the major customers' performance. We demonstrate that these effects weaken as the supplier's power grows over its relationship with major customers. The negative associations between major customer concentration and supplier firm profitability are robust across different samples, various measures of profitability, different model specifications, difference-in-difference tests around mergers, and including/controlling the firms that do not report any major customers.

Note that customer concentration is just one metric of the underlying construct of customer power. Our study focuses on customer concentration because it builds directly on the recent studies that examine the effects of customer concentration only. We demonstrate that our inferences are similar when we use major customers' purchases relative to the supplier firm's sales as an alternative measure of customer power. We believe that our results reflect more generally the effects of customer power, and future research may study more nuanced aspects of customer power on firm performance.

References

Ahern, K. R., & Harford, J. (2014). The importance of industry links in merger waves. *Journal of Finance* 69 (2), 527-576.

Balakrishnan, R., Linsmeier, T., & Venkatachalam, M. (1996). Financial benefits from JIT adoption: Effects of customer concentration and cost structure. *The Accounting Review* 71 (2), 183-205.

Bhattacharyya, S., & Nain, A. (2011). Horizontal acquisitions and buying power: A product market analysis. *Journal of Financial Economics* 99 (1), 97-115.

Borghesani, W. H., Peter, L., & Berry, D. B. (1997). Controlling the chain: Buyer power, distributive control, and new dynamics in retailing. *Business Horizons* 40 (4), 17-24.

Campello, M., & Gao, J. (2017). Customer concentration and loan contract terms. *Journal of Financial Economics* 123(1), 108-136.

Chen, Z. (2008). Defining buyer power. *Antitrust Bulletin* 53 (2), 241-247.

Clevenger, T., & Campbell, G. (1977). Vertical organization: A neglected element in market structure performance models. *Industrial Organization Review* 5 (1), 60–66.

Dhaliwal, D., Judd, J. S., Serfling, M. & Shaikh. S., (2016). Customer concentration risk and the cost of equity capital. *Journal of Accounting and Economics* 61 (1), 23-48.

Ellis, J. A., Fee, C. E., & Thomas, S. E. (2012). Proprietary costs and the disclosure of information about customers. *Journal of Accounting Research* 50 (3), 685-727.

Ellison, S. F., & Snyder, C. M. (2010). Countervailing power in wholesale pharmaceuticals. *Journal of Industrial Economics* 58 (1), 32-53.

Fama, E. F., & MacBeth, J. D. (1973). Risk, return, and equilibrium: Empirical tests. *Journal of Political Economy* 81 (3), 607-636.

Fairfield, P. M., & Yohn, T. L. (2001). Using asset turnover and profit margin to forecast changes in profitability. *Review of Accounting Studies* 6 (4), 371-385.

Fee, C. E., & Thomas, S. (2004). Sources of gains in horizontal mergers: Evidence from customer, supplier, and rival firms. *Journal of Financial Economics* 74 (3), 423-460.

Galbraith, J. K. (1952). *American Capitalism: The Concept of Countervailing Power.* Boston: Houghton Mifflin.

Gosman, M., Kelly, T., Olsson, P., & Warfield, T. (2004). The profitability and pricing of major customers. *Review of Accounting Studies* 9 (1), 117–139.

Hui, K. W., Klasa, S., & Yeung, P. E. (2012). Corporate suppliers and customers and accounting conservatism. *Journal of Accounting and Economics* 53 (1-2), 115-135.

Irvine, P. J., Park, S. S., & Yıldızhan, Ç. (2015). Customer-base concentration, profitability, and the relationship life cycle. *The Accounting Review* 91(3), 883-906.

Landeros, R., & Monczka, R. M. (1989). Cooperative buyer/seller relationships and a firm's competitive posture. *Journal of Supply Chain Management* 25 (3), 9-18.

Lustgarten, S. (1975). The impact of buyer concentration in manufacturing industries. *Review of Economics and Statistics* 57 (2), 125–132.

McGuckin, R., & Chen, H. (1976). Interactions between buyer and seller concentration and industry price-cost margins. *Industrial Organization Review* 4 (3), 123–132.

Newey, W. K., & West, K. D. (1986). A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. *Econometrica* 55 (3), 703-708.

Patatoukas, P. N. (2012). Customer-base concentration: Implications for firm performance and capital markets. *The Accounting Review* 87 (2), 363-392.

Perry, M. K. (1988). Vertical integration: Determinants and effects. *Handbook of Industrial Organization* 1, 183-255.

Porter, M. E. (1974). Consumer behavior, retailer power and market performance in consumer goods industries. *Review of Economics and Statistics* 56 (4), 419–436.

Porter, M. E. (1979). How competitive forces shape strategy. *Harvard Business Review* 57 (2), 137-145.

Schumacher, U. (1991). Buyer structure and seller performance in U.S. manufacturing industries. *Review of Economics and Statistics* 73 (2), 277-284.

Scherer, F. M., & Ross, D. (1990). *Industrial Market Structure and Economic Performance*. Boston: Houghton Mifflin.

Shahrur, H. (2005). Industry structure and horizontal takeovers: Analysis of wealth effects on rivals, suppliers, and corporate customers. *Journal of Financial Economics* 76 (1), 61-98.

Snyder, C. M. (1996). A dynamic theory of countervailing power. *Rand Journal of Economics* 27 (4), 747–769.

Snyder, C. M. (1998). Why do larger buyers pay lower prices? Intense supplier competition. *Economics Letters* 58 (2), 205-209.

Stigler, G. (1964). A theory of oligopoly. *Journal of Political Economy* 72 (1), 44–61.

Tobin, J. (1958). Estimation of relationships for limited dependent variables. *Econometrica* 26 (1), 24-36.

Yoshino, M. Y., & Rangan, S. (1995). *Strategic Alliances: An Entrepreneurial Approach to Globalization*. Boston: Harvard Business School Press.

Appendix A: Variable Definitions

Variables	Definition
CC	Major customer concentration, defined as the sum of the fraction of a firm's sales made to its major customers (i.e., sales to a major customer / firm sales), weighted by this fraction
ROA	Return on assets, measured as the ratio of income before extraordinary items to the beginning of year total assets
ATO	Assets turnover, measured as the ratio of net sales to the beginning of year total assets
PM	Profit margin, measured as the ratio of income before extraordinary items to net sales
GM	Gross margin, measured as the difference between net sales and cost of goods sold, divided by net sales
SG&A	Selling, general and administrative expense, measured as the ratio of selling, general and administrative expense to net sales
Days Receivables	Days accounts receivables, measured as the ratio of accounts receivable to net sales multiplied by 365
ROE	Return on equity, measured as the ratio of income before extraordinary items to the beginning of year book value of equity
OM	Operating margin, measured as the ratio of operating income before depreciation to net sales
NOM	Non-operating margin, measured as profit margin minus operating margin
MV	Market value of equity, measured as fiscal year-end price times shares outstanding
AGE	Firm age, measured as the number of years with financial data in Compustat
SG	Sales growth, measured as the annual percentage sales growth rate
FLEV	Financial leverage, measured as the ratio of total assets to book equity
CONGLO	Degree of firm diversification, =1 if the firm reports at least two business segments, =0 otherwise
Customer GM	Weighted average of gross margin for identifiable customers, where the weights are sales shares to each identifiable customer (i.e., sales to an identifiable customer / total sales to all identifiable customers)
Customer Days Payable	Weighted average of days payable for identifiable customers, where days payable is measured as the ratio of accounts payable to net sales multiplied by 365 and the weights are sales shares to each identifiable customer
MV_Cus	Weighted average of market value for identifiable customers, where the weights are sales shares to each identifiable customer
AGE_Cus	Weighted average of firm age for identifiable customers, where the weights are sales shares to each identifiable customer
SG_Cus	Weighted annual sales growth for identifiable customers, where the weights are sales shares to each identifiable customer
FLEV_Cus	Weighted average of financial leverage for identifiable customers, where the weights are sales shares to each identifiable customer
CONGLO_Cus	Weighted average of degree of firm diversification for identifiable customers, where the weights are sales shares to each identifiable customer
CusDep	Customer dependence, measured as the firm's sales to identifiable customers as a fraction of the customers' cost of goods sold
LINKAGE	Weighted average of the duration (in years) of the link between the firm and its identifiable customers, where the weights are sales shares to each identifiable customer
AssetSize	Logarithm of firm total assets
Purchase-to-Sales	The ratio of the major customers' total purchases to the supplier's total sales

Appendix B1: Replication of Patatoukas' (2012) Main Results

In Appendix B1, we replicate Patatoukas' (2012) main results (Table 2) and show that Patatoukas' (2012) results go away after fixing the sample truncation problem. Results are reported in Table B1.1 and Table B1.2 below. Untabulated descriptive statistics show that the variable distribution and industry composition of the sample are similar to Patatoukas' (2012).

Table B1.1
This table presents the regression results of major customer concentration on firm profitability measures that replicate Patatoukas' (2012) Table 2. We follow the same sample period (1977-2006) and sample selection criteria of Patatoukas (2012). The dependent variables are return on assets (*ROA*), return on equity (*ROE*), assets turnover (*ATO*), profit margin (*PM*), operating margin (*OM*), non-operating margin (*NOM*), gross margin (*GM*), and selling, general, and administrative expense (*SG&A*). *CC* is scaled annually in decile to lie between 0 (lowest rank) and 1 (highest rank). The vector of controls includes market value (*MV*), firm age (*AGE*), annual percentage sales growth (*SG*), financial leverage (*FLEV*), and degree of diversification (*CONGLO*). Industry fixed effects are included. Coefficients are estimated using Fama-MacBeth (1973) annual regressions with Newey-West adjusted *t*-statistics in parentheses. ***, **, and * denote 1%, 5% and 10% levels of significance, respectively. Please see Appendix A for variable definitions.

Panel A: Replication of Patatoukas' (2012) Table 2 Panel A

	(1) ROA	(2) ROE	(3) ATO	(4) PM	(5) OM	(6) NOM	(7) GM	(8) SG&A
Rank(CC)	0.022***	0.048***	0.058**	0.017***	0.030***	-0.013***	-0.027***	-0.058***
	(7.89)	(7.55)	(2.48)	(11.18)	(20.34)	(-6.37)	(-4.11)	(-9.97)
Log(MV)	0.016***	0.037***	-0.043***	0.015***	0.022***	-0.008***	0.015***	-0.007***
	(12.13)	(9.81)	(-3.15)	(9.65)	(39.12)	(-4.91)	(11.20)	(-5.74)
Log(AGE)	-0.017***	-0.038***	-0.082***	-0.005	-0.015***	0.010***	-0.035***	-0.019***
	(-3.82)	(-2.98)	(-2.97)	(-1.61)	(-8.62)	(4.19)	(-8.54)	(-7.38)
SG	0.028***	0.078***	0.129***	0.010***	0.008***	0.003	0.011***	0.003
	(5.36)	(6.94)	(4.11)	(3.25)	(4.27)	(1.42)	(6.32)	(1.27)
CONGLO	-0.015***	-0.045***	-0.068***	-0.012***	-0.021***	0.010***	-0.056***	-0.033***
	(-8.63)	(-7.66)	(-3.56)	(-7.57)	(-10.33)	(4.88)	(-18.14)	(-18.83)
FLEV	-0.003***	0.063***	0.008**	-0.002***	-0.001***	-0.002***	-0.004***	-0.004***
	(-5.89)	(13.80)	(2.45)	(-5.26)	(-2.77)	(-6.27)	(-9.89)	(-10.70)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Avg. Adj. R2	0.162	0.196	0.312	0.133	0.460	0.325	0.390	0.304
N	39,805	39,805	39,805	39,805	39,805	39,805	39,805	39,805

Panel B: Replication of Patatoukas' (2012) Table 2 Panel B (with Identifiable Major Customers)

	(1) ROA	(2) ROE	(3) ROA	(4) ROE
Rank(CC)	0.019***	0.034***	0.020***	0.034***
	(4.72)	(3.62)	(4.78)	(3.38)
Log(MV)	0.010***	0.021***	0.011***	0.021***
	(12.41)	(11.08)	(13.07)	(11.31)
Log(AGE)	-0.005	-0.010	-0.005	-0.010
	(-1.38)	(-1.56)	(-1.34)	(-1.63)
SG	0.052***	0.150***	0.052***	0.151***
	(10.41)	(8.11)	(11.42)	(8.56)
CONGLO	-0.012***	-0.017***	-0.012***	-0.017***
	(-19.03)	(-6.86)	(-18.20)	(-6.87)
FLEV	-0.009***	-0.014**	-0.009***	-0.015**
	(-4.79)	(-2.63)	(-4.96)	(-2.75)
Log(MV_Cus)			-0.001***	-0.002
			(-3.04)	(-1.32)

Table B1.1 (Continued)

	(1) ROA	(2) ROE	(3) ROA	(4) ROE
Log(AGE_Cus)			0.003	0.008
			(1.51)	(1.53)
SG_Cus			0.018***	0.044***
			(4.19)	(3.82)
CusDep			-0.013**	-0.020
			(-2.09)	(-1.32)
Log(LINKAGE)			0.002	0.004
			(0.85)	(1.03)
Industry FE	Yes	Yes	Yes	Yes
Avg. Adj. R2	0.222	0.121	0.224	0.120
N	18,559	18,559	18,559	18,559

Table B1.2

This table presents the regression results that re-do the replication of Patatoukas' (2012) Table 2 but include loss firms. We follow the same selection criteria as Patatoukas (2012), except that we do not exclude observations with negative operating margins. The dependent variables are return on assets (*ROA*), return on equity (*ROE*), assets turnover (*ATO*), profit margin (*PM*), operating margin (*OM*), non-operating margin (*NOM*), gross margin (*GM*), and selling, general, and administrative expense (*SG&A*). *CC* is scaled annually in decile to lie between 0 (lowest rank) and 1 (highest rank). The vector of controls includes market value (*MV*), firm age (*AGE*), annual percentage sales growth (*SG*), financial leverage (*FLEV*), and degree of diversification (*CONGLO*). Industry fixed effects are included. Coefficients are estimated using Fama-MacBeth (1973) annual regressions with Newey-West adjusted *t*-statistics in parentheses. ***, **, and * denote 1%, 5% and 10% levels of significance, respectively. Please see Appendix A for variable definitions.

Panel A: Re-do Patatoukas' (2012) Table 2 Panel A but include negative operating margin observations

	(1) ROA	(2) ROE	(3) ATO	(4) PM	(5) OM	(6) NOM	(7) GM	(8) SG&A
Rank(CC)	-0.034***	-0.041***	-0.053***	-0.231***	-0.205***	-0.026***	-0.062***	0.112***
	(-3.96)	(-3.07)	(-3.36)	(-6.60)	(-6.39)	(-4.77)	(-6.68)	(5.39)
Log(MV)	0.034***	0.064***	0.001	0.056***	0.058***	-0.003*	0.021***	-0.035***
	(15.16)	(19.79)	(0.11)	(7.28)	(8.83)	(-1.78)	(19.37)	(-7.08)
Log(AGE)	0.021***	0.006	-0.046*	0.090***	0.068***	0.018**	-0.028***	-0.088***
	(2.95)	(0.44)	(-1.93)	(4.42)	(5.09)	(2.59)	(-5.77)	(-8.83)
SG	-0.026*	0.028	0.046	-0.040**	-0.049**	0.002	0.002	0.047***
	(-2.00)	(1.69)	(1.55)	(-2.16)	(-2.73)	(0.70)	(0.36)	(3.97)
CONGLO	-0.008**	-0.021***	-0.051**	0.031***	0.020**	0.011***	-0.048***	-0.061***
	(-2.42)	(-3.49)	(-2.63)	(3.67)	(2.46)	(4.88)	(-11.04)	(-9.70)
FLEV	0.001	0.004	0.011***	0.009***	0.009***	-0.001	-0.003***	-0.011***
	(1.11)	(0.45)	(3.67)	(2.99)	(4.15)	(-0.87)	(-5.83)	(-6.39)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Avg. Adj. R2	0.127	0.068	0.260	0.081	0.101	0.171	0.197	0.159
N	50,929	50,929	50,929	50,929	50,929	50,929	50,929	50,929

Panel B: Re-do Patatoukas' (2012) Table 2 Panel B but include negative operating margin observations

	(1) ROA	(2) ROE	(3) ROA	(4) ROE
Rank(CC)	-0.015***	-0.025***	-0.020***	-0.035***
	(-2.85)	(-3.05)	(-3.73)	(-4.48)
Log(MV)	0.023***	0.042***	0.022***	0.040***
	(12.01)	(11.20)	(11.67)	(11.07)
Log(AGE)	0.023***	0.029**	0.018**	0.019**
	(2.82)	(2.70)	(2.50)	(2.20)
SG	0.042***	0.126***	0.046***	0.132***
	(4.41)	(6.10)	(4.89)	(6.79)
CONGLO	-0.013***	-0.027***	-0.013***	-0.026***
	(-13.56)	(-8.63)	(-13.10)	(-8.44)
FLEV	-0.003	-0.008	-0.003	-0.008
	(-0.98)	(-1.14)	(-1.08)	(-1.21)
Log(MV_Cus)			-0.001	-0.001
			(-0.75)	(-0.41)
Log(AGE_Cus)			0.006**	0.015**
			(2.13)	(2.55)
SG_Cus			0.032***	0.056***
			(6.38)	(3.95)
CusDep			0.012	0.041*
			(0.96)	(2.02)
Log(LINKAGE)			0.023***	0.040***
			(7.68)	(5.89)
Industry FE	Yes	Yes	Yes	Yes
Avg. Adj. R2	0.195	0.131	0.202	0.134
N	23,135	23,135	23,135	23,135

Appendix B2: Replication of Irvine et al.'s (2016) Main Results

In Appendix B2, we replicate Irvine et al.'s (2016) main results (Table 5 Panel A) and re-interpret their results by focusing on the total effects of *CC* over supplier-customer relationship. Results are reported in Table B2 below. Untabulated descriptive statistics show that the variable distribution of the sample are similar to Irvine et al.'s (2016).

Table B2

This table presents the regression results of major customer concentration on firm profitability measures conditional on the length of supplier-customer relationships. Panel A reports the regression results of the interaction effects of *LINKAGE* and *CC* on firm profitability, which replicate Irvine et al.'s (2016) Table 5 Panel A. Panel B reports the F-test results for the total effect of *CC* in the top *LINKAGE* quintile, i.e., F-test for the sum of Rank(CC) and its interaction with the top *LINKAGE* quintile. Untabulated F-test results show that the total effects of *CC* in other *LINKAGE* quintiles are not positive. Panel C reports the t-test results for the total effect of *CC* in each *LINKAGE* quintile by creating separate variables representing linkage quintiles. *LinkageQ1*, *LinkageQ2, LinkageQ3, LinkageQ4, LinkageQ5* are dummies that equal one if *LINKAGE* falls into the second, third, fourth, and fifth quintile, respectively. *CC* is scaled annually in decile to lie between 0 (lowest rank) and 1 (highest rank). The dependent variables are return on assets (*ROA*), return on equity (*ROE*), assets turnover (*ATO*), profit margin (*PM*), gross margin (*GM*), and selling, general, and administrative expense (*SG&A*). The vector of controls includes market value (*MV*), firm age (*AGE*), annual percentage sales growth (*SG*), financial leverage (*FLEV*), and degree of diversification (*CONGLO*). Industry fixed effects are included. Coefficients are estimated using Fama-MacBeth (1973) annual regressions with Newey-West adjusted *t*-statistics in parentheses in Panel A and C, and p-value of the F-tests are in parentheses in Panel B. ***, **, and * denote 1%, 5% and 10% levels of significance, respectively. Please see Appendix A for variable definitions.

Panel A: Replication of Irvine et al.'s (2016) Table 5 Panel A

	(1) ROA	(2) ROE	(3) ATO	(4) PM	(5) GM	(6) SG&A
Rank(CC)	-0.065***	-0.121***	-0.258***	-0.379***	-0.065***	0.178***
	(-5.29)	(-5.93)	(-11.63)	(-5.90)	(-5.17)	(5.75)
Rank(CC)*LinkageQ2	0.029***	0.088***	0.135***	0.105***	-0.001	-0.076***
	(3.84)	(4.82)	(4.72)	(3.34)	(-0.16)	(-2.86)
Rank(CC)*LinkageQ3	0.042***	0.072***	0.129***	0.178***	-0.020***	-0.129***
	(4.43)	(4.04)	(4.50)	(5.80)	(-4.19)	(-4.82)
Rank(CC)*LinkageQ4	0.066***	0.121***	0.195***	0.277***	-0.008	-0.208***
	(7.06)	(8.71)	(10.62)	(5.47)	(-1.01)	(-6.90)
Rank(CC)*LinkageQ5	0.079***	0.149***	0.372***	0.320***	-0.001	-0.207***
	(7.35)	(8.16)	(20.99)	(5.23)	(-0.13)	(-6.08)
Log(MV)	0.022***	0.041***	-0.061***	0.033***	0.016***	-0.021***
	(9.14)	(10.32)	(-10.16)	(4.99)	(5.62)	(-4.07)
Log(AGE)	0.019*	0.024**	0.026	0.081**	-0.022***	-0.061***
	(1.74)	(2.05)	(1.31)	(2.72)	(-3.12)	(-7.89)
SG	0.050***	0.138***	0.608***	0.076***	0.026***	-0.019
	(5.01)	(6.67)	(18.46)	(4.66)	(3.74)	(-1.02)
CONGLO	-0.003	-0.008	-0.011	0.020***	-0.046***	-0.052***
	(-1.19)	(-1.21)	(-0.59)	(3.55)	(-22.19)	(-8.32)
FLEV	-0.012***	-0.028***	0.005	-0.010***	-0.009***	-0.008***
	(-10.88)	(-7.59)	(0.70)	(-5.08)	(-19.47)	(-6.39)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Avg. Adj. R2	0.207	0.140	0.351	0.161	0.262	0.133
N	23,928	23,928	23,928	23,928	23,928	23,928

Panel B: Re-interpret Irvine et al.'s (2016) Results Using F-tests for the top *LINKAGE* Quintile

	(1) ROA	(2) ROE	(3) ATO	(4) PM	(5) GM	(6) SG&A
F-test:						
Rank(CC)+Rank(CC)*LinkageQ5	0.014	0.028	0.113	-0.059	-0.066	-0.028
p-value	(0.392)	(0.317)	(0.000)	(0.509)	(0.000)	(0.543)

Panel C: Re-interpret Irvine et al.'s (2016) Results Using t-tests

	(1) ROA	(2) ROE	(3) ATO	(4) PM	(5) GM	(6) SG&A
Rank(CC)*LinkageQ1	-0.065***	-0.121***	-0.258***	-0.379***	-0.065***	0.178***
	(-5.29)	(-5.93)	(-11.63)	(-5.90)	(-5.17)	(5.75)
Rank(CC)*LinkageQ2	-0.035***	-0.033**	-0.124***	-0.274***	-0.067***	0.103***
	(-5.04)	(-2.68)	(-5.34)	(-5.80)	(-5.26)	(4.58)
Rank(CC)*LinkageQ3	-0.022***	-0.049***	-0.130***	-0.201***	-0.085***	0.049***
	(-4.70)	(-3.75)	(-5.42)	(-4.51)	(-7.13)	(4.05)
Rank(CC)*LinkageQ4	0.002	0.000	-0.064***	-0.102***	-0.073***	-0.030***
	(0.28)	(0.02)	(-3.45)	(-4.27)	(-8.32)	(-4.41)
Rank(CC)*LinkageQ5	0.014	0.028	0.113***	-0.059*	-0.066***	-0.028
	(1.53)	(1.61)	(6.42)	(-1.81)	(-5.12)	(-1.39)
Log(MV)	0.022***	0.041***	-0.061***	0.033***	0.016***	-0.021***
	(9.14)	(10.32)	(-10.16)	(4.99)	(5.62)	(-4.07)
Log(AGE)	0.019*	0.024**	0.026	0.081**	-0.022***	-0.061***
	(1.74)	(2.05)	(1.31)	(2.72)	(-3.12)	(-7.89)
SG	0.050***	0.138***	0.608***	0.076***	0.026***	-0.019
	(5.01)	(6.67)	(18.46)	(4.66)	(3.74)	(-1.02)
CONGLO	-0.003	-0.008	-0.011	0.020***	-0.046***	-0.052***
	(-1.19)	(-1.21)	(-0.59)	(3.55)	(-22.19)	(-8.32)
FLEV	-0.012***	-0.028***	0.005	-0.010***	-0.009***	-0.008***
	(-10.88)	(-7.59)	(0.70)	(-5.08)	(-19.47)	(-6.39)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Avg. Adj. R2	0.207	0.140	0.351	0.161	0.262	0.133
N	23,928	23,928	23,928	23,928	23,928	23,928

Table 1
Sample Characteristics

This table provides descriptive statistics for our sample. Panel A reports the summary statistics for the main variables. Panel B reports the sample distribution by economic sectors based on two-digit SIC codes. Panel C reports the Pearson (Spearman) pairwise correlations among the main independent variables above (below) the main diagonal. Please see Appendix A for variable definitions.

Panel A: Descriptive Statistics

	Mean	Std. Dev.	10th	25th	Median	75th	90th
Full Sample: Sample with Major Customers (N=73,856)							
CC	0.119	0.175	0.003	0.016	0.052	0.144	0.313
ROA	-0.028	0.285	-0.275	-0.056	0.033	0.088	0.158
ATO	1.306	1.005	0.297	0.605	1.107	1.703	2.476
PM	-0.297	1.530	-0.527	-0.062	0.026	0.073	0.140
GM	0.265	0.725	0.105	0.208	0.333	0.495	0.671
SG&A	0.362	0.635	0.018	0.104	0.215	0.382	0.672
MV	878.336	2667.939	5.335	17.896	80.954	431.858	1810.000
AGE	14.145	11.714	3.000	6.000	10.000	19.000	32.000
SG	0.257	0.785	-0.207	-0.034	0.103	0.300	0.683
FLEV	2.701	3.025	1.184	1.378	1.868	2.776	4.372
CONGLO	0.247	0.431	0.000	0.000	0.000	0.000	1.000
Main Sample: Firms with Identifiable Major Customers (N=32,751)							
CC	0.134	0.173	0.011	0.026	0.070	0.168	0.337
ROA	-0.036	0.284	-0.304	-0.064	0.033	0.088	0.160
ATO	1.320	0.987	0.306	0.615	1.142	1.727	2.460
PM	-0.242	1.072	-0.573	-0.070	0.026	0.072	0.136
GM	0.265	0.639	0.099	0.204	0.327	0.492	0.673
Days Receivable	67.764	44.873	28.456	43.196	58.814	79.981	111.851
SG&A	0.320	0.439	0.004	0.098	0.205	0.370	0.647
MV	1,008.776	3,086.052	5.769	19.889	90.079	472.961	2,032.925
AGE	14.436	12.098	3.000	6.000	10.000	20.000	33.000
SG	0.238	0.670	-0.209	-0.038	0.100	0.300	0.687
FLEV	2.204	3.821	1.119	1.314	1.793	2.707	4.323
CONGLO	0.286	0.452	0.000	0.000	0.000	1.000	1.000
LINKAGE	4.059	3.414	1.000	2.000	3.000	5.000	8.480
Purchase-to-Sales	0.779	1.615	0.000	0.000	0.017	0.366	5.103
Firms with Identifiable Non-Financial Major Customers (N=32,085)							
Customer GM	0.315	0.184	0.104	0.186	0.277	0.420	0.586
Customer Days Payable	53.982	42.397	21.543	31.998	43.443	60.943	91.706
MV_Cus	33,901.4	53,389.4	217.3	1,919.4	11,196.6	39,199.3	103,341.3
AGE_Cus	28.512	14.885	7.000	16.305	29.716	39.302	48.000
SG_Cus	0.110	0.207	-0.060	0.011	0.078	0.160	0.293
FLEV_Cus	3.058	3.195	1.297	1.846	2.432	3.360	5.436
CONGLO_Cus	0.509	0.457	0.000	0.000	0.524	1.000	1.000

Table 1 (Continued)

Panel B: Main Sample Distribution by Sectors

Two-Digit SIC Industry Groups	# Firm-Years	% in the Sample	% in Non-Financial Compustat Firms	Mean (CC)
Agriculture and Forestry (01-09)	108	0.33	0.50	0.108
Mining (10-14)	2,886	8.81	13.00	0.179
Construction (15-17)	305	0.93	1.28	0.132
Manufacturing (20-39)	20,642	63.03	42.03	0.134
Telecommunication (48)	724	2.21	4.00	0.104
Wholesale (50-51)	1,134	3.46	4.22	0.118
Retail (52-59)	218	0.67	6.72	0.078
Services (70-88)	4,819	14.71	20.12	0.129
Other	1,915	5.85	8.13	0.105
Total	32,751	100	100	0.134

Panel C: Pearson (Spearman) Pairwise Correlations above (below) the Main Diagonal

		(1)	(2)	(3)	(4)	(5)	(6)
(1)	Rank(CC)		0.293	-0.168	-0.231	0.096	-0.032
(2)	Rank(Purchase-to-Sales)	0.293		-0.294	-0.173	0.018	-0.045
(3)	MV	-0.198	-0.458		0.275	-0.017	0.138
(4)	AGE	-0.213	-0.142	0.218		-0.180	0.395
(5)	SG	0.043	-0.058	0.150	-0.232		-0.165
(6)	LINKAGE	-0.007	-0.030	0.167	0.360	-0.174	

Table 2
Customer Concentration and Firm Profitability

This table presents the regression results of major customer concentration on firm profitability measures. Panel A reports the results using the full sample consisting of firm-years from the Compustat Segment Customer File over 1977-2013. We follow the sample selection criteria of Patatoukas (2012) except that we do not remove firms with negative operating margin (i.e., the ratio of operating income before depreciation to net sales). Panel B repots the results using the truncated sample as in Patatoukas (2012), i.e., excluding firm-years with negative operating margin. Panel C reports the results using Tobit model and OLS model, censoring the dependent variable at zero when it is negative. The dependent variables are return on assets (*ROA*), assets turnover (*ATO*), profit margin (*PM*), gross margin (*GM*), and selling, general, and administrative expense (*SG&A*). *CC* is scaled annually in decile to lie between 0 (lowest rank) and 1 (highest rank). The vector of controls includes market value (*MV*), firm age (*AGE*), annual percentage sales growth (*SG*), financial leverage (*FLEV*), and degree of diversification (*CONGLO*). Industry fixed effects are based on two-digit SIC codes. Coefficients are estimated using Fama-MacBeth (1973) annual regressions with *t*-statistics (in parentheses) corrected for serial correlation using the Newey-West (1987) adjustment at three lags. ***, **, and * denote 1%, 5% and 10% levels of significance, respectively. Please see Appendix A for variable definitions.

Panel A: Effects of CC on Profitability Measures

	(1) ROA	(2) ATO	(3) PM	(4) GM	(5) SG&A
Rank(CC)	-0.062***	-0.170***	-0.656***	-0.308***	0.121***
	(-6.35)	(-6.17)	(-6.45)	(-6.40)	(5.73)
Log(MV)	0.029***	-0.032***	0.057***	0.018***	-0.038***
	(16.38)	(-4.33)	(6.57)	(8.54)	(-8.11)
Log(AGE)	0.023***	0.009	0.149***	0.016	-0.076***
	(3.00)	(0.41)	(4.90)	(1.60)	(-5.66)
SG	-0.025**	0.235***	-0.022	0.010	0.038***
	(-2.35)	(7.51)	(-1.17)	(1.01)	(3.31)
FLEV	-0.011***	-0.004	-0.011***	-0.006***	-0.003***
	(-17.34)	(-1.20)	(-5.89)	(-5.64)	(-3.21)
CONGLO	0.010*	0.009	0.151***	0.033	-0.058***
	(1.99)	(0.55)	(2.98)	(1.25)	(-4.26)
Industry FE	Yes	Yes	Yes	Yes	Yes
Avg. Adj. R^2	0.15	0.30	0.11	0.11	0.12
N	73,856	73,856	73,856	73,856	73,856

Panel B: Replications of CC in Patatoukas (2012) (Excluding Observations with Negative Operating Margin)

	(1) ROA	(2) ATO	(3) PM	(4) GM	(5) SG&A
Rank(CC)	0.021***	0.001	0.020***	-0.010	-0.051***
	(5.95)	(0.02)	(7.14)	(-1.26)	(-8.30)
Log(MV)	0.012***	-0.068***	0.014***	0.013***	-0.009***
	(10.87)	(-8.39)	(13.90)	(10.46)	(-8.74)
Log(AGE)	-0.015***	-0.024	-0.004**	-0.038***	-0.021***
	(-4.17)	(-1.04)	(-2.10)	(-13.69)	(-8.49)
SG	0.028***	0.396***	0.016***	0.011***	0.001
	(8.49)	(12.34)	(5.16)	(6.13)	(0.21)
FLEV	-0.009***	-0.009**	-0.009***	-0.006***	-0.005***
	(-13.58)	(-2.33)	(-20.18)	(-15.58)	(-16.49)
CONGLO	-0.008***	-0.025**	-0.006**	-0.019**	-0.015***
	(-3.04)	(-2.10)	(-2.59)	(-2.57)	(-3.71)
Industry FE	Yes	Yes	Yes	Yes	Yes
Avg. Adj. R^2	0.18	0.36	0.16	0.33	0.31
N	56,851	56,851	56,851	56,851	56,851

Table 2 (Continued)

Panel C: Tobit and OLS Models Using Full Sample (ROA is censored to zero when it is negative)

	(1)	(2)
Dep. Var.: ROA	Tobit Model	OLS Model
Rank(CC)	-0.010*	0.010***
	(-1.71)	(3.02)
Log(MV)	0.026***	0.011***
	(10.56)	(9.72)
Log(AGE)	-0.003	-0.012***
	(-0.48)	(-4.58)
SG	0.041***	0.028***
	(5.46)	(6.82)
FLEV	-0.014***	-0.005***
	(-9.57)	(-6.38)
CONGLO	-0.004	-0.006***
	(-1.13)	(-2.75)
Industry FE	Yes	Yes
Avg. Pseudo R^2 for Tobit & Avg Adj. R^2 for OLS	0.20	0.12
N	73,856	73,856

Table 3
Customer Concentration and Firm Profitability over Relationship Life Cycle

This table presents the results of major customer concentration on accounting rates of returns, conditional on the length of supplier-customer relationships. Panel A reports the regression results of *CC* on *ROA* including interactions with the quintiles of supplier-customer relationship length (*LINKAGE*). Panel B reports the regression results of *CC* on *ROA* over each *LINKAGE* quintile. *LinkageQ1*, *LinkageQ2, LinkageQ3, LinkageQ4, LinkageQ5* are dummies that equal one if *LINKAGE* falls into the first, second, third, fourth, and fifth quintile, respectively. *CC* is scaled annually in decile to lie between 0 (lowest rank) and 1 (highest rank). The vector of controls includes market value (*MV*), firm age (*AGE*), annual percentage sales growth (*SG*), financial leverage (*FLEV*), and degree of diversification (*CONGLO*). Industry fixed effects are based on two-digit SIC codes. Coefficients are estimated using Fama-MacBeth (1973) annual regressions with *t*-statistics (in parentheses) corrected for serial correlation using the Newey-West (1987) adjustment at three lags. ***, **, and * denote 1%, 5% and 10% levels of significance, respectively. Please see Appendix A for variable definitions.

Panel A: Effects of CC on ROA over LINKAGE Quintiles (F-test)

Dep. Var.: ROA	(1)	(2)	(3) *F*-test for LinkageQ2 (p-value)	(4) *F*-test for LinkageQ3 (p-value)	(5) *F*-test for LinkageQ4 (p-value)	(6) *F*-test for LinkageQ5 (p-value)
Rank(CC)	-0.048***	-0.144***				
	(-5.48)	(-7.73)				
Rank(CC) × LinkageQ2		0.070***	-0.074			
		(6.11)	(0.002)			
Rank(CC) × LinkageQ3		0.090***		-0.054		
		(6.53)		(0.024)		
Rank(CC) × LinkageQ4		0.132***			-0.012	
		(7.88)			(0.646)	
Rank(CC) × LinkageQ5		0.152***				0.008
		(7.68)				(0.762)
Control Variables	Yes	Yes				
Industry FE	Yes	Yes				
Avg. Adj. R^2	0.14	0.16				
N	32,751	32,751				

Panel B: Effects of CC on ROA over LINKAGE Quintiles (t-test)

	ROA
Rank(CC) × LinkageQ1	-0.144***
	(-7.73)
Rank(CC) × LinkageQ2	-0.074***
	(-5.98)
Rank(CC) × LinkageQ3	-0.054***
	(-4.19)
Rank(CC) × LinkageQ4	-0.012
	(-1.39)
Rank(CC) × LinkageQ5	0.008
	(1.24)
Control Variables	Yes
Industry FE	Yes
Avg. Adj. R2	0.16
N	32,751

Table 4

Customer Concentration and Firm Profitability over Predicted and Unpredicted Relationship Life Cycle

This table presents the regression results for the effect of supplier-customer relationship length on the relation between major customer concentration and firm profitability. Panel A reports the mean values of supplier market value (*Supplier MV*) and sales (*Supplier Sales*) over the quintiles of *LINKAGE* as well as in double sorting portfolios by *CC* and *LINKAGE*. Panel B and Panel C present the results for *ROA* and *SG&A*, respectively. In both panels, Column (1) reports the interaction effect of *CC* and *LINKAGE*; Column (2) reports the interaction effect of *CC* and the *pred_LINKAGE*, where *pred_LINKAGE* is the predicted value from the regression of *LINKAGE* on the log transformed supplier sales and supplier market value (controlling for industry and year fixed effects); Column (3) reports the interaction effect of *CC* and *res_LINKAGE*, where *res_LINKAGE* is the residual of *LINKAGE* after removing *pred_LINKAGE*. *CC*, *LINKAGE*, *pred_LINKAGE* and *res_LINKAGE* are scaled annually in decile to lie between 0 (lowest rank) and 1 (highest rank). The vector of controls includes the direct effects of *LINKAGE* (*pred_LINKAGE*, or *res_LINKAGE*), market value (*MV*), firm age (*AGE*), annual percentage sales growth (*SG*), financial leverage (*FLEV*), and degree of diversification (*CONGLO*). Industry fixed effects are based on two-digit SIC codes. Coefficients are estimated using Fama-MacBeth (1973) annual regressions with *t*-statistics (in parentheses) corrected for serial correlation using the Newey-West (1987) adjustment at three lags. ***, **, and * denote 1%, 5% and 10% levels of significance, respectively. Please see Appendix A for variable definitions.

Panel A: Mean Values of Supplier Size (*MV* and *Sales*) over LINKAGE

		CC				
Supplier ***MV***	All Firms	Q1	Q2	Q3	Q4	Q5
Shortest LINKAGE	775.619	1128.360	831.324	928.227	576.466	413.469
2	776.630	1276.970	864.601	783.418	516.339	441.449
3	918.215	1349.108	1281.145	789.309	722.561	448.705
4	1157.742	1464.652	1689.943	1455.433	740.716	437.641
Longest LINKAGE	1475.686	2614.867	1644.933	1471.059	863.645	783.927
L-S	**700.067**	**1544.312**	**1244.055**	**1077.901**	**677.476**	**499.805**
(p-value)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.002)**	**(0.000)**
Supplier ***Sales***						
Shortest LINKAGE	634.165	1148.473	706.338	692.682	424.256	198.778
2	576.211	1250.783	662.996	488.745	287.098	191.001
3	723.212	1318.262	924.231	595.017	503.275	274.895
4	921.838	1408.488	1368.936	945.944	519.807	365.604
Longest LINKAGE	1514.278	2600.721	1774.062	1492.367	1003.187	701.052
L-S	**880.113**	**1523.854**	**1068.575**	**831.656**	**537.714**	**338.206**
(p-value)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**

Panel B: Effect of LINKAGE on the Relation between CC and ROA

Row	Dep. Var.: ROA	(1)	(2)	(3)
1	Rank(CC)	-0.180***	-0.196***	-0.042**
		(-7.26)	(-6.71)	(-2.65)
2	Rank(CC) ×Rank(LINKAGE)	0.236***		
		(7.51)		
3	Rank(CC) ×Rank(pred_LINKAGE)		0.353***	
			(7.29)	
4	Rank(CC) ×Rank(res_LINKAGE)			-0.010
				(-0.53)
	Control Variables	Yes	Yes	Yes
F-test:	Row1+Row2	0.056		
		(0.166)		
	Row1+Row3		0.157	
			(0.009)	
	Row1+Row4			-0.052
				(0.042)
Industry FE		Yes	Yes	Yes
Avg. Adj. R^2		0.16	0.20	0.15
N		32,751	32,751	32,751

Table 4 (Continued)

Panel C: Effect of LINKAGE on the Relation between CC and SG&A

Row	Dep. Var.: SG&A	(1)	(2)	(3)
1	Rank(CC)	0.186***	0.104*	-0.037
		(5.41)	(1.78)	(-1.49)
2	Rank(CC) ×Rank(LINKAGE)	-0.294***		
		(-6.88)		
3	Rank(CC) ×Rank(pred_LINKAGE)		-0.325***	
			(-4.13)	
4	Rank(CC) ×Rank(res_LINKAGE)			0.078*
				(1.97)
	Control Variables	Yes	Yes	Yes
F-test:	Row1+Row2	-0.108*		
		(0.057)		
	Row1+Row3		-0.221**	
			(0.031)	
	Row1+Row4			0.041
				(0.388)
Industry FE		Yes	Yes	Yes
Avg. Adj. R^2		0.15	0.23	0.14
N		32,751	32,751	32,751

Table 5
Analysis of Major Customer Performance

This table presents the regression results for the effect of major customer concentration on major customer firm performance as well as supplier firm performance. Panel A presents the results for the effect of major customer concentration on major customers' gross margin and days payable, as well as for supplier's gross margin and days receivable. Panel B and Panel C present the results for the interaction effect of relationship life cycle. *CC*, *LINKAGE*, *pred_LINKAGE* and *res_LINKAGE* are scaled annually in decile to lie between 0 (lowest rank) and 1 (highest rank). The vector of controls includes market value (*MV*), firm age (*AGE*), annual percentage sales growth (*SG*), financial leverage (*FLEV*), degree of diversification (*CONGLO*), the duration between the firm and its major customers (*LINKAGE*) (*pred_LINKAGE*, or *res_LINKAGE*), customers' market value (*MV_Cus*), customers' firm age (*AGE_Cus*), customers' annual percentage sales growth (*SG_Cus*), customers' financial leverage (*FLEV_Cus*), and customers' degree of diversification (*CONGLO_Cus*). Coefficients are estimated using Fama-MacBeth (1973) annual regressions with *t*-statistics (in parentheses) corrected for serial correlation using the Newey-West (1987) adjustment at three lags. ***, **, and * denote 1%, 5% and 10% levels of significance, respectively. Please see Appendix A for variable definitions.

Panel A: Effect of CC on Customer GM and Days Payable vs. Supplier GM and Days Receivable

		(1)	(2)	(3)	(4)
Row		Customer GM	Customer Days Payable	Supplier GM	Supplier Days Receivable
1	Rank(CC)	0.029**	2.536**	-0.304***	2.417**
		(2.46)	(2.12)	(-5.61)	(2.16)
2	Log(MV)	-0.001	-0.168	0.021***	-1.465***
		(-0.54)	(-0.91)	(4.91)	(-2.80)
3	Log(AGE)	-0.018***	-2.059**	0.006	-4.826**
		(-4.33)	(-2.59)	(0.41)	(-2.13)
4	SG	0.002*	0.784*	0.030**	-8.418***
		(1.77)	(1.95)	(2.30)	(-6.62)
5	FLEV	-0.000	-0.069	-0.001	0.251***
		(-1.33)	(-1.11)	(-1.05)	(3.75)
6	CONGLO	-0.007	0.011	-0.010	2.811
		(-1.49)	(0.02)	(-0.13)	(0.89)
7	Log(MV_Cus)	0.020***	2.551***	-0.004	0.161
		(6.02)	(4.89)	(-1.44)	(0.74)
8	Log(AGE_Cus)	-0.004	-2.265**	-0.003	-1.060**
		(-0.49)	(-2.10)	(-0.47)	(-2.20)
9	SG_Cus	0.049***	14.991***	0.052**	-3.877***
		(2.83)	(4.29)	(2.22)	(-2.89)
10	FLEV_Cus	-0.010***	1.653***	0.003**	1.179
		(-3.39)	(2.84)	(2.57)	(1.27)
11	CONGLO_Cus	-0.020	3.920**	0.024	3.053***
		(-1.39)	(2.24)	(1.40)	(3.40)
12	Log(LINKAGE)	-0.013**	-2.689***	0.057***	-6.057***
		(-2.44)	(-2.74)	(4.81)	(-4.21)
Industry FE		Yes	Yes	Yes	Yes
Avg. Adj. R^2		0.25	0.12	0.16	0.14
N		32,085	32,085	32,085	32,085

Table 5 (Continued)

Panel B: Effect of LINKAGE on Customer GM vs. Supplier GM

Row		Customer GM (1)	(2)	(3)	Supplier GM (4)	(5)	(6)
1	Rank(CC)	0.050***	0.035**	0.031*	-0.526***	-0.813***	-0.143***
		(2.75)	(2.10)	(1.84)	(-5.26)	(-5.25)	(-6.50)
2	Rank(CC) ×Rank(LINKAGE)	-0.039**			0.432***		
		(-2.69)			(4.61)		
3	Rank(CC) ×Rank(pred_LINKAGE)		-0.049***			1.104***	
			(-3.01)			(4.82)	
4	Rank(CC) ×Rank(res_LINKAGE)			-0.008			-0.255***
				(-0.65)			(-3.37)
	Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
F-test:	Row1+Row2	0.011			-0.094		
		(0.647)			(0.494)		
	Row1+Row3		-0.014			0.291	
			(0.548)			(0.230)	
	Row1+Row4			0.023			-0.398
				(0.275)			(0.000)
Industry FE		Yes	Yes	Yes	Yes	Yes	Yes
Avg. Adj. R^2		0.25	0.27	0.25	0.16	0.20	0.16
N		32,085	32,085	32,085	32,085	32,085	32,085

Panel C: Effect of LINKAGE on Customer Days Payable vs. Supplier Days Receivable

Row		Customer Days Payable (1)	(2)	(3)	Supplier Days Receivable (4)	(5)	(6)
1	Rank(CC)	7.865***	5.139**	4.172*	12.846***	8.906**	-1.473
		(2.77)	(2.44)	(1.76)	(4.09)	(2.62)	(-0.64)
2	Rank(CC) ×Rank(LINKAGE)	-10.030**			-19.969***		
		(-2.32)			(-3.96)		
3	Rank(CC) ×Rank(pred_LINKAGE)		-11.011***			-22.089***	
			(-3.23)			(-3.86)	
4	Rank(CC) ×Rank(res_LINKAGE)			-3.653			4.636
				(-1.00)			(1.04)
	Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
F- test:	Row1+Row2	-2.165			-7.123		
		(0.678)			(0.238)		
	Row1+Row3		-5.872			-13.183	
			(0.151)			(0.055)	
	Row1+Row4			0.519			3.163
				(0.906)			(0.532)
Industry FE		Yes	Yes	Yes	Yes	Yes	Yes
Avg. Adj. R^2		0.12	0.13	0.12	0.14	0.16	0.14
N		32,085	32,085	32,085	32,085	32,085	32,085

Table 6
Horizontal Mergers by Major Customers and Firm Profitability

This table presents results for the effect of horizontal mergers by major customers on firm profitability. The sample contains merger-treated supplier firms where the firm's major customers have at least one horizontal mergers completed in the year. The matched control firms are from the same year and one-digit SIC industry, and are propensity score matched on *AssetSize*, *CC* and *ROA* at the year-end prior to a merger event. Panel A reports the characteristics of matching variables. Panel B reports the univariate analysis results on the changes in *CC* and *ROA* from year -1 to year + 1 relative to the merger event. Panel C reports the regression results using the matched sample, where the dependent variables are changes in *CC* and *ROA* from year -1 to year + 1 relative to the merger event. Treated is a dummy variable that equals one if the supplier has at least one major customer experiences a merger event in the year. The vector of controls includes firm age (*AGE*) and changes in variables of market value (*MV*), sales growth (*SG*), financial leverage (*FLEV*), degree of diversification (*CONGLO*) and the duration between the firm and its major customers (*LINKAGE*) from year -1 to year +1 relative to the merger event. Coefficients are estimated using panel data regressions with year fixed effects and industry (two-digit SIC) fixed effects. Standard errors are double clustered at year and industry (*t*-statistics in parentheses). ***, **, and * denote 1%, 5% and 10% levels of significance, respectively. Please see Appendix A for variable definitions.

Panel A: Matching Variables (N=3,770)

	Treated	Matched	Difference	t-statistics
Matching variables at the end of year -1 relative to a merger event:				
AssetSize	5.102	5.174	-0.072	-1.09
CC	0.134	0.128	0.005	1.13
ROA	-0.042	-0.046	0.004	0.34

Panel B: Univariate Results (N=3,770)

	Treated	Matched	Difference	t-statistics
Change from year – 1 to year +1 relative to a merger event:				
Rank(ΔCC)	0.501	0.475	0.026	2.50**
ΔROA	-0.005	0.018	-0.023	-2.33**

Panel C: Difference-in-Difference Regressions

	(1) Rank(ΔCC)	(2) ΔROA
Treat	0.029*	-0.023**
	(1.90)	(-2.05)
ΔLog(MV)	0.015	0.076***
	(1.26)	(6.82)
Log(AGE)	0.035***	-0.034***
	(6.90)	(-3.10)
ΔSG	-0.003	0.011
	(-0.41)	(0.34)
ΔFLEV	-0.002***	-0.002
	(-2.70)	(-1.39)
ΔCONGLO	0.055***	-0.012
	(2.86)	(-0.47)
ΔLog(LINKAGE)	0.027*	-0.017*
	(1.67)	(-1.95)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Adj. R^2	0.01	0.06
N	3,770	3,770

Table 7
Analysis of Intertemporal Changes

This table presents the regression results for the effect of annual changes in major customer concentration on one-year-ahead annual changes in return on assets, as well as the interaction effect of the supplier-customer relationship life cycle. *CC*, *LINKAGE*, *pred_LINKAGE* and *res_LINKAGE* are scaled annually in decile to lie between 0 (lowest rank) and 1 (highest rank). The vector of controls includes the direct effects of *LINKAGE*) (*pred_LINKAGE*, or *res_LINKAGE*), profit margin (*PM*), assets turnover (*ATO*), and their respective annual changes Δ*PM* and Δ*ATO*. Industry fixed effects are based on two-digit SIC codes. Coefficients are estimated using Fama-MacBeth (1973) annual regressions with *t*-statistics (in parentheses) corrected for serial correlation using the Newey-West (1987) adjustment at three lags. ***, **, and * denote 1%, 5% and 10% levels of significance, respectively. Please see Appendix A for variable definitions.

Row	Dep. Var.: ΔROA_{t+1}	(1)	(2)	(3)	(4)
1	Rank(ΔCC)	-0.015**	-0.047***	-0.050**	-0.018
		(-2.19)	(-3.24)	(-2.64)	(-1.59)
2	Rank(ΔCC) ×Rank(LINKAGE)		0.057***		
			(3.41)		
3	Rank(ΔCC) ×Rank(pred_LINKAGE)			0.069**	
				(2.61)	
4	Rank(ΔCC) ×Rank(res_LINKAGE)				0.004
					(0.24)
5	Rank(LINKAGE)		-0.025*		
			(-1.94)		
6	Rank(pred_LINKAGE)			0.002	
				(0.10)	
7	Rank(res_LINKAGE)				0.002
					(0.18)
8	PM	-0.054***	-0.055***	-0.061***	-0.057***
		(-3.52)	(-3.52)	(-3.88)	(-3.59)
9	ATO	-0.008*	-0.008*	-0.010**	-0.008*
		(-1.92)	(-1.89)	(-2.27)	(-1.85)
10	ΔPM	0.007	0.008	0.027	0.021
		(0.32)	(0.33)	(0.67)	(0.59)
11	ΔATO	0.011***	0.010**	0.009*	0.009*
		(2.84)	(2.70)	(1.98)	(2.12)
Row1+Row2			0.010		
(p-value of *F* test)			(0.673)		
Row1+Row3				0.019	
(p-value of *F* test)				(0.559)	
Row1+Row4					-0.014
(p-value of *F* test)					(0.492)
Industry FE		Yes	Yes	Yes	Yes
Avg. Adj. R^2		0.08	0.09	0.09	0.09
N		26,483	26,483	26,483	26,483

Table 8
Analysis of Purchase-to-Sales as an Alternative Customer Power Measure

This table presents the regression results for the effect of the purchase-to-sales ratio on firm performance. Panel A presents the results for the main effect of purchase-to-sales on profitability measures. Panel B present the results for the interaction effect of the relationship life cycle. *Purchase-to-Sales* is measured as the ratio of the major customers' total purchases to the supplier's total sales. *Purchase-to-Sales*, *LINKAGE*, *pred_LINKAGE* and *res_LINKAGE* are scaled annually in decile to lie between 0 (lowest rank) and 1 (highest rank). The vector of controls includes market value (*MV*), firm age (*AGE*), annual percentage sales growth (*SG*), financial leverage (*FLEV*), degree of diversification (*CONGLO*), and the duration between the firm and its major customers (*LINKAGE*) (*pred_LINKAGE*, or *res_LINKAGE*). Coefficients are estimated using Fama-MacBeth (1973) annual regressions with *t*-statistics (in parentheses) corrected for serial correlation using the Newey-West (1987) adjustment at three lags. ***, **, and * denote 1%, 5% and 10% levels of significance, respectively. Please see Appendix A for variable definitions.

Panel A: Effect of Purchase-to-Sales on Profitability Measures

	(1)	(2)	(3)	(4)	(5)
	ROA	ATO	PM	GM	SG&A
Rank(Purchase-to-Sales)	-0.099***	-0.416***	-0.554***	-0.175***	0.226***
	(-6.15)	(-11.81)	(-6.82)	(-3.41)	(10.85)
Log(MV)	0.030***	-0.077***	0.028***	0.019***	-0.014***
	(15.32)	(-8.35)	(4.00)	(3.80)	(-6.78)
Log(Age)	0.014*	-0.025	0.111***	0.024	-0.049***
	(1.90)	(-0.97)	(4.13)	(1.64)	(-7.81)
SG	-0.009	0.362***	0.022	0.023*	0.010
	(-0.78)	(8.12)	(1.08)	(1.91)	(1.21)
FLEV	-0.000	0.003	0.004**	-0.001	-0.003***
	(-0.07)	(1.19)	(2.42)	(-1.44)	(-5.22)
CONGLO	-0.004	-0.045	-0.047	-0.038	-0.012
	(-0.23)	(-1.41)	(-0.38)	(-0.47)	(-1.64)
Log(LINKAGE)	0.046***	0.135***	0.168***	0.039***	-0.070***
	(8.65)	(11.33)	(7.10)	(3.74)	(-8.39)
Industry FE	Yes	Yes	Yes	Yes	Yes
Avg. Adj. R^2	0.156	0.322	0.133	0.140	0.157
N	32,751	32,751	32,751	32,751	32,751

Table 8 (Continued)

Panel B: Effect of LINKAGE on the Relation between Purchase-to-Sales and ROA and SG&A

		ROA			SG&A		
Row		(1)	(2)	(3)	(4)	(5)	(6)
1	Rank(Purchase-to-Sales)	-0.246***	-0.283***	-0.094***	0.435***	0.375***	0.199***
		(-8.75)	(-9.54)	(-5.64)	(9.73)	(10.29)	(4.12)
2	Rank(Purchase-to-Sales) *Rank(LINKAGE)	0.304***			-0.427***		
		(10.88)			(-7.82)		
3	Rank(Purchase-to-Sales) *Rank(pred_LINKAGE)		0.523***			-0.641***	
			(9.75)			(-10.39)	
4	Rank(Purchase-to-Sales) *Rank(res_LINKAGE)			0.004			0.014
				(0.19)			(0.24)
	Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
F-test:	Row1+Row2	0.058			0.008		
		(0.152)	0.240		(0.914)	-0.266	
	Row1+Row3		(0.000)			(0.001)	
				-0.090			0.213
	Row1+Row4			(0.003)			(0.010)
	Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
	Avg. Adj. R^2	0.156	0.322	0.133	0.140	0.157	0.157
	N	32,751	32,751	32,751	32,751	32,751	32,751