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Customer concentration and M&A performance

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Customer Concentration and M&A Performance[*]

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Journal of Corporate Finance (forthcoming)

June 2021

Abstract

This paper examines how the target's customer concentration affects merger performance. We find that the acquirer purchasing a customer-concentrated firm experiences significantly lower stock market returns and worse long-run operating performance. The effect is more pronounced when customers face lower switching costs or the target undertakes a higher level of relationship-specific investments, exhibits higher cash volatility, or is acquired by a less well-known company. Further analysis shows that the negative association is mainly driven by corporate customers, while relatively safe government customers moderate the effect. We also find that shared major customers, overconfident CEOs, and poor corporate governance are more likely to increase the likelihood of customer-concentrated acquisitions. Overall, our findings suggest that higher customer concentration leads to lower value creation in mergers.

Keywords: customer concentration; mergers and acquisitions; announcement return; major government customer

JEL classification: G30; G34; M41

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1. Introduction

The Pareto principle (also known as the 80/20 rule) seems to apply well to supply chain management, where, for many firms, a small set of large customers contributes a sizeable portion to a supplier's sales (Ellis et al. (2012) and Perry (2013)).[1] That a firm's total revenue is distributed across this small set of customers (or customer base) undergirds the concept of customer concentration. Supplier firms often make huge efforts to develop deep relationships with principal customers, which nevertheless can significantly influence firms' operational and financial performance from different aspects. The economic implications of customer concentration have drawn increasing attention from academics and practitioners in recent years (see, e.g., Patatoukas (2012), Irvine et al. (2014), Dhaliwal et al. (2016), Campello and Gao (2017), Chiu et al. (2019), Hui et al. (2019), and Working (2019)).

However, that existing studies yield mixed results on the economic consequences of customer concentration suggests that winning the business of big customers is a double-edged sword. On the one hand, a strong relationship between major customers and suppliers can reduce a firm's transaction costs and discretionary expenses and foster information sharing and collaboration along the supply chain, which in turn improve firm efficiency and performance (Kalwani and Narayandas (1995), Patatoukas (2012), Irvine et al. (2014), Ak and Patatoukas (2016), Chu et al. (2018)). In the context of M&As, productive efficiency improvement, as the result of a reduction in operating costs and information sharing, is commonly considered to be a source of gains to the acquisition of a target with major customers (Fee and Thomas (2004)). On the other hand, heavily relying on a few major customers is also likely to translate into higher expenses and increased business risks, which shareholders and stakeholders shoulder (e.g., Cohen and Freazzini (2008), Itzkowitz (2013), and Campello and Gao (2017)). A small operational change can have a significant negative impact on the customer relationship (Cen et al. (2016a)). In particular, a merger and acquisition (M&A) may expose the customer relationship to vulnerabilities. Anecdotal evidence suggests that buyers and investors view deep relationships with key customers as a source of risk, rather than a strength, in M&As (e.g., Kastner (2018)).[2] Once a deal closes, the seller may lose control of the customer relationship, and major customers are likely to either exit or make demands for price concessions with the new combined entity. In this context, acquirer returns are disastrous, and the road to rebuilding revenues is painful. The 2016 merger of American

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[1] The 80 and 20 are anecdotal, of course, probably has a different distribution. For example, Campello and Gao (2017) point out that one-third of the sales of U.S. manufactures flow to a few large customers.
[2] See Kastner (2018), who is President of GP Venture.

Axle & Manufacturing Holdings' (AXL) and Metaldyne Performance Group (MPG) exemplifies this dilemma. Among many factors that led AXL to experience five-day abnormal returns of -23.7%, it is widely believed that MPG's concentrated customer base (i.e., the top-three customers account for over 60% of the sales) was a key risk factor. However, studies on customer concentration in the context of mergers are still scant. In this study, we attempt to fill this important gap by systematically studying the effects of a target's customer concentration on merger performance.

This paper examines how the target's customer concentration affects several aspects of merger performance, that is, the announcement returns of the acquirer and the combined entity, as well as the long-run market and operating performance. To perform our tests, we gather M&A data from the Securities Data Company (SDC) Premium database and customer information from the Compustat Segments Customer database. The matching procedure produces a sample of 1,446 M&As by publicly traded U.S. companies from 2000 to 2017. Following the Statement of Financial Accounting Standards (SFAS) No. 131, we define major customers as those accounting for 10% or more of the supplier's total sales. We construct three main measures that capture various dimensions of the target's customer concentration. To sharpen the inference, we control for firm- and deal-level characteristics, as well as year and industry fixed effects in our empirical tests.

Our baseline results suggest that, across all measures of customer concentration, acquirers purchasing targets with major customers experience lower announcement returns associated with mergers. The effect is statistically and economically significant. The presence of the target's major customer is associated with a decrease of 1.7 percentage points in the acquirer's five-day cumulative abnormal returns (CARs) around the deal announcement. Moreover, a one-standard-deviation increase in the percentage of sales to all major customers and the sales-based Herfindahl-Hirschman index (HHI) leads to an approximately 76% and 51% reduction in the acquirer's five-day CARs, respectively. The trivial effect on target announcement returns implies that an unfavorable market reaction toward the acquirer is not attributed to an overpay issue. Furthermore, we find that the combined acquirer and target firm announcement returns (i.e., merger synergy) and the acquirer's long-term performance, measured by one- and two-year post-acquisition buy-and-hold abnormal returns (BHAR), are negatively associated with the target's customer concentration. These findings support the view that the target's customer concentration is an important risk factor in M&A transactions, one that may be underestimated by acquirers.

The relation between M&A performance and the customer concentration of targets in the above analysis is potentially subject to concerns of omitted variables, unobserved heterogeneity, and self-selection problems. To

alleviate these concerns, we further perform an instrumental variable (IV) method, the Durbin-Wu-Hausman test, and the propensity score matching (PSM) technique to validate our findings. We construct two IVs: (1) the number of potential major customers for a target and (2) the industry average of the number of major customers and a PSM matched sample. The IV and PSM estimations all suggest that the target's customer concentrations remain negatively associated with the acquirer's announcement returns and support the proposition that the results in our initial analysis are not the outcome of a spurious relationship. Our results are also robust to a set of sensitivity tests.

To provide more evidence that additional costs and uncertainties stemming from the target's customer concentration underpin poor M&A outcomes, we conduct several tests to examine the cross-sectional variation in the relation between an acquirer's announcement returns and a target's customer concentration.[3] Some previous studies have documented that government customers and corporate customers impose different levels of operational uncertainty on suppliers (see, e.g., Dhaliwal et al. (2016), Huang et al. (2016a), and Cohen and Li (2020)). Unlike corporate entities, government customers are usually reliable and stable business partners, as they are much less likely to default or go bankrupt and tend to sign long-term procurement contracts with their suppliers. As such, we expect that contracting with major government customers and with major corporate customers impose different levels of risk to the target and have differential impacts on M&A performance. To test this conjecture, we reconstruct the measures of customer concentration and base them on major corporate and government customers separately. We find that corporate customer concentration is significantly and negatively associated with the acquirer announcement returns, suggesting that the effect is mainly driven by major corporate customers. In addition, we capture a moderating effect associated with having a major government customer, as the negative impact of the overall customer concentration on the acquirer's returns is less pronounced when the target has a major government customer.

Customer switching costs play an important role in the supplier-customer relationship. Substantial switching costs deter major customers from switching to alternative suppliers. Thus, we expect that the merged entity has a higher risk of losing future major customer revenue when the barrier to switching is lowered. Using a target's industry market share to measure its customer switching costs, we find that higher switching costs (i.e., above-median switching costs) could impede the major customer concentration from exerting a negative effect on the acquirer's returns. Moreover, suppliers are often required to undertake relationship-specific

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[3] These heterogeneity tests further alleviate the endogeneity concern, since it is unlikely that factors other than customer concentration would simultaneously fit into these settings.

investments and customize their operations and products to suit their major customers' needs. Relationship-specific investments generally have little value to other customers. Thus, the acquirer is expected to suffer more from the loss of a target's major customer when the target invested a significant amount of relationship-specific assets. The results are consistent with our prediction: the negative association between the target's customer concentration and M&A performance is more pronounced when the target has made more relationship-specific investments.

Higher cash flow volatility implies that a firm is more likely to cycle through periods of internal cash flow shortfalls and suffer from liquidity problems (Minton and Schrand (1999)). Thus, cash flow risk stemming from a target's customer concentration tends to be higher for those deals that involve targets with unstable cash flows before an M&A. We find evidence consistent with this argument and show that the negative impact of a target's customer concentration on the acquirer's shareholder value is more striking when the target has a higher level of cash volatility before the merger. We also examine whether larger and more reputable acquirers purchasing targets with a concentrated customer base experience better M&A outcomes. Our results show that relative to non-S&P acquirers (i.e., relatively small acquirers), S&P buyers acquiring targets with a major customer exhibit 2.40 percentage points higher five-day CARs, suggesting that larger and more reputable acquirers are more capable of navigating the intricacies associated with major customers.

The above-mentioned analysis supports our hypothesis that acquiring targets with high customer concentration can destroy the shareholder value of the acquirers. If the mergers do not create value for the acquiring firm, then why do they initiate such deals? What do they intend to achieve with the merger activity? To answer these questions, we further investigate the potential motives behind the acquisition of customer-concentrated targets from the perspectives of strategic considerations, hubris, and agency motivation. We find that the presence of common major customers, CEO overconfidence, and weak corporate governance are positively associated with the firm's probability of acquiring a customer-concentrated target.

Our study contributes to several research streams. Our work extends the literature investigating the determinants of M&As by documenting how a target's business model (i.e., customer concentration) affects the performance of M&A transactions, an area relatively unexplored by prior studies. This large body of literature has documented various factors significantly affecting a firm's decisions about M&As and M&A performance, including firm size (Moeller et al. (2004), Alexandridis et al. (2013)), board connections (Cai and Sevilir (2012)), social networks (Ishii and Xuan (2014), El-Khatib et al. (2015)), CEO inside debt holdings (Phan (2014)), investment banker directors (Huang et al. (2014)), human capital (Lee et al. (2018), Chemmanur et al. (2019)),

employee compensation contracts of target firms (Babenko et al. (2020)), acquirer organization capital (Li et al. (2018)), cultural similarity (Bereskin et al. (2018)), corporate social responsibility (Deng et al. (2013)), the legal and regulatory environment (Rossi and Volpin (2004)), and policy uncertainty (Nguyen and Phan (2017)). Our findings suggest that a target's customer concentration is an important determinant in M&A transactions and destroys the shareholder value of acquiring firms. Our work is related to that of Krolikowski et al. (2017), but our focus is different. Krolikowski et al. (2017) find that targets can benefit from strong customer-supplier relationships by receiving higher premium from acquirers and experiencing better stock announcement returns.[4] However, we suggest that a target's customer concentration is an important risk factor in M&A transactions and bidding customer-concentrated firms harms the shareholder value of acquirers.

This paper also adds to existing literature that examines the factors motivating merger and acquisition activity. Some research documents that multiple motives may be involved in mergers, including an increase in market power and synergies creation (Healy et al. (1992), Berkovitch and Narayanan (1993), Lee et al. (2018)), hubris (Roll (1986), Malmendier and Tate (2008), Seth et al. (2000)), and agency or managerial motives (Shleifer and Vishny (1988), Jenter and Lewellen (2015)). Our paper highlights the importance of shared major customers, CEO overconfidence, and corporate governance in the likelihood of firms undertaking a merger.

Furthermore, our study adds to the ongoing debate about how major customer concentration can affect supplier performance, accounting and financial policies, investment decision and market outcomes (e.g., Banerjee et al. (2008), Patatoukas (2012), Irvine et al. (2014), Cen et al. (2016a), Cen et al. (2016b), Dhaliwa et al. (2016), Campello and Gao (2017) and Cao et al. (2021)). To our knowledge, however, the prior research has paid little attention to the effect of the supply chain relationship on strategic investment decisions and the performance of firms as related to suppliers. Our study provides new empirical evidence on the economic consequences of customer concentration in the context of M&As and supports the risk hypothesis that market participants perceive the risks associated with a target's major customers to outweigh potential benefits. This study is also related to existing work on exploring how the composition of a firm's customer base affects business risks (e.g., Dhaliwa et al. (2016), Huang et al. (2016a), and Cohen and Li (2020)). From the perspective of acquiring shareholders, we show that relying on different types of major customers has differential effects on the acquirer's shareholder value creation. That is, the presence of major government customers helps to mitigate

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[4] Based on a much bigger data set, we find the relation between the target's customer concentration and its announcement returns is negative but statistically insignificant, suggesting that the target's shareholders do not receive many gains from the merger if the target has a concentrated customer base.

risks associated with a target's customer concentration.

The remainder of this paper is organized as follows. In Section 2, we develop testable hypotheses. Section 3 introduces our sample, explain the construction of the key variables, and report descriptive statistics. Section 4 presents the main results for the relation between the target's customer concentration and M&A performance and our endogeneity analyses. Section 5 documents the results of additional heterogeneity tests. Section 6 discusses the potential motives for a firm to acquire a target with a concentrated customer base. Section 7 presents a set of robustness checks. Section 8 concludes.

2. Hypotheses Development

Acquiring a target with a concentrated customer base can affect M&A outcomes in complex ways. Previous studies have documented that firms with high levels of customer concentration could improve firms' operational efficiency and profitability (e.g., Patatoukas (2012), Irvine et al. (2014), Krishnan et al. (2019), Crawford et al. (2020)). In the context of M&As, improving efficiency and promoting growth is a key consideration for the acquiring firm. Firms with a concentrated customer base can achieve better performance and higher productive efficiency because of decreased marketing, selling, general, and administrative expenses; improved asset utilization; increased recurring revenue from major customers; enhanced production distribution; and shortened cash conversion cycles (e.g., Kalwani and Narayandas (1995), Patatoukas (2012), Irvine et al. (2014), and Ak and Patatoukas (2016)). A close relationship between suppliers and major customers also fosters information sharing, coordination, and collaboration along the supply chain, thereby improving working capital and the management of production and encouraging innovation (Kumar (1996), Kinney and Wempe (2002), and Chu et al. (2018)). Anderson, Havila, and Samli (2001) suggest that efficiencies accrued to suppliers with concentrated customer bases are transferable through mergers. Thus, acquiring a target with major customers may provide the acquirer with access to these improved efficiencies and benefits, yielding a positive value to the acquirers' shareholders (hereafter, the efficiency effect). Moreover, having stable major customers provides a certification of the supplier's quality (Tirole (1988), Chevalier and Goolsbee (2009), Itzkowitz (2013)). The certification effect sends a positive signal to investors, resulting in a favorable market reaction to the merger transaction involving the target with a concentrated customer base.

A target's customer concentration also can be viewed as a source of risk to M&A transactions and post-merger integration for several reasons (hereafter, the risk effect). First, a heavy reliance on a few customers could pose significant business risks to suppliers. Financial distress and bankruptcy can permeate the supply

chain, thereby unleashing a contagion effect (e.g., Hertzel et al. (2008), Jorion and Zhang (2009), Kolay et al. (2016)). If a major customer becomes financially distressed, declares bankruptcy, or switches to another supplier firm, the supplier will experience a sizable drop in its revenues and cash flows. In the M&As setting, the supplier-customer relationship becomes even more vulnerable. A strong customer-supplier relation often involves the supplier committing into relationship-specific investments and providing customized products to its major customers and a close personal connection between the top managers and major customers (Krug and Hegarty (2001), Banerjee et al. (2008), Campello and Gao (2017)). The change of control associated with an M&A may increase the likelihood of customers switching suppliers by disrupting the target's operations and the personal connection and reducing committed relationship-specific investments (Krug and Hegarty (1997)). Cen et al. (2016b) also suggest that threat of a takeover can impose costs on firms by adversely affecting relationships with major customers, resulting in deteriorating operating performance. Thus, the risk stemming from the target's major customer turnover will be absorbed by the acquirer and have a prolonged, negative effect on the combined entity.

Second, to ensure smooth integration and realize productivity gains and other synergies from acquiring a customer-concentrated target, the acquirer is required to make significant relationship-specific investments and long-term purchase commitments during post-acquisition integration so as to retain and maintain relationships with the target's major customers. Large customers tend to divert a disproportionate share of resources away from a larger number of smaller ones, as management could feel the need to cater to the top buyers. This diversion makes diversifying the customer base difficult and increases overdependence on too few customers in post-acquisition operations, which may increase the combined firm's cash flow risk. In addition, major customers enjoy stronger bargaining power not accessible to smaller customers (Piercy and Lane (2006) and Chiu et al. (2019)). They are more likely to engage in ex post renegotiation over contract terms, including low prices, and extended trade credits, with the acquirer. Doing so requires the use of a liquidity buffer to cope with long payment terms and late payment. Additional cash holdings may force the acquirer to reduce dividend payments and engage in tax avoidance and earnings management (Raman and Shahrur (2008), Wang (2012), and Huang et al. (2016a)), which, in turn, expose acquirers to unfavorable publicity and to the risk of litigation and penalties. These lead to an adverse effect on the outcome of acquisitions involving targets with major customers.

Third, suppliers with a concentrated customer base face higher costs of equity capital and bank loans, as prospective equity investors or debt holders view such firms as having a higher likelihood of default (Dhaliwal

et al. (2016) and Campello and Gao (2017)). The debt burden would be transferred to the acquirer purchasing a customer-concentrated supplier. The costs of financing either for the M&A transaction itself or for post-acquisition operation are expected to increase, which may deteriorate the market's reaction to the transaction and the synergy effect from integration. Taken together, we expect that the target's customer concentration is an important risk factor in M&A transactions and hypothesize that acquiring targets with concentrated customer bases reduces shareholder gains from mergers.

To summarize, both the efficiency improvement and risk effects of customer concentration have been discussed in the literature, and they can lead to contradictory implications for M&A transactions involving a target with a concentrated customer base. We, therefore, formalize the above discussions with the following competing hypotheses:

H1a: The target's customer concentration positively affects merger performance.

H1b: The target's customer concentration negatively affects merger performance.

3. Data and Empirical Methodology

3.1. Sample selection

We obtain M&A data from the Securities Data Company (SDC) Platinum database, customer concentration data from the Compustat Segments Customer database, stock return data from the Center for Research in Security Prices (CRSP), and financial statement information from the Compustat. Our initial sample encompasses all completed M&As valued at $1 million or more over the period 2000–2017[5] for which both the acquirer and the target are U.S. publicly listed companies. Following Erel et al. (2012), we exclude spin-offs, recapitalizations, self-tender offers, exchange offers, repurchases, minority stake purchases, acquisitions of remaining interest, and privatizations. To ensure a transfer of corporate control, we further require that the acquirer should control less than 50% of the target's shares before the M&A and own 100% of the target's shares after the transaction. If more than one deal involving the same acquirer on the same day is recorded in the SDC database, we retain the one with the largest transaction value. We construct our final sample by requiring the deal to have available financial data for the acquirer and the target in Compustat and sufficient stock price data from CSRP to calculate abnormal returns. These restrictions leave us with 1,446 successful

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[5] Major customer disclosure requirements were initially introduced in 1976 by the Statement of Financial Accounting Standards (SFAS) No. 14, which was superseded by the SFAS 131 in 1997. SFAS 131 still requires firms to disclose the total amount of revenue from each customer that contributes more than 10% of total revenue, but no longer requires them to report the identity of such customers. Because of the change in regulations, several firms restated their customer segment information during 1998–1999 (Banerjee et al. (2008)). To avoid any potential bias caused by the change in regulation, we start our sample period in year 2000.

mergers with acquirer information available and 1,152 deals with acquirer and target firm information available.

Table 1 presents the distribution of our M&A sample by acquirer industry and announcement year. As reported in Panel A, considerable heterogeneity is evident in the deal frequency by year. Consistent with the pattern of the 5th and 6th merger waves, our sample shows a very active M&A market over 2000–2001 and 2004–2006. The number of deals diminishes to a relatively low level during the 2008 financial crisis and rebounds to a high level in the period 2014 to 2016. The patterns in the two subsamples (i.e., targets with and without major customers) across years follow a similar trend as in the full sample. Panel B shows the distribution of industries (Fama-French 12 industry) in the sample. Consistent with Cai and Sevilir (2012), the greatest number of M&As takes place in the Finance (34.16%) industry, followed by the Business Equipment and Healthcare industries with the proportions of 23.17% and 9.89%, respectively. Transactions involving targets with major customers are concentrated in some industries, including Business Equipment, Healthcare, Oil, Gas and Coal Extraction, and Products and Manufacturing.

[Table 1 is about here]

3.2. Customer concentration measures

We use the Compustat Segments Customer files to identify the major customers of each target firm. The Statement of Financial Accounting Standards No. 14 (SFAS 14) and SFAS 131 require a supplier to disclose external customers that individually account for 10% or more of its total sales. Some suppliers voluntarily report customers that contribute to less than 10% of their total sales; thus, the information is also recorded in the Compustat.[6] In this paper, to alleviate the concern of selection bias, we treat a customer that accounts for at least 10% of total sales as a major customer.[7]

We follow prior studies and construct three primary measures to capture the customer concentration of the target firm. Our first measure is an indicator variable, $Major\ Customer_{it}$, that is equal to one if a target firm reports at least one major customer in a given year, and zero otherwise (e.g., Cen et al. (2016a), Dhaliwal et al. (2016)). In our sample, 30.98% of deals involve targets reporting that they have at least one major customer.

Our second customer concentration measure is defined as the sum of sales to all major customers scaled

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[6] After matching the targets in the SDC database to firms in the Compustat Segments Customer Database, we find that there are 592 deals for which customer records are available for the target.

[7] SFAS No. 14 and 131 require all public firms to disclose their customers that represent 10% or more of the firm's total sales. The Compustat Segments Customer Database collects information including the names of the customers and their assigned sales figures accordingly. The compulsory action allows us to count all major customers whose sales make up 10% or more of each target's total sales. However, if we use a cutoff below 10%, such as 5%, some firms report their customers that account for 5%–10% sales voluntarily, but others may not, which may lead to the concern of selection bias. Nevertheless, our results are qualitatively unchanged if we use the 5% of total sales as the threshold to define major customers.

by total sales (e.g., Banerjee et al. (2008), Huang et al. (2016a)). Specifically, $MajorALL_{it}$ of target i at year t with J major customers is computed as

$$MajorALL_{it} = \sum_{j=1}^{J} \frac{Sales_{ijt}}{Sales_{it}} , \qquad (1)$$

where $Sales_{ijt}$ denotes the sales of target firm i to major customer j at year t, and $Sales_{it}$ denotes the total sales of target firm i at year t. A higher value can be interpreted as higher customer concentration. If a target does not have a major customer or does not have customer information recorded in the Compustat Segments Customer Database in a given year, we set the value of $MajorALL_{it}$ to zero.

As our third measure of customer concentration, we employ the HHI of sales, a common proxy for market concentration and competition (e.g., Patatoukas (2012), Crawford et al. (2020)). This measure could capture two elements of customer concentration: (a) the number of major customers and (b) the relative importance of each major customer in the firm's total sales. The measure is constructed as follows:

$$HHI_{it} = \sum_{j=1}^{J} \left(\frac{Sales_{ijt}}{Sales_{it}} \right)^{2}, \qquad (2)$$

where $Sales_{ijt}$ and $Sales_{it}$ follow the same definitions used in Equation (1). HHI is bounded between 0 and 1, where higher values indicate more concentrated customer base.[8]

3.3. M&A performance measures

This subsection describes the construction of the merger performance measures used in the following tests. We use acquirer's five-day CARs centered on the deal announcement day, that is, CAR (-2, 2), as one of the main merger outcome measures.[9] The acquirer CAR captures the market's view of whether the acquirer's management is creating or destroying shareholder wealth through the proposed merger (John et al. (2015)). We obtain CARs for the acquirer from a market model estimated using the CRSP value-weighted index return as a proxy for market returns. The estimation period is from 241 trading days to 40 days before the announcement. Following Kaplan and Weisbach (1992) and El-Khatib et al. (2015), we calculate CARs for the combined firm as the market-value-weighted average of CARs of the acquirer and the target over five trading days around the announcement to proxy for total synergies generated by the merger. The weights are based on the market values of the acquirer and the target's equity eleven days prior to the merger announcement day. We also use long-run

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[8] This measure equals zero for targets that do not disclose sales to any major customers and equals one for a target that completely relies on a single major customer for all annual sales.
[9] Our results remain robust when we use CARs over three-day event windows for the acquirer and the combined firm.

stock market reactions and operating performance, as proxied for by one-, two- and three-year BHARs, and changes in returns on assets (ROA), as alternative measures of merger performance.

3.4. Empirical methodology

To examine the relation between target customer concentration and merger outcomes at the deal level, we estimate the following specification:

$$M\&A\ performance_{d,t}$$
$$= \alpha + \beta \times Customer\ concentration_{i,t-1} + \lambda \times \textbf{\textit{Firm\_C}}_{d,t-1} + \mu \times \textbf{\textit{Deal\_C}}_{d,t} + \gamma_{year} + \delta_{ind}$$
$$+ \varepsilon_{i,t}\ ,$$

where d, i, and t correspond to the deal, target firm, and the year of acquisition, respectively. $M\&A\ performance_{d,t}$ is our merger performance measure. We mainly use the acquirer's five-day CARs around the announcement date of the acquisition, that is, CAR (-2, 2) to measure the merger outcome. $Customer\ concentration$ represents one of three measures defined in Section 3.2, that is, *Major Customer*, *MajorAll*, or *HHI*.

_Firm_C_ and **_Deal_C_** are vectors of firm-level and deal-level control variables, respectively. Following the prior literature, we control for a set of acquirer-specific characteristics that substantially affects acquirer returns, including firm size, Tobin's Q, free cash flows, and leverage (e.g., Lang et al. (1991), Maloney et al. (1993), Moeller et al. (2005)). Considering that potential information leakage before the announcement might induce ex ante market reactions, we further include $Stock\ price\ run\_up$, measured by the BHAR of the acquirer over the period from 210 to 11 days before the deal announcement (John et al. (2015)). Prior studies show that payment method is related to the ex ante stock market performance of the acquirer (e.g., Moeller et al. (2004), Officer et al. (2009)), so we include two payment indicators: one is $Pure\ stock\ deal$, which takes the value of one if the deal is fully financed with stock and zero otherwise, and the other is $Mixed\ deal$, which indicates that the acquirer completes the transaction using a proportion of stock as payment. We also control for the relative size of the deal, which is calculated as the ratio of the transaction value to the acquirer's market value of equity, and an indicator ($High\ tech$) that equals one if the acquirer and target both belong to high-tech industries, and zero otherwise.

All firm-level control variables in the model are lagged one year relative to the announcement year. M&A performance and customer concentration should vary largely by industry, so we also control for the industry fixed effect, δ_{ind}. We include year fixed effect (γ_{year}) to control for time-varying macro factors that might affect M&A performance. Table A1 in the Appendix defines the variables in detail.

3.5. Descriptive statistics

Table 2 reports descriptive statistics for the key variables used in this study. Panel A provides the summary statistics for the customer concentration measures for both the full sample and the subset of targets with (without) a major customer. In our sample, 31% of acquisitions involve a target with at least one major customer accounting for 10% or more of sales. For the subset of targets that disclose at least one major customer, the mean sales to all major customers account for 42.3% of total sales.[10] Over the sample period, the mean values of *HHI* for the full sample and the major customer subsample are 0.045 and 0.146, respectively.

Panel B of Table 3 reports the summary statistics for the acquirer and the target as well as the deal characteristics. The first two columns of the table report the means and standard deviations for the full sample. Compared to the target, the acquiring firm tends to have a larger size, a larger Tobin's Q, free cash flow and stock price run-up, and smaller market leverage. Specifically, the means of *Firm size, Tobin's Q, Leverage, Free cash flow*, and *Stock price run-up* are 8.127, 1.591, 0.165, 0.020, and 0.063, respectively, for acquiring firms, and 6.267, 1.430, 0.179, 0.011, and 0.023, respectively, for target firms. As for deal characteristics, we notice that 29.1% of deals are completed with 100% stock payment and 41.3% of deals involve both stock and cash payments. The transaction value accounts for approximately 28.4% of the acquirer's market value on average, and high-tech companies actively engage in M&As, taking a proportion of 23.5% in our sample.

Columns (3)–(6) report summary statistics for the subsamples of targets with and without a major customer. Compared with acquirers bidding on targets without major customers, acquirers bidding on customer-concentrated targets have a smaller size, a higher Tobin's Q, and lower leverage. Similarly, targets with a major customer are smaller in size and have a higher Tobin's Q compared with their peers. However, we do not observe significant differences for either free cash flow or stock price run-up between subsamples with and without a major customer. For the payment method, deals involving targets with a major customer are less likely to be mixed paid. We also see that the acquisitions of customer-concentrated targets are more likely in high-tech industries. The comparisons reveal that deals with or without a major customer vary substantially along many dimensions, and they validate the controls we use in our multivariate analysis.

[Table 2 is about here]

4. Target Customer Concentration and M&A Returns

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[10] It is worthy of note that the biggest proportion of sales accounted for by major customers is 100%. This occurs in the case of Trubion Pharmaceuticals Inc., whose single major customer was Wyeth LLC in 2007 and 2008.

4.1. Univariate analysis

Table 3 reports acquirer CARs and combined CARs, as well as acquirer BHARs for the full sample, followed by a comparison of the two subsamples based on whether or not the targets have a major customer. The mean (median) CARs for the full sample are negative for the acquirers. For example, the mean CAR (-2, 2) for the acquirer is -0.01%, confirming that M&A transactions overwhelmingly destroy the acquirer's short-term shareholder wealth in prior literature (e.g., Andrade et al. (2001), Cai and Sevilir (2012), and Ishii and Xuan (2014)). A comparison of the two subsamples uncovers that acquirers with a major customer experience a more unfavorable market reaction than those without a major customer. For example, the difference of approximately 0.8% over the five-day window is statistically significantly different from zero and also economically meaningful. In addition, a comparison of the combined announcement returns for the subsamples reveals that the value creation effect is larger in deals without a major customer. However, the difference in CARs is statistically, insignificantly different from zero.

The BHARs indicate the difference between the buy-and-hold returns of a sample firm and that of the market portfolio proxied for by the value-weighted CRSP index returns over the one-, two-, and three-year periods following an M&A deal. The mean values of acquirers' one-, two-, and three-year BHARs are 2.8%, 3.2%, and 3.8%, respectively, suggesting M&A transactions create positive long-term value to the acquirer shareholders. On closer examination of the subsamples, however, we discover that the value creation is almost entirely generated from deals in which the acquirer pursues a target without a major customer. On the other hand, if the acquirer pursues a target with a major customer, the acquirer suffers a substantial loss. Specifically, the means of one-year BHARs are -1.6% and 4.7% for deals with and without major customers, respectively; the figures correspond to -1.9% and 5.5% over a 2-year horizon. The equalities in mean one- and two-year BHARs between the two subsamples are rejected at least at the 5% level.

The univariate analysis delivers a consistent message: a target's higher customer concentration of is associated with a loss in value to the acquirer's shareholders in the short and long runs.

[Table 3 is about here]

4.2. Multivariate analysis

In this subsection, we examine the association between a target firm's customer concentration and M&A performance in a multivariate setting, in which we can further control for acquirer, target, and deal characteristics that have been documented in the literature to influence merger outcomes.

4.2.1. Announcement returns

We first examine the relation between the level of the target's customer concentration and the acquirer's announcement returns, which capture the market's view of whether the acquirer's management is creating or destroying shareholder wealth through the merger. Table 4 provides multivariate tests. The dependent variable is the five-day abnormal returns around the announcement dates. Columns (1)–(3) correspond to three measures of customer concentration, *Major Customer*, *MajorALL*, and *HHI*, respectively. The coefficients for all three measures of customer concentration are negative and statistically and economically significant, suggesting that the acquisition of a customer-concentrated target imposes a substantially negative wealth effect on acquirer shareholders.[11] For example, in Column (1), the presence of at least one major customer for the target is associated with a reduction of 1.7 percentage points in the acquirer CAR (-2, 2). Considering that the average market value is $17.91 billion, the reduction could translate into a loss of $304.47 million to acquiring firms' shareholders. The economic magnitudes are also substantial for the other two measures. In Columns (2) and (3), a one-standard-deviation increase in *MajorALL* and *HHI* would decrease acquirer CARs by 76.48% and 50.74% on average, respectively. Unfavorable market reactions imply that a target with major customers imposes additional integration costs and reduces the intrinsic value of a merger. This corroborates the view that significant risks are embedded in a target's concentrated customer base and support our hypothesis H1b.[12]

The coefficients for other control variables mainly produce predictable signs. Acquirers experience significantly lower returns among stock financing deals, consistent with Amihud et al. (1990). The higher stock price run-up prior to the announcement date destroys the acquirers' shareholder value. This finding may capture a potential information leakage (e.g., Cai and Sevilir (2012), Masulis et al. (2007)). There is also a positive effect from leverage on acquirer returns (e.g., El-Khatib et al. (2015)).

[Table 4 is about here]

One of the criteria for a successful merger is total synergy gains. Hietala et al. (2003) suggest that the acquirer's losses could be offset by the expectation of large synergy gains from the deal as a whole. To test the implications of the target's customer concentration for the total takeover synergies, we estimate the regressions using the market-value-weighted average of the CARs for the acquirer and the target over a five-day event window around the announcement; that is, the combined CAR (-2, 2) is our dependent variable. The primary explanatory variables of interest are still the target's customer concentration. We control for acquirer, target, and

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[11] If we use the a 5%, 15%, 20%, or 25% threshold of total sales to classify a customer as a major customer, the estimated coefficients for the three measures of customer concentration are consistently and negatively related to the acquirer CAR.
[12] Our main findings are robust to the inclusion of an industry-year fixed effect. For brevity, the results are not tabulated but are available on request.

deal characteristics that could affect the combined CARs. The results are reported in Appendix Table A2. Across all specifications, the extent of target's customer concentration is consistently and negatively related to the combined abnormal returns. The results confirm the notion that the target's customer concentration can interfere with post-merger integration and thereby stymie value creation for shareholders.

4.2.2. Long-run buy-and-hold abnormal returns

The integration of two firms, including assets, organization, management, human resources, and corporate culture, requires a long length of time to be realized. Thus, the potential impact of acquiring a customer-concentrated firm on the post-acquisition operations is agnostic at the time of the merger announcement. Market participants might underestimate or overestimate the risks associated with the target's customer concentration base around the deal announcement and react differently after incorporating sufficient information. It is, therefore, necessary to examine whether the target's customer concentration persistently influences the acquirer's shareholders, specifically their wealth. We follow Rau and Vermaelen (1998) and measure long-term value creation using the post-merger stock returns of the acquirer over a three-period following the year of acquisition. BHARs indicate the difference between the buy-and-hold returns of a sample firm and that of the market portfolio proxied for by the value-weighted CRSP index returns over the one-, two-, and three-year periods following an M&A deal.Table 5 reports the results from the regression models.

Except for the coefficient for *Major Customer* in the two-year regression BHAR, all other coefficients on the post-merger abnormal stock returns over two-year horizon consistently exhibit significantly negative signs, suggesting that bidding a customer-concentrated firm not only affects the stock market assessment at the instant of the announcement but also destroys the shareholder value over a relatively long-term horizon. Taking *MajorALL* as an example, a one-standard-deviation increase in the proportion of sales to all major customers is associated with a decrease of 3.56% and 3.11% in abnormal returns for holding periods of one and two years, respectively. However, we find only one of three customer concentration measures (i.e. *HHI*) maintains its significance in three-year BHAR regressions, implying that the negative effect of target customer concentration become weakened.[13] Market investors may perceive that acquiring firms can learn how to deal with the issues brought by the major customers over a long horizon.

The unreported results for the control variables are similar to those in Table 4. Firms with a smaller size or a higher growth potential tend to perform worse in the long run, as these firms are not equipped to tackle the

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[13] Because of the concern for the noise in the long-run return variables, many studies only examine the BHAR performance over two-year horizons (e.g., Bouwman et al. (2009), Phan (2014), Oh (2018)).

problems associated with customer concentration, lack of bargaining power, for example. Likewise, a larger relative size of an acquirer to a target enhances the long-run stock market performance after the merger. Also, market reactions before the announcement and stock payments are negatively associated with the BHARs.

[Table 5 is about here]

In sum, Tables 4 and 5 consistently show a picture that acquiring targets with a concentrated customer base deteriorates acquirers' short- and long-term stock performance. These negative effects are significant, both statistically and economically, implies that acquirers may underestimate the risks associated with customer concentration.

4.2.3 Wealth transfer or performance effect

CARs capture not only performance but also wealth transfer, and, thus, the deteriorating effect of target customer concentration on acquirer returns can be explained in two ways.[14] First, some prior studies show that mergers themselves do not create shareholder value but instead transfer wealth from acquirers to targets (e.g., Roll, (1986)). In our case, the acquirer may favor a target with major customers, as a strong and stable relationship between major customers and suppliers can generate many potential benefits, such as reducing transaction costs or shortening cash conversion cycles. The positive expectations may induce the acquirer to pay a premium for the target, further affecting the allocation of surplus created around the announcement dates between the acquirer and the target. Second, the acquisition of a customer-concentrated target is associated with substantial liquidity and business risks ex-post, which could deteriorate the long-run operating performance of the acquirer. To disentangle the two explanations of wealth transfer and performance effects from one another, we examine the relations between the target's customer concentration and, in turn, the takeover premium, the relative gain of the target, and the long-run operating performance of the acquirer.

The takeover premium is regarded as an important dimension along which to examine the source of gains or losses in a merger. We define the takeover premium as the difference between the price paid per share and the target share price 20 days prior to the announcement date, and we regress it on our customer concentration measures as well as on other firm- and deal-level controls.[15] The results are reported in the first three columns of Panel A of Table 6. Across all specifications, the estimated coefficients on the variables of customer concentration are insignificant, suggesting that the acquirer does not buy the customer-concentrated target at a higher premium. To further check whether the allocation of synergies is affected by the level of target's customer

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[14] We thank an anonymous reviewer for this insightful comment.
[15] Premiums are truncated at −100% and 200%, as suggested by Officer (2003).

concentration, following Ahern (2012), we calculate a relative gain of the target as the difference in dollar gains between the target and acquirer scaled by the sum of acquirer's and target's market value 50 days prior to the announcement date. The measure is specifically defined as $\Delta\$Target\ CAR = \frac{Target\ MV \times TCAR - Acquirer\ MV \times ACAR}{Acquirer\ MV + Target\ MV}$. In Columns (4)–(6), we find no evidence of a significant relation between $\Delta\$Target\ CAR$ and our customer concentration measures. These results provide weak support to the explanation of wealth transfer, which suggests the acquirer pays a higher price and the target obtains a larger proportion of surplus created at the announcement.

Another way of explaining why target customer concentration is associated with low CARs is that market investors regard a concentrated customer base as a risk factor for post-merger operations. Thus, we test this prediction by investigating the impact on the operating performance of the acquirer. We use two measures of changes in ROA to reflect post-merger operating performance because change measures are more likely to capture the abnormal pattern (Barber and Lyon (1996)). The first one is the change in the acquirer's ROA between the year subsequent to the merger and the year prior to. In addition, following Healy et al. (1992), Chen et al. (2007), and Ben-David et al. (2020), we calculate an abnormal change in ROA over the 3-year horizon after the announcements by estimating the model as follows:

$$\frac{1}{3}\sum_{t=1}^{3}(ROA_{i,t} - ROA_{ind,t}) = \alpha + \beta\frac{1}{3}\sum_{t=-3}^{-1}(ROA_{i,t} - ROA_{ind,t}) + \epsilon_{i,t}\,, \tag{4}$$

where i, ind, and t denotes the acquirer, acquirer's industry, and year, respectively. Year 0 is the merger year. The right-hand side is the three-year average industry-adjusted ROA in pre-merger periods, and the left-hand side is the three-year average industry-adjusted ROA in post-merger periods. Thus, the residual from the regression, as our second performance measure, captures the average change in operating performance driven by the merger event.

Panel B of Table 6 reports the results. Across all specifications, the extent of the target's customer concentration is consistently and negatively related to the ROA-related measures. Take *Major Customer* as an example, the presence of a major customer in the target will significantly decrease the abnormal ROA of the acquirer by 0.8 percentage points. The results imply that buying a customer-concentrated target deteriorates the acquirer's long-run operating performance. Taken together, we cautiously conclude that the pessimistic expectations on the post-merger operating performance, instead of the wealth transfer between the acquirer and the target, lead to unfavorable market reactions surrounding the announcement dates.

4.3. Endogeneity

Extensive literature has captured several good determinants of merger outcomes, such as board connections, director experience, and employee rights, which cannot be exhaustively controlled for in our estimations (e.g., Cai and Sevilir (2012), Field and Mkrtchyan (2017), John et al. (2015)). Hence, concerns about endogeneity may rise due to unobserved factors. Also, the relation between M&A performance and customer concentration in the abovementioned analysis is potentially subject to concerns about measurement error and estimation bias. Furthermore, if merger opportunities are predictable, targets may adjust their customer base in advance. In this case, observed relations between a target's customer concentration and announcement returns would be spurious. To address the endogeneity concerns, we perform several tests in following subsections.

4.3.1. An instrumental variable approach

We first employ an IV approach to validate our findings. We construct two instrumental variables. The first instrument is the number of potential major customers for a target. A look at the customer data informs us that a large proportion of major customers are notable companies with a strong influence in their industry. For example, the well-known Wal-Mart Stores Inc., Cardinal Health Inc., Hewlett-Packard Co., Home Depot Inc., Intel Corp., and Samsung Electronics Co. are the six companies most frequently featured as major customers. Given that (a) public firms are more likely to be sizeable monopolists, and (b) the geographic distance between firms is crucial to the match of supplier and customer (Bönte (2008)), we construct a pool of potential major customers as the instrument for a target's customer concentration by using the weighted number of nearby public firms in the same industry as a target's major customers. Specifically, the instrument is structured as follows: (a) we manually collect the industry information of each major customer from the Compustat Segments Customer Database and calculate the customer composition for each industry, that is, a set of industry-pair indicators of sales from industry i to major customers in industry j scaled by total sales of industry i;[16] (b) for a specific target q in industry i, we count the number of potential major customers, that is, public firms located in the q's state and adjacent state in each customer industry j $(j = 1, 2, ..., J)$ of industry i at time t; and (c) we calculate an industry-weighted number of potential major customers for the specific target q, that is, $\sum_{j=1}^{J} \frac{sales_{i,j,t}}{sales_{i,t}} \times number\ of\ listed\ firms\ nearby_{q,j,t}$.[17]

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[16] For example, in 2015, target companies whose SIC code was 3714 (motor vehicle parts and accessories) had 53.85% of their major customers coming from industry 3711 (motor vehicles and passenger car bodies), 38.46% from 3531 (construction machinery and equipment), and 7.69% from 5331 (variety stores).

[17] Some companies do not disclose their customer details. For example, the annual report of Robinson Nugent Inc. in fiscal year 1999

These procedures yield a firm-specific measure for each target, and we believe that they satisfy the two conditions of a valid instrument: relevance and exclusion. First, geographical proximity could increase the chance of customer-supplier match. The composition of potential major customers within a restricted distance from the target should affect the structure of the target's customer base. Second, the number of potential industry-weighted major customers will not directly affect M&A performance of an unrelated acquirer, aside from its influence on the customer concentration of the related target.

The second instrument is the one-year-lagged industry average of the number of major customers, that is, the mean for all firms—other than the target firm—in the same sector (three-digit SIC code) (see, e.g., Dhaliwal et al. (2016)). The industry average well represents the structure of customer base in the target's industry and other industry characteristics. The instrument is highly correlated with an individual target's customer base as it represents the structure of a supplier's industry. But it is less likely related to an acquirer's performance and merger outcomes after controlling for the individual target's risk.

Table 7 reports the results from a two-stage-least-square (2SLS) regression. The first-stage results of regressing each customer concentration measure on two instrument variables, $ln(1 + weighted\ number\ of\ potential\ customers)$ and $ln(1 + number\ of\ industry\ average\ major\ customers)$, are presented in Columns (1)–(3) and Columns (4)–(6), respectively, of Panel A.[18] All estimated coefficients for the instrument are significantly positive and so validate the relevance condition. The Kleibergen-Paaprk LM statistics suggest that our instrument passes the under-identification test. Also, except for the HHI measure, F-statistics from the regressions for the other two measures imply that the weighted number of potential customers and the industry average variable do not suffer from the weak instrument problem.

The second-stage results across all columns of Panel B consistently show a significantly negative association between acquirer returns and target customer concentration. The magnitudes of economic influence are comparable to those from the baseline estimations: for example, from Column (2) of Panel B, we find that a one-standard-deviation increase in the instrumented $\widehat{MajorALL}$ is associated with a reduction of 225 basis

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documents that the company has sales of approximately $14 million to customer A, $11 million to customer B, and $10 million to customer C. In this case, we search for other target companies that share the same industry code and have data available for the major customers in the preceding two years of M&As, so as to proxy for the customer composition of those firms with absent information.

[18] The values of these two instruments are always positive, so they may suffer from the problem of skewed distribution. The standard deviation and mean value of the potential major customer IV are 5.228 and 5.423, and those of the industry average IV are 0.742 and 0.967. This finding implies a relatively large volatility within the data. The logarithmic transformation makes the data less skewed and improves the fitness of the OLS estimations. Nevertheless, we adopt the absolute versions of two instruments to ensure robustness. We consistently find strong evidence of a significantly negative association between the acquirer's returns and the target's customer concentration. The results can be provided on request.

points in the acquirer's five-day abnormal returns. The results for the 2SLS regression thus ensure our baseline findings: the pursuit of a customer-concentrated firm is more likely to destroy an acquirer's shareholder value.

[Table 7 is about here]

4.3.2. Durbin-Wu-Hausman test

To formally test the extent of endogeneity, that is, unobserved heterogeneity at the firm level, which may decide both the level of customer concentration and M&A performance, we perform the augmented regression version of the Durbin-Wu-Hausman (DWH) test. Following the procedures in Davidson and MacKinnon (1993, chap. 7) and Drobetz and Momtaz (2020), we adopt a control function approach and model endogeneity in the error term. Specifically, we first model the endogenous customer concentration measures as a function of the exogenous regressors in our baseline model to obtain the residuals. In the second stage, we regress the acquirer CARs on each customer concentration measures, control variables, and particularly the DWH residuals.

According to Davidson and MacKinnon (1993), insignificant DWH residues in the second stage indicate that endogeneity is not a major concern. For each customer concentration measure, we test the endogeneity under this two-stage framework and report the results in Appendix Table A3. We find insignificant DWH residuals in all columns, suggesting that the observed customer-concentration-value relationship is less likely to be driven by unobserved heterogeneities.

4.3.3. Propensity score matching

To further address the endogeneity issues, we perform additional analysis using propensity score matching (PSM) technique (Caliendo and Kopeinig (2008), Roberts and Whited (2013)). Specifically, we first regress the indicator variable for whether the target has at least one major customer on the firm- and deal-level controls introduced in the baseline model and compute the propensity score for each observation in our sample. Next, we one-to-one match the deals in the treatment group, that is, targets that have at least one major customer, with the remaining deals that have the closest propensity score. We require that the computed propensity score between the treatment and the match is within a maximum distance of 0.05. The procedure yields a matched sample consisting of 894 deals.

To evaluate the validity of our matching procedure, we first estimate a logit model predicting whether the target has at least one major customer, and we report the results for the full sample in Column (1), Panel A of Table 8, and for the PSM sample in Column (2). We find that all of the estimated coefficients for the control variables are insignificant in the PSM sample, and the pseudo-R^2 is less than 0.01%. Thus, none of the controls explains the variation in whether the target has major customers. Second, we present the statistics of the

predicted propensity score for the treatment and the matched groups. No discernable differences of these statistics can be found in Panel B. Third, we perform the mean difference tests for all controls between the treatment and the match. The univariate comparisons in Panel C show that the deals in the two groups are statistically indistinguishable with respect to those variables used to generate the matched sample. Together, the diagnostic tests strongly suggest that our matching is successful. Panel D reports the regression results of our baseline model using the PSM sample. Across all columns, the estimated coefficients for the target's customer concentration are negative and statistically significant, suggesting that buying a customer-concentrated firm harms the shareholder value of the acquirer. These results reinforce the causal effect in our models.

[Table 8 is about here]

4.4. Acquirers' customer concentration

The unfavorable market reaction and long-run operating performance of the acquirer imply that the presence of targets' major customers is associated with high business risks and expenses in post-merger operations. We posit that the acquirer bears the disadvantages of an increase in the concentration of customer base. However, the acquisition of a target with concentrated customers may not necessarily mean an increase of the customer concentration of the new combined entity.[19] Then, the bad performance may not be attributed to the business risks brought by the targets' customer concentration. To substantiate our analysis, we provide evidence on the change in the level of acquirers' customer concentration before and after M&As, as well as its effect on the acquirers' returns.

Using the methodology described in Section 3.2, we construct three measures of customer concentration for each acquirer at the year prior to the announcement and the year subsequent to, and calculate the change over the specified horizon. We first investigate whether pursuing a target with a concentrated customer base will increase the degree of customer concentration of the acquirer after the merger. Columns (1)–(3) of Table 9 report the results. We include the same firm and deal controls as in the baseline model and additionally control for an indicator for whether the acquirer has a major customer before the merger. Across all specifications, the results show a significantly positive relation between targets' customer concentration and the change in acquirer's customer concentration. Next, we examine the relation between the change of acquirers' customer concentration and announcement returns. The results in Columns (4)–(6) provide strong evidence that the increase in the

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[19] Take a simple numerical case for example. An acquirer has two major customers, each one taking 50% of the total sales. The HHI of the acquirer is 0.5. A target has one major customer taking 100% of its sales, and the HHI of the target is 1. Supposing that the acquirer is two times bigger than the target and there are no overlapped customers, the HHI of the combine entity is 0.344. In this case, acquiring a customer-concentrated target actually diversify the customer base of the acquirer. We thank an anonymous reviewer for point this out.

acquirers' customer concentrations lead to unfavorable stock market reactions surrounding the announcements. Overall, the findings in Table 9 suggest that the acquisition of a target with concentrated customers leads to an increase in the acquiring firm's customer concentration and also deteriorates merger performance.

[Table 9 is about here]

4.5. Horizontal and vertical M&As

The motives behind the horizontal and vertical M&As are different. Many studies document that horizontal mergers can reduce the market competition and increase the bargaining power against either suppliers or customers (see, e.g., Levin (1990); Kim and Singal (1993)), and others suggest that horizontal mergers are motivated by efficiency improvement reasons (See, e.g, Eckbo and Wier (1985), Shahrur (2005), Bhattacharyya and Nain (2011)). Vertical mergers, however, allow firms to substitute the internal exchange within the boundaries of the firm for contractual or market exchanges (Fan and Goyal (2006)). Buying firms in the supplier or customer industries can reduce transaction costs and mitigate the hold-up problems (Perry (1989)). Such different motives of mergers may generate substantial heterogeneity in the relation between targets' customer concentration and acquirers' returns.

In horizontal mergers, acquiring a target with a concentrated customer base in the same industry might mitigate the business risk associated with the target's customer concentration, because the merged firm would have strong bargaining power against the target's major customers. In vertical mergers, acquiring an upstream target with a high level of customer concentration may strengthen the acquirer's position against its competitors that are the target's major customers. In this case, some existing major customers may choose to switch the supplier after the merger and the business risk of the merged firm will be significantly increased.[20]

To examine whether the effect of targets' customer concentration is heterogeneous, we follow Ahern and Harford (2014) to classify our deals into horizontal and vertical mergers. Horizontal mergers are identified by any overlap of industry codes between the acquirer and the target. Drawing on the data of Input-Output Table provided by the U.S. Bureau of Economic Analysis (BEA), we classify a deal as a vertical merger if any of the following four ratios exceed the threshold of 1%: (1) the percentage of the acquirer industry's sales that are purchased by the target industry, (2) the percentage of the target industry's sales that are purchased by the acquirer industry, (3) the percentage of the acquirer industry's inputs that are purchased from the target industry, and (4) the percentage of the target industry's inputs that are purchased from the acquirer industry. We also use

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[20] We thank an anonymous reviewer for pointing out these differences between horizontal and vertical deals.

a 5% threshold to define vertical mergers for a robustness test. We then regress the analogous regressions of the baseline model based on horizontal deals and vertical deals, respectively.

The results in Table 10 show that all of the estimated coefficients on customer concentration are negative and statistically significant, suggesting that buying a firm with a concentrated customer base either in the same industry or in a vertical-related industry imposes a significantly negative effect on the acquirer's returns. The economic magnitude of the negative effect is slightly larger in vertical mergers relative to horizontal mergers. Take *Major Customer* for example, the presence of a target's major customer decreases the acquirer CAR by 1.9 percentage points in horizontal subsample and by 2.7 percentage points in vertical subsample using 1% threshold. We cautiously conclude that, though the market power of the merged entity is strengthened in the horizontal merger, it cannot neutralize the business risks associated with customer concentration and thereby leads to unfavorable returns.

[Table 10 is about here]

5. Cross-sectional Analyses

In this section, we substantiate our main findings by conducting a set of cross-sectional analyses. Several factors could alter the extent of a target's reliance on major customers and the impact on M&A performance. Therefore, we attempt to elucidate those factors shaping the relation between the target's customer concentration and the acquirer's returns.

5.1. Corporate customer versus government customer

Prior studies have shown that corporate customers and government customers impose differential impacts on the supplier's risk level (e.g., Banerjee et al. (2008), Dhaliwa et al. (2016), and Huang et al. (2016a)). Being largely dependent on major corporate customers is often perceived as an unstable factor for a supplier's revenue, whereas holding a large contract with government buyers is perceived to be less risky. Government customers are not driven by a profit motive and tend to sign a long-term contract with their suppliers, both of which lower the risk for firms that government customers switch to alternative suppliers. Moreover, government customers seldomly default or go bankrupt and thus provide stable revenue to suppliers compared with their counterparts. A contract with the federal government could also signal the existence of political connections, raising the significance and reputation of the supplier within its industry. In this sense, having government customers could mitigate the risk of customer concentration. For example, Dhaliwal et al. (2016) and Huang et al. (2016a) suggest that suppliers that depend on major government customer experience lower costs of equity and are less

likely to engage in tax avoidance, respectively. Likewise, we hypothesize that the negative effect of customer concentration on the acquirer's returns is mainly driven by corporate customers, while the concentration of government customers might affect the acquirer's returns in a beneficial way.

To disentangle the effects of major corporate and major government customers, we construct two sets of concentration measures, namely, $Major\ Customer\_Govt$, $MajorALL\_Govt$, HHI_Govt, and $Major\ Customer\_Corp$, $MajorALL\_Corp$, and HHI_Corp, and report simple statistics in Panel A of Table 11. On average, 4.63% of targets in our sample have at least one government customer that accounts for more than 10% of their total sales, and the figure for corporate customers is 27.59%. Mean sales to all major government and major corporate customers account for 2.21% and 11.02% of total sales, respectively.

We separately examine the relation between the acquirer's returns, CAR (-2, 2), and two types of customer concentration and report the results in Panels B and C, respectively. In the context of corporate customers, again, we find that the customer concentration is significantly and negatively associated with the acquirer's returns. For example, the presence of a major corporate customer in the target's customer concentration reduces the acquirer's announcement returns by 170 basis points. Similarly, the coefficients for the other two corporate customer concentration measures are negative and statistically significant at the 1% level, and their magnitudes are also comparable to those in benchmark estimations. These results indicate that higher levels of corporate customer concentration for targets are associated with significantly lower acquisition returns.

By contrast, in Panel C, we observe that all coefficients for measures of government customer concentration enter with insignificant signs, with two of three even showing positive signs. The results corroborate our conjecture that acquisitions of targets having a strong customer-supplier relationship with the government do not harm the acquirer's shareholder value. If government customers represent a more stable relationship compared with corporate customers, we expect to see the target with a major government customer so as to neutralize the negative effect of customer concentration on acquisition returns. To test the moderating effect of government customers, we include the interaction terms between the indicator variable, $Dummy\_Govt$, with our customer concentration measures. In unreported results, we observe that the coefficients for the interaction terms are all significantly positive, implying that a stable and deep relationship with a government customer can limit potential losses to an acquirer and increase the market participants' confidence about the deal.

In summary, our findings suggest that the negative effect of customer concentration on the acquirer's shareholder value around M&As is mainly driven by major corporate customers and support the notion that suppliers with a concentrated customer base of safer government customers face less risk from having a

concentrated customer base.

[Table 11 is about here]

5.2. Customer switching costs

The risk of having a major customer derives from the fact that the major customer can switch to other competitive rivals. A switch can ignite a large loss of ex ante customized expenditures and sales revenues and increase the likelihood of a firm becoming financially distressed. Switching costs (or switching barriers) play an important role in a supplier-customer relationship and measure how easily a customer can switch to alternative suppliers (Huang et al. (2016a)). Therefore, we next examine whether the effect of a concentrated customer base on announcement returns varies with the likelihood that a target loses its major customers. We expect that a major customer with lower barriers to switching suppliers increases the uncertainty of the merged entity's cash flows and challenges the liquidity management of the acquirer. As a result, the negative relation between the target's customer concentration and the acquirer's returns should be more salient when the target's customers face lower switching costs.

The industry market share of a supplier implicitly reveals the level of switching costs for its customers (Inderst and Wey (2007), Dhaliwal et al. (2016)). A low industry market share implies that customers can purchase from many alternative suppliers and a high likelihood that a target's major customers will switch suppliers after the acquisition closes. To test our prediction, we construct a dummy variable, *High switching costs*, that equals one if the industry market share of the target is above the industry median (market share based on the three-digit SIC code) in a given year and zero otherwise. This indicator captures a group of targets with high barriers to switching. We include this variable and its interactions with three measures of customer concentration and report the estimation results in Panel A of Table 12.

As we expected, all coefficients for the interaction terms are significantly positive, suggesting that the target's higher customer switching costs (i.e., above-median switching costs) could impede the major customer concentration from exerting a negative influence on the acquirer returns. Yet the insignificant coefficients for the switching cost terms suggest that the customer switching costs of the target may not directly affect merger performance. In short, the evidence shows that higher switching costs could reduce the risks to the acquiring firm generated by the target's customer concentration.

[Table 12 is about here]

5.3. Relationship-specific investments

To retain crucial customers, suppliers often need to undertake substantial investments specific to the

customer's particular needs and such investments have a small value in any alternative customers. When a supplier loses its major customers, the investment losses significantly increase the likelihood with which the supplier experience financial distress and bankruptcy (Titman and Wessels (1988), Kale and Shahrur (2007), and Campello and Gao (2017)). Moreover, under the bargaining power hypothesis (e.g., Klein et al. (1978)), targets that have made substantial relationship-specific investments will be particularly susceptible if their customers adopt a tougher bargaining stance post-merger. Thus, relationship-specific investments are another dimension of risk embedded in customer concentration. We posit that the negative association between the target's customer concentration and the acquirer's returns is more pronounced when a target has made more relationship-specific investments.

We use the ratio of R&D expenses to total assets one year before the acquisition (*Target's R&D expense*) as the proxy for the target's relationship-specific investments. R&D intensity as the proxy for asset specificity is prevalent in previous empirical studies, particularly for those on transaction cost economics (e.g., Levy (1985); Gatignon and Anderson (1988), Kale and Shahrur (2007), Macher and Richman (2008), Raman and Shahrur (2008), Dhaliwal et al. (2016)). Asset specificity is likely to generate a bilateral dependence between contractual parties and introduce bargaining problems. Coff (2003) shows that R&D intensity can create quasi-rents and increase the likelihood of lockup agreements between contractual parties. Substantial R&D expenditures potentially produce firm-specific know-how and drive complex interstage interdependencies between suppliers and customers (Armour and Teece (1980)). Some part of R&D expenditures is undertaken to meet the needs of major customers. For example, in the automobile industry, suppliers invest in R&D to design specialized accessories and equipment to meet the needs of large auto manufacturers (Holmstrom and Roberts (1998)). Therefore, firms with more R&D expenditures tend to create relationship-specific assets.[21] To further account for variations in R&D intensity across industries, our measure is adjusted by the industry mean (SIC three-digit code).

We interact *Target's R&D expense* with our customer concentration measures in the baseline model. The results in Panel B of Table 12 demonstrate that a concentrated customer base harms the acquirer's returns; however, the target's R&D intensity creates value to the acquirer's shareholder, underscoring the importance of corporate innovation. More importantly, across all specifications, the interaction term is consistently negative

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[21] R&D intensity is also a good proxy for capturing business environments in which relationship-specific investments are prevalent (Raman and Shahrur (2008)). The R&D-intensive industry is found to have close input-output industry links and involve specialized inputs (Allen and Phillips (2000)).

and significant at the 10% level or better, suggesting the negative relation between the target's customer concentration and the acquirer's returns is more pronounced when the target makes larger relationship-specific investments. [22] Our findings provide evidence that relationship-specific investments increase the risks associated with acquiring a target with a concentrated customer base.

5.4. Target's cash flow volatility

One of the major concerns accompanying a concentrated customer base is that the loss of key customers could lead to a sizeable drop in the firm's cash flow, resulting in financial distress (Dhaliwal et al. (2016), Huang et al. (2016a)). The impact could be even worse when the supplier's cash flow level stays low and unstable. Hence, holding abundant cash holdings, as a buffer, can reduce the customer concentration risk of the supplier. As evidence of this, some earlier studies find that suppliers with major customers are likely to hold additional cash to prepare for potential declines in income and signal the ability for providing customized investments and stable operations (e.g., Itzkowitz (2013)). Accordingly, we expect that the acquirer faces higher cash flow risk and higher operation uncertainties if the target has unstable cash flows before the merger.

We use the standard deviation of a target's free cash flows over a three-year horizon preceding the acquisition as the proxy for *Target's cash volatility* and incorporate this variable and its interaction with the customer concentration measures in Model (1). We find significantly negative coefficients for the interaction terms in Panel C. The results suggest that the loss of the acquirer's shareholder value is larger when the customer-concentrated target has a high level of cash volatility.

5.5. Large and reputable acquirers

A big customer for a target might be a small customer for a large acquirer, which represents less customer concentration risk.[23] A dominant market position lends a large acquirer a competitive advantage and affords them a strong bargaining power with their customers post-merger. In addition, the target's major customers may be happy that the supplier is being acquired by a larger and reputable company, which reduces the customer's supplier risk and the likelihood that the customers exit or make demands for price concessions. Therefore, we expect that a larger and more reputable buyer may be less vulnerable to the target's customer concentration risk and can experience better announcement returns compared with small acquirers.

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[22] If we employ another widely used proxy for relationship specificity in the literature, that is, the sum of SG&A and advertising expenses scaled by total assets, to run analogous regressions and test the heterogeneity (see, e.g., Titman and Wessels (1988), Dhaliwal et al. (2016), Hui et al. (2019)), we continue to find that a concentrated customer base harms the acquirer's returns, and the negative relation is more pronounced when the target makes larger relationship-specific investments. To save space, we do not tabulate the results; however, they can be provided on request.

[23] Let's use the case of Transdigm Group Inc. merging with Breeze-Eastern Corp. as an example. The target has three major customers accounting for 57% of its total sales before the deal, but the sales correspond to 2.25% of the acquirer's volume.

To test our prediction, we create an indicator variable that is set to one if an acquirer is one of the S&P 500 companies and zero otherwise. The S&P 500 index is generally considered to be one of the best representations of the U.S. stock market and consists of most of the largest and reputable U.S companies. Therefore, this indicator captures a group of acquirers that are more capable of dealing with the risks associated with customer-concentrated targets. We then interact this dummy variable with our customer concentration measures. The results in Panel D show that the interaction terms are positive and statistically significant in all models, confirming that the adverse effect from the target's customer concentration is weakened for S&P acquirers. The estimated coefficient in Column (1) suggests that, relative to non-S&P acquirers, S&P companies acquiring targets with a concentrated customer base have a 2.4 percentage points higher five-day CAR. Overall, these findings are consistent with our conjecture that a larger and reputable acquirer performs better in mergers involving a target with a concentrated customer base.

Taken together, this section explains the logic behind our main findings. High reliance on a small number of customers negatively affects the firm of buying such suppliers and more so if the set is restricted to corporate customers, the customer-supplier relationship is easily broken up, or the supplier is more financially unstable.[24] We also notice that large and reputable acquirers accomplish such tasks of great difficulty better.

6. Discussions of the Motives of Acquisitions

Our analysis so far suggests that the target's customer concentration destroys value for the acquirer, as market participants perceive customer concentration to be a potential risk factor. Harford et al. (2019) show that firms with major customers are less likely to be targeted in acquisitions. Then our analysis encounters an important question about why acquiring firms initiate such value-destructive deals.[25] While extensive research demonstrates that M&As often destroy the value for the acquirer (e.g., Eckbo and Thorburn (2000), Moeller et al. (2005), Harford and Li (2007)), three major motives have been advanced in the literature: synergy, hubris, and the agency motive (see, e.g., Roll (1986), Shleifer and Vishny (1988), Morck et al. (1990), Berkovitch and

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[24] One concern is that all three moderator variables may be strongly associated with firm size—small firms are more likely to have low market share, high R&D intensity, and high cash-flow volatility—so the results might be driven by the target firm's size. To address this concern and ensure the robustness of our results, we adopt a two-stage framework in which each moderator, that is, market share, R&D intensity, and cash flow volatility, is modeled as a function of firm size, and we use the residues obtained from the first stage, instead of raw measures, to conduct the cross-sectional analyses. The results remain unchanged and are available on request. We thank an anonymous reviewer for this valuable suggestion.

[25] We think that the managers of the acquiring firm are likely aware of the potentional risks associated with the acquisition of a customer-concentrated target as a deal typically involves due diligence, which would have easily uncovered the risks. Our untabulated results show that acquirers tend to favor the stock payment method instead of cash payment when purchasing targets with a high customer concentration. The stock payment is generally considered to be a means of protection against overpayment and a means by which to share future cash flow risk with the target's shareholders (e.g., Faccio and Masulis (2005), Huang et al. (2016b)).

Narayanan (1993), Malmendier and Tate (2008)). The synergy motive refers to that acquirers can obtain additional economic and efficiency gains by merging their resources with those of the target. The hubris motive was proposed by Roll (1986), which suggests that managers may overestimate their abilities and make mistakes in evaluating the economic gains of merging two firms. The agency motive is related to the potential conflicts of interests between shareholders and managers. By undertaking an M&A, managers can pursue their personal benefits at the expense of shareholders. The latter two motives predict that acquisitions are value destroying. In this section, we discuss the potential motives behind the acquisitions of customer-concentrated targets along these three perspectives.

6.1. Strategic consideration

Strategic consideration plays an important role in merger decisions (Benile (2012), Benile and Lyandres (2019)). Even the acquiring firms are aware of potential high risks associated with their focused deals, they may still initiate the mergers to achieve long-term strategic objectives, such as eliminating future competition, increasing bargaining power in the product market, or exploring growth opportunity. Harford et al. (2019) show that, though firms are less likely to buy a target with major customers, a combination of two firms sharing a common customer can increase the bargaining power of the merged entity vis-à-vis the other firm. Therefore, we conjecture that the value-destroying investments may be driven by a purpose of establishing selling power along the supply chain. By glimpsing at our sample, it is not uncommon that the acquirer and the target server for the same major customer. Panel A of Table 13 presents the number of deals in which the target firm has a major customer and share a common customer with the acquiring firm. The target and the acquirer have a common customer in 114 deals, which account for 25.4% of 448 deals in which target firms have major customers. The pattern is more striking when targets have major governmental customers: approximately 80% of the deals (53 out of 67) are the combination of two firms which are both the suppliers of the federal government.

Many previous researches document that similarities among resource allocations, culture, and some aspects of strategy and business operation in the acquiring and target firms on merger decisions and outcomes (e.g., Singh and Montgomery (1987), Harrison et al. (1991), Bereskin et al. (2018), Bettinazzi et al. (2018)). More similar partners can better understand one another and combine resources in a more efficient way. Firms with similar customer bases generally have similar resource allocation patterns to facilitate satisfaction of specific customer needs and own similar skills and techniques to manage the risks associated with customers. In this vein, we conjecture that shared major customers would increase the likelihood of two entities merged.

To test the prediction, we use a methodology similar to Bena and Li (2014) and estimate a logit regression with a group of pseudo deals for each actual deal:

$$ActualDeal_{i,j,t} = \alpha + \beta_1 Commmon\ Customer_{i,j,t-1} + \beta_2 AcquirerControls + \beta_3 TargetControls$$
$$+ \beta_4 SameState + \ \gamma_{year} + \delta_{ind} + \varepsilon_{i,t}, \qquad\qquad (5)$$

The dependent variable is equal to one if firm i acquires firm j at time t, and zero otherwise. $Commmon\ Customer_{i,j,t-1}$ is either an indicator of whether firm i and firm j share a common customer before the acquisition, or a count variable corresponding to the number of shared customers. For each actual deal, we group five pseudo deals in which the acquirer is the same and five matched pseudo targets that are mostly similar to the actual target, and group another five pseudo deals for the same target but with five pseudo acquirers. To do this, we construct an industry-, size-, leverage-, and B/M-matched control sample. Specifically, we find the matched merger pairs based on the PSM approach. The potential control firms should satisfy two conditions: i) the firm is neither an acquirer nor a target in the preceding three years, and ii) the firm operates in the same industry of the actual acquirer (target).

Panel B presents the estimation results of Equation (5). The coefficients on the measures of common customer are positive and significant at the 1% level. The effect on the likelihood of a merger pair formation is also economically significant. Taking the coefficient estimate on *Number Common Customer* as an example, ceteris paribus, a one-standard-derivation increase in *Number Common Customer* (0.253) is associated with an odds ratio of a merger pair formation of exp (0.627*0.253) = 0.159. This finding suggests that mergers are more likely to take place between parties sharing common customers. Therefore, we cautiously conclude that establishing market power is an important driver behind firms acquiring targets with major customers, but the associated costs may outweigh the benefits. In turn, market participants may exhibit unfavorable reactions to these acquisitions.[26]

[Table 13 is about here]

6.2. Hubris

The hubris hypothesis posits that the management team of the acquirer is sometimes overoptimistic in evaluating potential targets as managers engage in few mergers across their careers (Roll (1986)). Their

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[26] In unreported tables, we regress the acquirer CARs on the common customer dummy using the subsample in which targets have at least a major customer (448 deals). The results suggest that, among these value-destroying deals, the presence of a shared customer between the acquirer and the target significantly improves the merger performance. Then we further estimate a regression that includes both the indicator for whether the target has a major customer and the indicator for having a common major customer using the full sample. We find that a similarity in an acquirer and target's customer base can positively influence acquirer's returns but cannot counteract the negative influence of the target's major customer.

overoptimism eventually leads them to pay a higher bid premium and destroys shareholder wealth in the acquiring firms. Malmendier and Tate (2008) show that overconfident CEOs are more likely to conduct value-destroying mergers. In our context, one possibility is that the managers of the acquiring firms believe that major customers can generate exceptional benefits and also that managers are aware of the risks associated with customer concentration, but they are overconfident in their ability to handle these risks. In other words, even when acquisitions are driven by strategic consideration, overconfident managers can make mistakes in evaluating the target firms and overestimate the synergies.

To test the hubris hypothesis, which implies overconfident CEOs pressure firms to acquire targets with major customers, we create an indicator for an overconfident CEO of the acquiring firm. Following Billett and Qian (2008) and Campbell et al. (2011), we collect the insider trading data from Thomson Financial and calculate a *net purchase ratio* as the difference between the number of shares acquired through the open market or private purchases, and through option exercises, minus the number sold over the period of six months before the deal announcement. The CEO's net purchase ratio captures his/her optimism about future firm performance.

Using the full deal sample, we estimate a logit model in which the dummy indicating the presence of a target's major customer is taken as the dependent variable and CEO optimism as the key regressor. We include the same controls used in the baseline model, as well as the industry and year fixed effects. The results are reported in Column (1) of Table 14. We find that overoptimistic CEOs are more likely to acquire firms with major customers, providing some suggestive evidence that hubris is a potential motive behind the acquisitions of customer-concentrated targets.

[Table 14 is about here]

6.3. Corporate governance

Managers tend to build empires (Jensen (1986), Kanniainen (2000)). M&As, as the most significant corporate investments, serve this purpose well. Meanwhile, managers can entrench themselves by expanding existing lines of business excessively, such as during acquisitions (Shleifer and Vishny (1988), Morck et al. (1990)). Experience is more important than ability for managers' future prospects. Whether the deal is value creative or value destructive, CEOs and the directors of acquiring firms can obtain more subsequent board seats (Harford and Schonlau (2013)). These incentives induce managers and directors to engage in more deals, even at the expense of the shareholders. It is well recognized that strong corporate governance can effectively monitor the behaviors of managers and prevent harmful strategic decisions, while managers for firms with weak corporate governance are more likely to conduct empire-building mergers (e.g., Masulis et al. (2007), McDonald

et al. (2008)). In this sense, the agency motive of acquiring customer-concentrated firms should be more prominent when firms have poor corporate governance.

To test our prediction, we employ three proxies for corporate governance. The first measure is *Busy Board*, defined as the average number of board seats held by directors. Multiple directorships are detrimental to shareholder value and are associated with weak corporate governance (Core et al. (1999), Fich and Shivdasani (2006), Falato et al. (2014)). Our second measure is *Duality*, a dummy indicating whether the acquirer separates the position of board chairman and CEO. CEO-chairman duality leads to high CEO compensation and low sensitivity of CEO turnover to firm performance (Goyal and Park (2002) and, particularly, imposes a negative effect on acquirer returns (Masulis et al. (2007)). The third is board independence. Existing studies show that more independent directors are associated with better corporate decisions, for example, acquisitions with higher returns (Byrd and Hickman (1992)).

We then estimate a logit model and predict the likelihood of merging a target with major customers on the measures of corporate governance. The results are summarized in Columns (2)–(4) of Table 14. Busy board and CEO duality both have a positive effect on the likelihood of merging a target with major customers, suggesting that fewer directorships held by board members or a separation of board chairman and CEO help rein in managers who go after the value-destroying acquisitions. Board independence is significantly and negatively related to the incidence of merging customer-concentrated firms. A high quality of board monitoring impedes firms from engaging in those mergers that hurt shareholder value. Overall, our results suggest that good corporate governance can alleviate agency conflicts and prevent empire building and harmful acquisition decisions. Our results implicitly show that the agency motive plays a role in the acquisitions of targets with major customers.

7. Robustness Checks

In the previous sections, we have captured a negative relation between the target's customer concentration and merger performance. In the last section, we perform a set of sensitivity tests to confirm the robustness of our findings.[27]

7.1. Restricted to targets with customer information

SFAS No. 14 and SFAS No. 131 require that firms to disclose any external customers that individually

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[27] For the sake of brevity, we do not report these results in the tables, which are available on request.

account for more than 10% of sales in the United States, so we treat targets without any recorded customer information in the Compustat Segments Customer Database as those without major customers. For these firms with absent information, we assign the value of zero to each of the customer concentration measures in our estimations. However, the inclusion of these firms (about 59.06% of our sample) might overestimate the effect of customer concentration. To mitigate this concern, we reestimate our model and focus on a subsample of deals for which the targets have at least one record in the Compustat Segments Customer Database.[28] The results along the intensive margin are consistent with those from the full sample.[29]

7.2. Announcement returns of CAR (-1, 1)

Many studies on merger outcomes focus on announcement returns over a three-day event window, as a shorter period is expected to capture the majority of the announcement effect on the condition of early information leakage (e.g., Bouwman et al. (2009), Ishii and Xuan (2014), and Huang et al. (2014)). We thus use acquirer CAR (-1, 1) as an alternative measure of the acquirer announcement return and relate it to the target's customer concentration. The results are virtually similar and hence not reported.

7.3. Alternative measures of customer concentration

Though our three measures provide insights into customer concentration from different perspectives, we acknowledge that some other studies use the simple count or the relative strength among a small set of major customers to proxy for the extent to which the supplier engages in business with major customers (e.g., Campello and Gao (2017)). Thus, we also create two alternative customer concentration measures, namely, the number of major customers ($Number_{it}$) and the Gini coefficient of sales ($Gini_{it}$) for target firm i at year t.[30] The results show qualitatively similar patterns to our baseline analysis.

7.4. Controlling for target's volatility and profitability

The analysis in Section 5.4 has shown that the negative influence of customer concentration is intensified by the target's cash volatility, as it could increase the uncertainty and the likelihood of financial distress for the combined entity. Also, some other studies have shown that profitability could act as a modulating factor and ease the negative influence of customer concentration (e.g., Patatoukas (2012), Irvine et al. (2014), and

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[28] Some firms voluntarily disclose information about customers that account for less than 10% of their sales if the customer is important to their business, and thus the related information is also recorded in the Segment Customer database.

[29] For all estimations throughout the paper, we drew very qualitatively and quantitatively results in this restricted subsample.

[30] The Gini index is constructed as follows: (1) by arranging the J major customers of target i in year t in nondecreasing order (i.e.,

$Sales_{i,j,t} < Sales_{i,j+1,t}$) and (2) by calculating index based on the equation: $Gini_{it} = \frac{2\sum_{j=1}^{J} j*Sales_{ijt}}{J\sum_{j=1}^{J} Sales_{ijt}} - \frac{J+1}{J}$.

Campello and Gao (2017)). To further mitigate any concern of omitted variables, we additionally control for the target's volatility and profitability in the baseline regressions. Likewise, we measure the target's volatility as the standard deviation of free cash flows over a three-year horizon before the announcement. Profitability corresponds to the return on assets (ROA) of the target. The results are robust to the inclusion of additional two variables, and they have a moderate impact on the acquirer's returns.

7.5. Excluding deals in financial and utility industries

Many M&A studies exclude financial firms and utilities from their samples because these firm types subscribe to business models that are different from other firms (e.g., Erel et al. (2012), Karolyi and Taboada (2015)). Therefore, we perform a robustness test excluding firms from the financial (SIC codes 6000–6999) and utility (SIC codes 4900–4999) industries. After removing the observations we still find that all coefficients for customer concentration exhibit significantly negative signs. Moreover, the level of customer concentration is likely to vary across industries with different market structures and competitive environments. Thus, to examine whether the negative relationship between targets' customer concentration and the announcement return varies across different industries, we include the interaction terms between the Fama-French 12 industry dummies with the three main customer concentration measures in the baseline model. Our untabulated results show that nearly all coefficients for the interaction terms are statistically insignificant, suggesting that the observed relationship is not driven by industry structures.

8. Conclusions

Recent literature on customer concentration mainly examines how it affects suppliers and provides inconclusive evidence about whether a concentrated customer base benefits or harms a firm's operations. Based on the existence of potential risks and gains, we extend this line of literature to a merger and acquisition setting. This paper examines how the customer concentration of target firms relates to merger outcomes specific to acquirers, targets, and the combined entity.

Using detailed information of customers from Compustat Segment and M&A deals from SDC, we construct multiple measures of customer concentration for each target over the period of 2000-2017. Our examinations show that bidding a firm with a high level of reliance on several major customers strongly damages the shareholder value of acquirers both in the short run and in the long run. The results are virtually unchanged if we use an instrumental variable approach, the PSM method, or many other robustness checks. We also show that acquiring a customer-concentrated firm will increase the degree of customer concentration for

the acquirer, a factor that is negatively related to acquirer returns. Our main findings hold in both vertical and horizontal deals.

By recognizing the differential impacts of corporate customers and government customers on suppliers, we draw on two sets of customer concentration measures to show that the negative influence on merger outcomes mainly derives from corporate major customers. Government customers, on the contrary, are more likely to reduce the operational risks. Moreover, the negative association between the target's customer concentration and the acquirer's returns is particularly striking when the switching costs are low or the relationship-specific investments are high. Moreover, the target's large cash volatilities further deteriorate the deal performance. These cross-sectional variations imply that a heavy reliance on a small set of customers and unstable cash resources raise concerns about liquidity risks and hence mire the post-acquisitions operations in difficulties and uncertainty, while larger and more reputable acquirers are more capable of contending with the associated risks.

Lastly, we explore the potential motives behind these value-destroying acquisitions from the perspectives of synergy, hubris, and agency motives. We find that sharing a common customer has a significant effect on the probability of a merger taking place. Thereby, we cautiously conclude that establishing selling power is an important driver of such acquisitions. Moreover, we show that firms with overconfident CEOs and poor corporate governance are more likely to acquire firms with major customers.

Overall, this paper shows that the customer concentration of targets substantially affects several aspects of merger outcomes. Our work illuminates new insight into the understanding of customer concentration and broadens the scope of research beyond the supplier, and also have important implications for investment decision makers. Within this context, future research could consider examining a second-order effect of customer concentration on several types of supplier-related industries and firms.

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Table 1 Sample distribution

This table reports the distribution of M&A deals by year in Panel A and by industry in Panel B. In both panels, the number and percentage for the full sample are presented first in columns 1-2, followed by a breakout based on the presence of target's major customers in columns 3-6. We define the customer that accounts for at least 10% of total sales of a supplier as a major customer.

Panel A by year

	Full sample		Without Major customer		With Major customer			Full sample		Without Major customer		With Major customer	
	Number	%	Number	(3)/(1)%	Number	(5)/(1)%		Number	%	Number	(9)/(7)%	Number	(11)/(7)%
Year	(1)	(2)	(3)	(4)	(5)	(6)	Year	(7)	(8)	(9)	(10)	(11)	(12)
2000	126	8.71	87	69.05	39	30.95	2009	47	3.25	31	65.96	16	34.04
2001	124	8.58	91	73.39	33	26.61	2010	72	4.98	49	68.06	23	31.94
2002	73	5.05	46	63.01	27	36.99	2011	41	2.84	28	68.29	13	31.71
2003	97	6.71	64	65.98	33	34.02	2012	62	4.29	44	70.97	18	29.03
2004	102	7.05	68	66.67	34	33.33	2013	68	4.70	50	73.53	18	26.47
2005	93	6.43	59	63.44	34	36.56	2014	79	5.46	56	70.89	23	29.11
2006	100	6.92	63	63.00	37	37.00	2015	89	6.15	54	60.67	35	39.33
2007	83	5.74	57	68.67	26	31.33	2016	83	5.74	67	80.72	16	19.28
2008	53	3.67	39	73.58	14	26.42	2017	54	3.73	45	83.33	9	16.67

Panel B by industry

Fama 12 Industry	Full sample		Without Major customer		With Major customer	
	Number	%	Number	(3)/(1)%	Number	(5)/(1)%
	(1)	(2)	(3)	(4)	(5)	(6)
1 Consumer NonDurables -- Food, Tobacco, Textiles, Apparel, Leather, Toys	40	2.77	17	42.50	23	57.50
2 Consumer Durables -- Cars, TV's, Furniture, Household Appliances	16	1.11	5	31.25	11	68.75
3 Manufacturing -- Machinery, Trucks, Planes, Off Furn, Paper, Com Printing	85	5.88	48	56.47	37	43.53
4 Oil, Gas, and Coal Extraction and Products	69	4.77	33	47.83	36	52.17
5 Chemicals and Allied Products	24	1.66	15	62.5	9	37.5
6 Business Equipment -- Computers, Software, and Electronic Equipment	335	23.17	160	47.76	175	52.24
7 Telephone and Television Transmission	49	3.39	34	69.39	15	30.61
8 Utilities	34	2.35	25	73.53	9	26.47
9 Wholesale, Retail, and Some Services (Laundries, Repair Shops)	51	3.53	39	76.47	12	23.53
10 Healthcare, Medical Equipment, and Drugs	143	9.89	74	51.75	69	48.25
11 Finance	494	34.16	471	95.34	23	4.66
12 Other -- Mines, Constr, BldMt, Trans, Hotels, Bus Serv, Entertainment	106	7.33	77	72.64	29	27.36
Total	1446	100	998	69.02	448	30.98

Table 2 Summary statistics

This table presents the summary statistics. Panel A presents the statistics of customer concentration measures for the full sample first, followed by the subsample involving targets with major customers. We define the customer that accounts for at least 10% of the total sales of a supplier as a major customer. *Major Customer* is an indicator variable which equals one if the target has major customer in either of the two fiscal years before the acquisition and zero otherwise. *MajorALL* is the fraction of the target sales represented by major customers. *HHI* is the Herfindahl-Hirschman Index of the target sales to major customers. *Number Major Customer* is the number of target major customers. Gini is the Gini Index of the target sales to major customers. *MajorALL*, *HHI*, *Number Major Customer*, and *Gini* take the average figures across the two fiscal years before the acquisition. Panel B presents the mean and standard deviation values of firm and deal characteristics for the full samples first, followed by two subsamples partitioned by the presence of target's major customers. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels based on *t-test* for the differences in mean values. All variables are defined in the Appendix.

Panel A Statistics for customer concentration measures

	Full sample				With Major customer			
	No.	Median	Mean	Std	No.	Median	Mean	Std
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Major Customer	1446	0.000	0.310	0.463	448	1.000	1.000	0.000
MajorALL	1446	0.000	0.131	0.239	448	0.380	0.423	0.247
HHI	1446	0.000	0.045	0.118	448	0.087	0.146	0.175
Number Major Customer	1446	0.000	0.560	0.997	448	2.000	1.808	0.974
Gini	1446	0.000	0.021	0.061	448	0.009	0.069	0.093

Panel B Statistics for controls

Variable name	Full sample		Without Major customer		With Major customer	
	Mean	Std	Mean	Std	Mean	Std
	(1)	(2)	(3)	(4)	(5)	(6)
Acquirer characteristics						
Firm size ($ millions)	23762.067	94248.220	28541.343	111544.466	13115.381***	28265.346
Firm size (Ln)	8.127	2.029	8.296	1.994	7.751***	2.056
Tobin's Q	1.591	0.587	1.478	0.564	1.841***	0.560
Leverage	0.165	0.142	0.172	0.149	0.150***	0.126
Free cash flow	0.020	0.131	0.017	0.122	0.025	0.149
Stock price run-up	0.063	0.270	0.060	0.264	0.070	0.282
Target characteristics						
Firm size ($ millions)	4034.811	33499.286	5188.680	40614.724	1634.516**	4256.907
Firm size (Ln)	6.267	1.853	6.529	1.789	5.721***	1.868
Tobin's Q	1.430	0.478	1.337	0.449	1.624***	0.479
Leverage	0.179	0.160	0.180	0.163	0.177	0.155
Free cash flow	0.011	0.061	0.012	0.053	0.008	0.075
Stock price run-up	0.023	0.349	0.027	0.338	0.014	0.372
Deal characteristics						
Mixed deal	0.413	0.493	0.437	0.496	0.359***	0.480
Pure stock deal	0.291	0.454	0.293	0.455	0.286	0.452
Relative deal size	0.284	0.253	0.283	0.248	0.287	0.263
High tech	0.235	0.424	0.170	0.376	0.380***	0.486

Table 3 Univariate evidence

This table presents the five-day cumulative abnormal returns (CARs) around announcement for the acquirers and the combined firms, as well as the one-, two-, and three-year post-announcement buy-and-hold abnormal returns (BHARs) for the acquirers. The combined CARs are calculated as the market value-weighted average of the CARs for the acquirer and the target. The statistics for the full sample are presented first, followed by a breakout based on the presence of target's major customer. We define the customer that accounts for at least 10% of the total sales of a supplier as a major customer. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels based on *t-test* for the differences in mean values and *z-value* of Wilcoxon test for the median difference.

Variable	Full sample				Without Major customer			With Major customer			Difference	
											t-value (t-test)	z-value (Wilcoxon test)
	Obs	Mean	Median	Std	Obs	Mean	Std	Obs	Mean	Std		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Acquirer CAR (-2, +2)	1446	-0.010	-0.009	0.055	998	-0.007	0.053	448	-0.015	0.059	2.383**	2.163**
Combined CAR (-2, +2)	1152	0.017	0.013	0.054	778	0.019	0.052	374	0.014	0.057	1.481	1.331
One-year BHAR	1405	0.028	-0.017	0.417	973	0.047	0.414	432	-0.016	0.418	2.610***	3.083***
Two-year BHAR	1292	0.032	-0.033	0.504	889	0.055	0.507	403	-0.019	0.492	2.494**	2.451**
Three-year BHAR	1125	0.038	-0.042	0.674	761	0.047	0.687	364	0.020	0.648	0.633	0.729

Table 4 The acquirer returns

This table shows the results of ordinary least squares (OLS) regressions relating the acquirer's five-day CARs around acquisition announcement to the target's customer concentration and control variables. The sample consists of 1446 M&A deals completed between 2000 and 2017. We define the customer that accounts for at least 10% of total sales of a supplier as a major customer. *Major Customer* is an indicator variable which equals one if the target has at least one major customer in either of the two fiscal years before the acquisition and zero otherwise. *MajorALL* is the fraction of the target sales represented by major customers. *HHI* is the Herfindahl-Hirschman Index of the target sales to major customers. All variables are defined in the Appendix. All models include year and industry fixed effects. The industry classification follows the Fama-French 12-industry categories. Standard errors are clustered at the acquirer level. The corresponding *p*-values are reported in parentheses. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

	Acquirer CAR (-2, +2)		
	(1)	(2)	(3)
Major Customer	-0.017***		
	(0.003)		
MajorALL		-0.032***	
		(0.002)	
HHI			-0.043**
			(0.033)
Acquirer Firm size	-0.001	-0.001	-0.001
	(0.285)	(0.289)	(0.316)
Acquirer Tobin's Q	-0.0002	-0.0002	-0.0002
	(0.893)	(0.911)	(0.924)
Acquirer Leverage	0.048***	0.048***	0.048***
	(0.009)	(0.008)	(0.010)
Acquirer Free cash flow	-0.024	-0.025	-0.026
	(0.654)	(0.644)	(0.632)
Acquirer Stock price run-up	-0.014**	-0.014**	-0.014**
	(0.014)	(0.013)	(0.014)
Mixed deal	-0.029***	-0.029***	-0.029***
	(0.000)	(0.000)	(0.000)
Pure stock deal	-0.032***	-0.032***	-0.033***
	(0.000)	(0.000)	(0.000)
Relative deal size	-0.0003	-0.0004	-0.0004
	(0.675)	(0.626)	(0.655)
High tech	-0.015	-0.016	-0.016
	(0.161)	(0.138)	(0.143)
Constant	0.056***	0.053***	0.049***
	(0.002)	(0.003)	(0.005)
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Observations	1,446	1,446	1,446
Adjust_R2	0.095	0.096	0.092

Table 5 The acquirer long-run buy-and-hold returns

This table shows the results of OLS regressions relating the one- and two-year post-announcement buy-and-hold abnormal return (BHAR) for the acquirers to the target customer concentration and control variables. The sample consists of 1,405 (1-year BHAR), 1,292 (2-year BHAR), and 1079 (3-year BHAR) M&A deals completed between 2000 and 2017. We define the customer that accounts for at least 10% of total sales of a supplier as a major customer. *Major Customer* is an indicator variable which equals one if the target has at least one major customer in either of the two fiscal years before the acquisition and zero otherwise. *MajorALL* is the fraction of the target sales represented by major customers. *HHI* is the Herfindahl-Hirschman Index of the target sales to major customers. All variables are defined in the Appendix. All models include year and industry fixed effects. The industry classification follows the Fama-French 12-industry categories. Standard errors are clustered at the acquirer level. The corresponding *p*-values are reported in parentheses. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

	Acquirer 1-year BHAR			Acquirer 2-year BHAR			Acquirer 3-year BHAR		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Major Customer	-0.047*			-0.048			-0.034		
	(0.090)			(0.171)			(0.416)		
MajorALL		-0.149***			-0.130**			-0.097	
		(0.002)			(0.034)			(0.203)	
HHI			-0.190**			-0.196*			-0.272**
			(0.035)			(0.065)			(0.046)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,405	1,405	1,405	1,292	1,292	1,292	1,079	1,079	1,079
Adjust_R2	0.093	0.097	0.094	0.115	0.116	0.115	0.113	0.113	0.115

Table 6 Wealth transfer or performance effect

Panel A shows the estimation results on the tests for wealth transfer hypothesis. *Takeover premium* is defined as as the difference between the price paid per share and the target's share price 20 days prior to the announcement date. $\Delta\$Target\ CAR$ is a relative gain of the target in the acquisition deal, defined as the difference in dollar gains between the target and acquirer scaled by the sum of acquirer's and target's market value 50 days prior to the announcement date. Panel B reports the estimation results on the relation between targets' customer concentration and acquirers' long-run operating performance. $\Delta ROA\ (-1,\ +1)$ is the absolute change in return on assets between the year subsequent to the merger and the year prior to, and *3-Year Abnormal ROA* is the the residual from the regression in which three-year average industry-adjusted ROA in pre-merger period is taken as the regressor and three-year average industry-adjusted ROA in post-merger periods as the dependent variable. *Major Customer* is an indicator variable which equals one if the target has at least one major customer in either of the two fiscal years before the acquisition and zero otherwise. *MajorALL* is the fraction of the target sales represented by major customers. *HHI* is the Herfindahl-Hirschman Index of the target sales to major customers. All variables are defined in the Appendix. The control variables are the same as those in Table 4. All models include year and industry fixed effects. The industry classification follows the Fama-French 12-industry categories. Standard errors are clustered at the acquirer level. The corresponding *p*-values are reported in parentheses. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Wealth transfer

	Takeover premiums			$\Delta\$Target\ CAR$		
	(1)	(2)	(3)	(4)	(5)	(6)
Major Customer	-0.023			0.006		
	(0.314)			(0.288)		
MajorALL		-0.019			0.011	
		(0.666)			(0.274)	
HHI			-0.029			0.015
			(0.696)			(0.394)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1318	1318	1318	1,117	1,117	1,117
Adjust_R2	0.141	0.140	0.140	0.134	0.134	0.134

Panel B: Long-run operating performance

	$\Delta ROA\ (-1, +1)$			3-Year Abnormal ROA		
	(1)	(2)	(3)	(4)	(5)	(6)
Major Customer	-0.023**			-0.008*		
	(0.044)			(0.089)		
MajorALL		-0.044**			-0.021**	
		(0.040)			(0.014)	
HHI			-0.066*			-0.044***
			(0.067)			(0.006)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,315	1,315	1,315	1,079	1,079	1,079
Adjust_R2	0.094	0.094	0.093	0.167	0.170	0.171

Table 7 An instrumental variable approach

This table reports the results of two-stage least squares (2SLS) regressions relating the acquirer's five-day CAR around acquisition announcement to the target customer concentration and control variables, using instrumental variables. We define the customer that accounts for at least 10% of total sales of a supplier as a major customer. Panels A and B present first-stage results second-stage estimation results, respectively. The dependent variables in the first-stage regressions are *Major Customer*, *MajorALL*, and *HHI*. *Major Customer* is an indicator variable which equals one if the target has at least one major customer in either of the two fiscal years before the acquisition and zero otherwise. *MajorALL* is the fraction of the target sales represented by major customers. *HHI* is the Herfindahl-Hirschman Index of the target sales to major customers. *No. of potential customers* is the nature logarithm of one plus the weighted number of potential major customers. *Industry average no. of major customers* is the nature logarithm of one plus the average of the number of major customers in the target's 3 digit SIC industry and year (excluding the targets). See Section 3.3 for the details of construction procedures. The dependent variable in the second-stage regressions is acquirer's five-day CAR around acquisition announcement. All variables are defined in the Appendix. All models include year and industry fixed effects. Industries are classified by the Fama-French 12 industries. Standard errors are clustered at the acquirer level. The corresponding *p*-values are reported in parentheses. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: First-stage results	No. of potential customers as an instrumental variable			Industry average as an instrumental variable		
	(1)	(2)	(3)	(4)	(5)	(6)
	Major Customer	MajorALL	HHI	Major Customer	MajorALL	HHI
No. of potential major customers	0.053***	0.023***	0.008**			
	(0.000)	(0.001)	(0.015)			
Industry average no. of major customer				0.346***	0.152***	0.054***
				(0.000)	(0.000)	(0.000)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1446	1446	1446	1446	1446	1446
Adjusted-R2	0.263	0.193	0.108	0.233	0.171	0.097
LM statistic	61.02	44.23	26.53	15.97	11.68	6.82
Kleibergen-Paap rk Wald F statistic	69.21	47.86	27.64	16.25	11.71	6.74
Panel B: Second-stage results	Dependent variable: Acquirer CAR (-2, 2)					
	No. of potential customers as an instrumental variable			Industry average as an instrumental variable		
	(1)	(2)	(3)	(4)	(5)	(6)
Predicted Major Customer	-0.098**			-0.051**		
	(0.042)			(0.025)		
Predicted MajorALL		-0.228*			-0.115**	
		(0.053)			(0.026)	

Predicted HHI			-0.620*			-0.326**
			(0.091)			(0.036)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,446	1,446	1,446	1,446	1,446	1,446
Pseudo R^2	0.066	0.046	-0.064	-0.075	-0.183	-0.556

Table 8 Propensity score matching

The table shows the analysis using propensity score matching (PSM) technique. We one-to-one match the deals in the treatment group, i.e., those that involve targets having at least one major customer, with remaining deals that has the closest propensity score. We require that the computed propensity score between the treatment and the match is within a maximum distance of 0.05%. Panels A to C report results of PSM diagnostic tests and Panel D reports esmation results using a PSM sample. *Major Customer* is an indicator variable which equals one if the target has at least one major customer in either of the two fiscal years before the acquisition and zero otherwise. *MajorALL* is the fraction of the target sales represented by major customers. *HHI* is the Herfindahl-Hirschman Index of the target sales to major customers. All variables are defined in the Appendix. The control variables not reported in Panel D are the same as those in Table 4. All models include year and industry fixed effects. The industry classification follows the Fama-French 12-industry categories. Standard errors are clustered at the acquirer level. The corresponding *p*-values are reported in parentheses. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: PSM diagnostic Logit regression	Dependent variable = Major Customer	
	Full sample (pre-matched)	PSM subsample (post-matched)
Acquirer Firm size	-0.136***	-0.004
	(0.000)	(0.908)
Acquirer Tobin's Q	0.025	0.015
	(0.265)	(0.612)
Acquirer Leverage	-0.217	-0.234
	(0.635)	(0.665)
Acquirer Free cash flow	0.814	0.331
	(0.102)	(0.541)
Acquirer Stock price run-up	-0.088	-0.016
	(0.446)	(0.900)
Mixed deal	-0.309**	0.085
	(0.034)	(0.610)
Pure stock deal	-0.247	0.235
	(0.122)	(0.204)
Relative deal size	-0.032	0.083
	(0.665)	(0.548)
High tech	0.938***	0.051
	(0.000)	(0.722)
Constant	0.219	-0.114
	(0.463)	(0.736)
Year	Yes	Yes
Industry	Yes	Yes
Pseudo_R2	0.055	0.003
Observations	1446	894

Panel B: Summary statistics of the propensity score between the treated group and control group								
	Obs.	mean	Std. dev	min	p25	p50	p75	max
Treatment	447	0.357	0.131	0.104	0.242	0.321	0.470	0.649
Control	447	0.352	0.126	0.114	0.242	0.321	0.459	0.651
Difference	0	0.005	0.005	0.010	0.000	0.000	0.011	-0.002

Panel C: Descriptive statistics for propensity-score matched subsamples (Caliper=0.05; Matching Ratio=1:1)			
	Treatment group Mean	Control group Mean	Difference in Mean (*p*-value of Test)
Acquirer Firm size	7.756	7.827	-0.071 (0.603)
Acquirer Tobin's Q	2.432	2.287	0.145 (0.377)
Acquirer Leverage	0.150	0.155	-0.005 (0.557)
Acquirer Free cash flow	0.025	0.023	0.002 (0.780)
Acquirer Stock price run-up	0.136	0.127	0.009 (0.822)
Mixed deal	0.360	0.365	-0.005 (0.890)

Pure stock deal	0.284	0.246	0.038 (0.198)
Relative deal size	0.367	0.343	0.024 (0.519)
High tech	0.378	0.365	0.013 (0.678)

Panel D: PSM regressions

	Acquirer CAR (-2, +2)		
	(1)	(2)	(3)
Major Customer	-0.014**		
	(0.018)		
MajorALL		-0.029***	
		(0.007)	
HHI			-0.032*
			(0.100)
Controls	Yes	Yes	Yes
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Observations	894	894	894
Adjust_R2	0.130	0.132	0.127

Table 9 Acquirers' customer concentration

This table present estimation results on the change in the degree of acquirer's customer concentration before and after the merger, as well as its effect on acquirers' returns. ΔAcquirer Major Customer, ΔAcquirer MajorALL, and ΔAcquirer HHI are three change variables for each acquirer, corresponding to the three measures of customer concentration. *Major Customer* is an indicator variable which equals one if the target has at least one major customer in either of the two fiscal years before the acquisition and zero otherwise. *MajorALL* is the fraction of the target sales represented by major customers. *HHI* is the Herfindahl-Hirschman Index of the target sales to major customers. All variables are defined in the Appendix. The control variables not reported are the same as those in Table 4. All models include year and industry fixed effects. The industry classification follows the Fama-French 12-industry categories. Standard errors are clustered at the acquirer level. The corresponding *p*-values are reported in parentheses. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

| | Acquirer Customer Concentration | | | Acquirer CAR (-2, 2) | | |
| | ΔAcquirer Major Customer | ΔAcquirer MajorALL | ΔAcquirer HHI | | | |
	(1)	(2)	(3)	(4)	(5)	(6)
Major Customer	0.051***					
	(0.010)					
MajorALL		0.056***				
		(0.003)				
HHI			0.107***			
			(0.000)			
Δ Acquirer Major Customer				-0.007*		
				(0.078)		
Δ Acquirer MajorALL					-0.017**	
					(0.043)	
Δ Acquirer HHI						-0.098**
						(0.040)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer Industry	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1446	1446	1446	1,446	1,446	1,446
Adjust_R2	0.156	0.147	0.07	0.107	0.108	0.091

Table 10 Vertical and horizontal mergers

This table separately reports the estimation results on the relation between acquirers' returns and targets' customer concentration for the subsamples of horizonal and vertical deals. Horizontal mergers are identified by any overlap of industry codes between the acquirer and the target. Using on the data of Input-Output Table provided by the U.S. Bureau of Economic Analysis (BEA), we classify a deal as a vertical merger if any of the following four ratios exceed the threshold of 1% in Columns (4) – (6) and 5% in Columns (7) – (9): (i) the percentage of the acquirer industry's sales that are purchased by the target industry, (ii) the percentage of the target industry's sales that are purchased by the acquirer industry, (iii) the percentage of the acquirer industry's inputs that are purchased from the target industry, and (iv) the percentage of the target industry's inputs that are purchased from the acquirer industry. We define the customer that accounts for at least 10% of total sales of a supplier as a major customer. *Major Customer* is an indicator variable which equals one if the target has at least one major customer in either of the two fiscal years before the acquisition and zero otherwise. *MajorALL* is the fraction of the target sales represented by major customers. *HHI* is the Herfindahl-Hirschman Index of the target sales to major customers. The control variables not reported are the same as those in Table 4. All models include year and industry fixed effects. The industry classification follows the Fama-French 12-industry categories. Standard errors are clustered at the acquirer level. The corresponding *p*-values are reported in parentheses. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

	Acquirer CAR (-2, +2)								
	Horizontal			Vertical (1%)			Vertical (5%)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Major Customer	-0.019**			-0.027***			-0.052***		
	(0.036)			(0.010)			(0.006)		
MajorALL		-0.043***			-0.055***			-0.072**	
		(0.008)			(0.006)			(0.028)	
HHI			-0.064*			-0.093*			-0.120**
			(0.066)			(0.065)			(0.018)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	787	787	787	324	324	324	150	150	150
Adjust_R2	0.126	0.130	0.124	0.236	0.241	0.237	0.373	0.356	0.351

Table 11 Corporate customers and government customers

This table shows the results of OLS regressions relating the acquirer's five-day CAR around acquisition announcement to target's corporate and governmental customer concentration and control variables. Panel A reports the summary statistic for corporate and governmental customer concentration measures. A corporate (governmental) major customer is defined as the corporate (governmental organization) accounting for at least 10% of the total sales of a supplier. *Major Customer_Corp* (*Major Customer_Govt*) is an indicator variable which equals one if the target has at least one corporate (governmental) major customer in either of the two fiscal years before the acquisition and zero otherwise. *MajorALL_Corp* (*MajorALL_Govt*) is the fraction of the target sales represented by corporate (governmental) major customers. *HHI_Corp* (*HHI_Govt*) is the Herfindahl-Hirschman Index of the target sales to corporate (governmental) major customers. Panel B presents the OLS regression results for corporate major customers, and Panel C for governmental major customers. The control variables are the same as those in Table 4. All models include year and industry fixed effects. The industry classification follows the Fama-French 12-industry categories. Standard errors are clustered at the acquirer level. The corresponding *p*-values are reported in parentheses. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A Summary statistic for corporate and government major customers								
	N	Min.	Q1	Median	Mean	Q3	Max.	Std
Major Customer_Govt	1446	0.000	0.000	0.000	0.046	0.000	1.000	0.210
MajorALL_Govt	1446	0.000	0.000	0.000	0.022	0.000	0.985	0.114
HHI_Govt	1446	0.000	0.000	0.000	0.011	0.000	0.970	0.069
Major Customer _Corp	1446	0.000	0.000	0.000	0.276	1.000	1.000	0.447
MajorALL _Corp	1446	0.000	0.000	0.000	0.110	0.122	1.000	0.219
HHI_Corp	1446	0.000	0.000	0.000	0.035	0.016	1.000	0.099

Panel B Corporate customers	(1)	(2)	(3)
Major Customer_Corp	-0.017***		
	(0.004)		
MajorALL_Corp		-0.043***	
		(0.000)	
HHI_Corp			-0.071***
			(0.008)
Controls	Yes	Yes	Yes
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Observations	1446	1446	1446
Adjust_R2	0.095	0.100	0.095

Panel C Government customers	(1)	(2)	(3)
Major Customer_Govt	-0.006		
	(0.571)		
MajorALL_Govt		0.014	
		(0.435)	
HHI_Govt			0.019
			(0.483)
Controls	Yes	Yes	Yes
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Observations	1,446	1,446	1,446
Adjust_R2	0.089	0.089	0.089

Table 12 Moderators

This table reports the heterogeneities based on the level of customer switching costs. *Target's market share*, is a dummy variable, which takes the value of one if the market share of the target is above the industry median (SIC 3-digit level) in a specific year and zero otherwise. *Target's R&D expense* is the ratio of research and development expenses to the total assets of the target one year before the acquisition (three-digit SIC industry adjusted). *Target's cash volatility* is the standard deviation of the target's free cash over the three-year horizon prior to the acquisition (three-digit SIC industry adjusted). *S&P500* is an indicator variable which equals one if the acquire is one of S&P 500 companies. A major customer is defined as the one accounting for at least 10% of the total sales of a supplier. A major customer is defined as the one accounting for at least 10% of the total sales of a supplier. *Major Customer* is an indicator variable which equals one if the target has at least one major customer in either of the two fiscal years before the acquisition and zero otherwise. *MajorALL* is the fraction of the target sales represented by major customers. *HHI* is the Herfindahl-Hirschman Index of the target sales to major customers. To save space, we do not report the results of controls. The control variables are the same as those in Table 4. All models include year and industry fixed effects. The industry classification follows the Fama-French 12-industry categories. Standard errors are clustered at the acquirer level. The corresponding *p*-values are reported in parentheses. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Customer switching costs	(1)	(2)	(3)
Major Customer	-0.018***		
	(0.003)		
Major Customer×Target's market share	0.026*		
	(0.069)		
MajorALL		-0.039***	
		(0.000)	
MajorALL×Target's market share		0.091***	
		(0.002)	
HHI			-0.053**
			(0.012)
HHI× Target's market share			0.127***
			(0.007)
Target's market share	-0.008	-0.011	-0.005
	(0.357)	(0.172)	(0.537)
Observations	1,359	1,359	1,359
Adjust_R2	0.109	0.113	0.107

Panel B: Relationship-specific investments	(1)	(2)	(3)
Major Customer	-0.025***		
	(0.009)		
Major Customer×Target's R&D expense	-0.164**		
	(0.012)		
MajorALL		-0.048***	
		(0.007)	
MajorALL ×Target's R&D expense		-0.269**	
		(0.012)	
HHI			-0.095**
			(0.021)
HHI×Target's R&D expense			-0.483**
			(0.030)
Target's R&D expense	0.134***	0.108**	0.080**
	(0.009)	(0.018)	(0.050)
Observations	621	621	621
Adjust_R2	0.130	0.130	0.127

Panel C: Target's cash volatility	(1)	(2)	(3)
Major Customer	-0.026***		
	(0.000)		
Major Customer×Target's cash volatility	-0.329***		
	(0.009)		
MajorALL		-0.047***	
		(0.000)	
MajorALL×Target's cash volatility		-0.535**	
		(0.018)	
HHI			-0.065***
			(0.003)
HHI× Target's cash volatility			-0.720*
			(0.063)
Target's cash volatility	0.214***	0.178**	0.119*
	(0.010)	(0.020)	(0.088)
Observations	1,444	1,444	1,444
Adjust_R2	0.100	0.100	0.095

Panel D: S&P 500 acquiring firms	(1)	(2)	(3)
Major Customer	-0.026***		
	(0.001)		
Major Customer×S&P500	0.024***		
	(0.008)		
MajorALL		-0.051***	
		(0.0004)	
MajorALL×S&P500		0.048***	
		(0.006)	
HHI			-0.079**
			(0.015)
HHI×S&P500			0.080**
			(0.024)
S&P500	-0.004	-0.002	0.001
	(0.599)	(0.735)	(0.912)
Observations	1,446	1,446	1,446
Adjust_R2	0.100	0.101	0.096

All Panels include			
Controls	Yes	Yes	Yes
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes

Table 13 Strategic consideration: shared customers

This table examines whether an acquisition is more likely to occur between two firms that have a common major customer or a similar customer base concentration. *Common Customer* is a dummy, taking the value of one if the acquirer and the target share a major customer and zero otherwise; *Number Common Customer* is the number of common customers between the acquirer and the target. Panel A reports the number of deals in which the target firm has a major customer and shares a common customer with the acquiring firm. Columns (1) and (2) of Panel B reports coefficient estimates from logit models in equation (4), where the dependent variable is equal to one for the actual acquirer-target firm pair, and zero for the matched firm pairs. In Columns (3) and (4), we take the acquirer's five-day CAR as the dependent variable using the subsample in which target has at least a major customer. All variables are defined in the Appendix. All models include year and industry fixed effects. Industries are classified by the Fama-French 12 industries. Standard errors are clustered at the acquirer level. The corresponding p-values are reported in parentheses. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A	Number of deals		
	Total	corporate customer	governmental customer
Targets with a major customer	448	399	67
Acquirers and targets sharing a common customer	114	62	53

Panel B	Merger incidence (1: 10 Pseudo deals)	
	(1)	(2)
Common Customer	1.130***	
	(0.000)	
Number Common Customer		0.627***
		(0.000)
Controls	Yes	Yes
Year	Yes	Yes
Industry	Yes	Yes
Observations	12881	12881
Pseudo_R2	0.065	0.062

Table 14 Hubris and corporate governance

This table examines the effect of CEO optimism and the quality of corporate governance on the likelihood of acquiring a customer-concentrated target. The dependent variable is a dummy variable, taking the value of one if the target has at least one major customer and zero otherwise. *CEO optimism* is a net purchase ratio as the difference between the number of shares acquired through open market or private purchases, and through option exercises, minus the number sold over the period of six months before the deal announcement. *Busy Board* is the average number of board seats held by directors. *CEO Duality* is a dummy indicating whether the acquirer separates the position of board chairman and CEO. *Board Independence* is the number of independent directors scaled by total number of board members. The control variable are the same as those in Table 4. All models include year and industry fixed effects. Industries are classified by the Fama-French 12 industries. Standard errors are clustered at the acquirer level. The corresponding p-values are reported in parentheses. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

| | Likelihood of merging customer-concentrated targets | | | |
	(1)	(2)	(3)	(4)
CEO Optimism	0.139**			
	(0.041)			
Busy Board		0.090**		
		(0.027)		
CEO Duality			0.155*	
			(0.069)	
Board Independence				-1.029*
				(0.055)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Observations	1410	1161	1377	1161
Adjust_R2	0.098	0.215	0.211	0.214

Appendix
Table A1. Variable Definitions

Variables	Definitions
Dependent Variables	
Acquirer/target CAR (-2, +2)	Five-day cumulative abnormal return around the acquisition announcement, calculated using the market model. The market model parameters are estimated over the period (-241, -41), with the CRSP value-weighted return as the market index.
Acquirer 1-year BHAR	Bidder's buy-and-hold abnormal return (BHAR) during the period (0, +252). The market index is the CRSP value-weighted return
Acquirer 2-year BHAR	Bidder's BHAR during the period (0, +504). The market index is the CRSP value-weighted return
Acquirer 3-year BHAR	Bidder's BHAR during the period (0, +756). The market index is the CRSP value-weighted return
Combined CAR (-2, +2)	The market-value-weighted average of the acquirer's and the target's CAR (-2, +2)
Takeover premium	The difference between the price paid per share and the target share price 20 days prior to the announcement date
$\Delta\$ Target\ CAR$	The difference in dollar gains between the target and acquirer scaled by the sum of acquirer's and target's market value 50 days prior to the announcement date
ΔROA (-1, 1)	The absolute change in the acquirer's ROA between the year subsequent to the merger and the year prior to the merger
3-Year abnormal ROA	The residual from the regression in which three-year average industry-adjusted ROA in pre-merger period is taken as the regressor and three-year average industry-adjusted ROA in post-merger periods as the dependent variable
Customer Concentration Measures	
Major customer	A dummy variable that equals one if the target has any major customer in the two years before the deal announcement and zero if the target does not have major customers in that period. Major customers are those representing 10% or more of the target's sales in a given fiscal year
MajorALL	The average proportion of sales to all of the target's major customers in the years *t*-1 and *t*-2 if the target has customer records in both years or the proportion of sales to all of the target's major customers in either year *t*-1 or year *t*-2 if the target has customer records in only one of the years. Major customers are those that represent 10% or more of the target's sales in a given fiscal year
HHI	The average Herfindahl-Hirschman index of all of the target's major customers in years *t*-1 and *t*-2 if the target has customer records in both years or the Herfindahl-Hirschman index of all of the target's major customers in either year *t*-1 or year *t*-2 if the target has customer records in only one of the years. Major customers are those that represent 10% or more of the target's sales in a given fiscal year
Number major customer	The average number of major customers of the target in the years *t*-1 and *t*-2 (where *t* is the deal announcement year) if the target has customer records in both years or the number in either year *t*-1 or year *t*-2 if the target has customer records in only one of the years. Major customers are those representing 10% or more of the target's sales in a given fiscal year
Gini	The average Gini index of all of the target's major customers in years *t*-1 and *t*-2 if the target has customer records in both years or the Gini index of all of the target's major customers in either year if the target has customer records in only one of them. Major customers are those that represent 10% or more of the target's sales in a given fiscal year.
Major Customer_Govt	*Major customer* based on major government customers. Major government customers include state, local, domestic, and foreign governments representing 10% or more of the target's sales in a given fiscal year
MajorALL_Govt	*MajorALL* based on major government customers. Major government customers include state, local, domestic, and foreign governments representing 10% or more of the target's sales in a given fiscal year
HHI_Govt	*HHI* based on major government customers. Major government customers include state, local, domestic, and foreign governments representing 10% or more of the target's sales in a given fiscal year
Major Customer_Corp	*Major customer* based on major corporate customers. Major corporate customers are corporate customers representing 10% or more of the target's sales in a given fiscal year

MajorALL_Corp	*MajorALL* based on major corporate customers. Major corporate customers are corporate customers representing 10% or more of the target's sales in a given fiscal year
HHI_Corp	*HHI* based on major corporate customers. Major corporate customers are corporate customers representing 10% or more of the target's sales in a given fiscal year
Dummy_Govt	A dummy variable that equals one if the target has any government customer in the two years before the deal announcement (no matter what percentage of sales it represents) and zero if the target does not have a government customer in that period
Number Common Customer	The number of common customer(s) shared by the acquirer and the target.
Common Customer Dummy	A dummy variable that equals one if the acquirer and the target shares a common customer and zero otherwise.

Firm Characteristics

Firm size	Natural logarithm of the book value of total assets (item6), at the end of the fiscal year before the deal announcement. Acquirer characteristic
Tobin's Q	The ratio of the market value of assets to the book value of assets, (item6-item60+item25*item199)/item6, at the end of the fiscal year before the deal announcement. Acquirer characteristic
Leverage	The ratio of the book value of debts (item34+item9) to the market value of total assets (item6-item60+item25*item199), at the end of the fiscal year before the deal announcement. Acquirer characteristic
Free cash flow	Operating income before depreciation (item13) – interest expenses (item15) –income taxes (item16) – capital expenditures (item128), scaled by the book value of total assets (item6), at the end of the fiscal year before the deal announcement. Acquirer characteristic
Stock price run-up	Buy-and-hold abnormal return (BHAR) during the period (-210, -11). The market index is the CRSP value-weighted return. Acquirer characteristic
Target's market share	The ratio of the sales of the target company to the total sales in the same three-digit SIC industry. Target characteristic
Target's cash volatility	The standard deviation of the target's free cash in the three years before the acquisition (three-digit SIC industry adjusted). Target characteristic
Target's R&D expense	The ratio of research and development expenses to the total assets of the target one year before the acquisition (three-digit SIC industry adjusted). Target characteristic
B/M	The book value of common equity scaled by the market value of common equity.
ROA	Earnings before interest, taxes, depreciation, and amortization scaled by total assets.
Sale Growth	The growth rate of sales in the year prior the acquisition
CEO optimism	A net purchase ratio, defined as the difference between the number of shares acquired through open market or private purchases, and through option exercises, minus the number sold over the period of six months before the deal announcement
Busy Board	The average number of board seats held by directors
CEO Duality	A dummy indicating whether the acquirer separates the position of board chairman and CEO
Board Independence	the number of independent directors scaled by total number of board members

Transaction Characteristics

Mixed deal	A dummy variable that equals one for deals paid in combinations of stock and cash and zero otherwise
Pure stock deal	A dummy that equals one for 100% stock-financed deals and zero otherwise
Diversify	A dummy variable that equals one if the acquirer and target do not have the same two digits at the start of their SIC code and zero otherwise
Relative deal size	The ratio of the transaction value to the acquirer's market value of equity as defined above
High tech	A dummy variable which equals one if the acquirer and target are both from high-tech industries, as defined by Loughran and Ritter (2004), and zero otherwise. Loughran and Ritter (2004) define tech stocks as those in SIC codes 3571, 3572, 3575, 3577, and 3578 (computer hardware); 3661, 3663, and 3669 (communications equipment); 3671, 3672, 3674, 3675, 3677, 3678, and 3679 (electronics); 3812 (navigation equipment); 3823, 3825, 3826, 3827, and 3829 (measuring and controlling devices); 3841 and 3845 (medical instruments); 4812 and 4813 (telephone equipment); 4899 (communications services); and 7371, 7372, 7373, 7374, 7375, 7378, and 7379 (software)

Table A2 The combined entity's returns

This table shows the results of OLS regressions relating the combined firm's five-day CAR around acquisition announcement to the target customer concentration and control variables. The combined CAR is calculated as the market value-weighted average of the CAR for the acquirer and the CAR for the target. We define the customer that accounts for at least 10% of total sales of a supplier as a major customer. *Major Customer* is an indicator variable which equals one if the target has at least one major customer in either of the two fiscal years before the acquisition and zero otherwise. *MajorALL* is the fraction of the target sales represented by major customers. *HHI* is the Herfindahl-Hirschman Index of the target sales to major customers. All variables are defined in the Appendix. All models include year and industry fixed effects. The industry classification follows the Fama-French 12-industry categories. Standard errors are clustered at the acquirer level. The corresponding *p*-values are reported in parentheses. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

	Combined CAR (-2, +2)		
	(1)	(2)	(3)
Major Customer	-0.010*		
	(0.057)		
MajorALL		-0.025**	
		(0.011)	
HHI			-0.042**
			(0.020)
Acquirer Firm size	-0.009***	-0.009***	-0.009***
	(0.000)	(0.000)	(0.000)
Acquirer Tobin's Q	-0.001	-0.001	-0.001
	(0.498)	(0.493)	(0.520)
Acquirer Leverage	0.052**	0.053**	0.053**
	(0.018)	(0.017)	(0.017)
Acquirer Free cash flow	0.024	0.024	0.025
	(0.307)	(0.302)	(0.295)
Acquirer Stock price run-up	-0.004	-0.004	-0.005
	(0.612)	(0.580)	(0.566)
Target Firm size	0.008***	0.008***	0.008***
	(0.000)	(0.000)	(0.000)
Target Tobin's Q	-0.002	-0.002	-0.002
	(0.372)	(0.419)	(0.391)
Target Leverage	0.0004	0.001	-0.0001
	(0.982)	(0.951)	(0.993)
Target Free cash flow	-0.001	-0.001	-0.002
	(0.938)	(0.946)	(0.859)
Target Stock price run-up	-0.002	-0.002	-0.002
	(0.665)	(0.662)	(0.669)
Mixed deal	-0.022***	-0.022***	-0.022***
	(0.000)	(0.000)	(0.000)
Pure stock deal	-0.026***	-0.025***	-0.026***
	(0.000)	(0.000)	(0.000)
Relative deal size	0.004***	0.004***	0.004***
	(0.003)	(0.003)	(0.003)
High tech	-0.017	-0.017	-0.017
	(0.124)	(0.107)	(0.108)
Constant	0.084***	0.083***	0.080***
	(0.000)	(0.000)	(0.000)
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Observations	1,152	1,152	1,152
Adjust_R^2	0.153	0.153	0.154

Table A3 Durbin-Wu-Hausman tests

This table report the results from the augmented regression version of Durbin-Wu-Hausman (DWH) test. The procedures are outlined in Davidson and MacKinnon (1993, chapter 7) and Drobetz and Momtaz (2020). We first model the endogenous customer concentration measures as a function of controls in our baseline model to obtain the residuals. In the second stage, we regress the acquirer CARs on each customer concentration measures, control variables, and particularly the DWH residuals obtained from the first stage. This table report the results of the second stage. *Major Customer* is an indicator variable which equals one if the target has at least one major customer in either of the two fiscal years before the acquisition and zero otherwise. *MajorALL* is the fraction of the target sales represented by major customers. *HHI* is the Herfindahl-Hirschman Index of the target sales to major customers. Control variables are the same as those in Table 4. All models include year and industry fixed effects. The industry classification follows the Fama-French 12-industry categories. Standard errors are clustered at the acquirer level. The corresponding *p*-values are reported in parentheses. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% level, respectively.

	Acquirer CAR (-2, 2)		
	(1)	(2)	(3)
Major Customer	-0.033***		
	(0.003)		
Major Customer_Residual	0.018		
	(0.146)		
MajorALL		-0.059***	
		(0.004)	
MajorALL_Residual		0.029	
		(0.202)	
HHI			-0.082**
			(0.035)
HHI_Residual			0.042
			(0.338)
Other controls	Yes	Yes	Yes
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Observations	1,446	1,446	1,446
Adjust_R2	0.095	0.096	0.092