The role of divestitures in horizontal mergers

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Abstract

We study the effectiveness of divestitures as a merger remedy. We show that divestitures are more effective in mitigating the market power impact of mergers if the merging firms divest assets to buyers outside the industry rather than existing rivals. Divestitures are also more effective as merger remedies when the merging industry is concentrated and when powerful customers are absent. Notably, stock price reactions of the acquirer and rivals suggest that firms are more concerned with maintaining a competitive edge relative to each other than gaining market power relative to customers.

1. Introduction

In the last few decades, more than a third of mergers and acquisitions (M&A) in the United States were between firms in the same industry. These deals, known as horizontal mergers, constituted about half of the total dollar value of merger activity. The Federal Trade Commission (FTC) and the Department of Justice (DOJ) routinely scrutinize horizontal mergers to ascertain whether a merger has the potential to reduce competition. Both regulatory bodies state that if a merger is expected to create market power vis-à-vis customers, the most common remedial measure required by the consent decree is a divestiture.[1] Consistent with that statement, Kühn (2010) observes that antitrust policy increasingly imposes structural remedies rather than a categorical veto of a merger. It is also well recognized that merger counterparts often undertake voluntary, pre-consummation divestitures to reduce the likelihood of an antitrust challenge (see Gotts, 2001).

Regulators expect divestitures to limit the market power impact of horizontal mergers. Although nascent industrial organization theory of Vergé (2010) and Vasconcelos (2010) provides a framework for how divestitures limit the price-increasing potential of mergers, there is little empirical evidence on the effects of merger-related divestitures. This paper closes the gap in the literature by providing the first empirical analysis of the effectiveness of divestitures as a remedy for the market power impact of mergers.[2]

Examining the impact of merger-related divestitures can also shed new light on the market-power potential of horizontal mergers, particularly given the lack of agreement in existing literature regarding this issue. Studies relying on stock-return analysis conclude that horizontal mergers are motivated by efficiency considerations and do not create market power (see Eckbo, 1983; Stillman, 1983; Eckbo, 1985; Eckbo and Wier, 1985; Fee and Thomas, 2004; Shahrur, 2005). Since this literature does not account for divestitures, it cannot determine whether anticompetitive potential exists but is mitigated through divestitures. A number

[1] See "Antitrust Division Policy Gide to Merger Remedies" provided by the DOJ and "Negotiating Merger Remedies" provided by the Bureau of Competition of the FTC.

[2] Several existing papers examine both acquisitions and divestitures, e.g., Mulherin and Boone (2000), Comment and Jarrell (1995), and Mitchell and Mulherin (1996). However, none of these papers study the role of divestitures as a remedy for merger-induced market power.

of studies that examine post-merger output prices conclude that horizontal mergers result in higher output prices due to a reduction in competition (see Barton and Sherman, 1984; Borenstein, 1990; Kim and Singal, 1993; Singal, 1996; Prager and Hannan, 1998; Kwoka and Shumilkina, 2010). Again, these papers do not consider the role of divestitures.

We examine three research questions related to divestitures accompanying mergers. The first question focuses on the impact on customer firms. We ask whether divestitures limit the market power effect of horizontal mergers as predicted by industrial organization theory, in particular, whether the effectiveness of divestures as a remedy for merger-induced market power depends on who buys the divested assets. We use two theoretical viewpoints to help outline the empirical predictions: the Market Power Hypothesis and the Competitive Efficiencies Hypothesis. Under the Market Power Hypothesis, horizontal mergers can lead to greater unilateral monopoly power as well as more opportunity for cooperative collusion. Divestitures reduce the size of the merged firm and limit its ability to exercise monopoly power. Moreover, if divested assets are purchased by a firm outside the industry (i.e., by a new entrant), the larger number of players makes the marketplace more competitive, and cooperative collusion is harder to sustain. Thus, under the Market Power Hypothesis, divestitures are more effective in restraining market power over customers if assets are sold to firms outside the industry.

An alternative argument presented by Verge (2010) and Vasconcelos (2010), which we term the Competitive Efficiencies Hypothesis, posits that new entrants cannot be cost efficient enough to compete effectively with the larger, merged firm. These papers argue that divestitures will be more effective in keeping output prices low if symmetry in size is restored in the industry by selling assets to existing rivals. The Market Power Hypothesis and the Competitive Efficiencies Hypothesis are not mutually exclusive; market power and efficiency gains can coexist in horizontal mergers. Our tests capture the net effects of these two forces and identify which type of divestitures are the most effective as merger remedies.

The second question we address is whether the efficacy of divestitures as a remedy for merger-induced market power depends on industry conditions, including both the characteristics of the merging industry and the customer industry. In highly competitive industries, horizontal mergers are not expected

to harm customers' interests and observed divestitures are less likely to have an impact on market power. Hence, we expect the effects of divestitures as a remedy for merger-induced market power will be stronger in concentrated industries. In addition, the presence of powerful customers can lead to countervailing market power (Galbraith, 1952; Snyder, 1996) and could, therefore, mitigate antitrust concerns. Hence, we expect the effects of divestitures will be stronger in the absence of such powerful customers.

Third, we focus on the impact of merger-related divestitures on acquirers and rival firms in order to distinguish between the market power and cost efficiency hypotheses of horizontal mergers. It is well recognized that firms in the merging industries (both the merging firms and their rivals) stand to benefit from any market power vis-à-vis customers the horizontal merger might create. Divestitures decrease the market power potential of the merger but do so to a lesser degree if the assets are sold to an existing rival firm. Divestitures matter in the context of competitive efficiencies as well. Rivals of merging firms face the prospect of competing with a larger, potentially more cost-efficient merged entity. Divestitures alter the relative size of firms in the industry depending on whether divested assets are purchased by an existing rival or a new entrant. We examine divestitures' wealth impact on the acquiring firm and rivals to see which of the two effects dominates.

We examine these questions using a sample of 2,269 large horizontal mergers and accompanying divestitures that occurred in manufacturing and mining industries between 1980 and 2018. Assuming that capital markets are efficient and reflect changes in the product market, we examine merger announcement returns of acquirers, their rivals, and customers conditional on whether a divestiture was observed in the year preceding merger announcement and whether the divested assets were sold within the industry or outside. We find that customer CARs at the announcement of a merger are significantly higher if the acquirer or target divests assets to firms outside the industry rather than to firms within the industry. This finding is consistent with the Market Power Hypothesis which predicts that divestitures are more effective in restraining product price increases (hence customers are better off) if the buyer lies outside the industry. We also find supportive evidence in supplementary tests that examine post-merger output prices. Using

Producer Price Index (PPI) data, we document that post-merger output prices are lower if the divested assets are sold to a firm outside the industry rather than to existing rivals.

Cross-sectional tests based on the characteristics of merging and customer industries show more supportive evidence that divesting to outsiders limits the market power impact of mergers. In concentrated industries, customers react more negatively if an existing competitor rather than an outsider buys the divested assets, while in competitive industries this variable is not a significant determinant of customer returns. Since market power is of greater concern in concentrated industries, this result is consistent with the notion that divestitures are effective merger remedies.

Prior research suggests that powerful customers can counteract upstream pricing power. In Snyder's (1996) theory of countervailing power, large buyers can obtain lower prices from colluding sellers. Galbraith (1952) argues that in a market with few sellers, the incentive to hold price near marginal cost is provided by the presence of strong buyers. These arguments suggest that divestitures are more likely to be effective merger remedies when the countervailing influence of powerful customers is absent. Indeed, we find that in customer industries without a large buyer or in customer industries that are competitive, stock prices react more negatively when an existing rival of the merging firms rather than an outsider buys assets divested by the merging firms. In contrast, the identity of the buyer of divested assets is not a significant determinant of customer returns if a large customer firm exists or if the customer industry is concentrated in the hands of a few players.

To gauge the net effect of market power and competitive efficiencies on industry peers, we look at the stock price reactions of acquirers and rival firms. We find that acquirer returns are *lower* when firms in the same industry purchase divested assets. This result is noteworthy given our finding that customer returns are lower and output prices higher when firms in the same industry purchase divested assets. This finding indicates that, for an acquiring firm, concerns about an existing rival growing bigger (through the purchase of divested assets) outweigh any benefits from gaining pricing power relative to customer firms.

The market power created by the merger also appears to be of secondary concern for the rivals of the merging firms. The announcement returns of rivals are *lower* when firms in the same industry purchase

divested assets. This finding is more pronounced for small rivals. Thus, for rivals of merging firms, particularly smaller rivals, keeping the size of existing competitors in check also appears to be a more pressing concern than gaining market power relative to customers.

To address the concern that our results might be driven by secular trends in the industry during our sample period, we conduct placebo tests that examine CARs on randomly selected dates during the six months surrounding merger announcements. On these hypothetical event dates, CARs of acquirers, rivals, and customers are not significantly related to who buys the divested assets.

Our paper has three key contributions. We provide the first large-sample analysis of the remedial role of divestitures in horizontal mergers. We find that not all divestitures are effective merger remedies. Divestitures are more successful in reducing the market-power impact of horizontal mergers if the assets are sold to firms outside the industry. Second, we show that merger-related divestitures are most beneficial for customers when industry conditions are conducive to the exercise of market power, for example, in more concentrated industries or when powerful buyers are absent. Third, our results also help reconcile the seemingly conflicting findings of existing product market studies, which conclude that horizontal mergers create market power, and of stock market studies, which conclude that mergers are primarily motivated by cost efficiencies. Our empirical analysis shows that horizontal mergers are accompanied by changes in both market power and competitive efficiency. The market power implications of mergers and accompanying divestitures are visible in output prices and customer stock price reactions. The impact of mergers and divestitures on firms' relative competitive efficiencies is reflected in the stock price reactions of acquirers and rival firms.

The rest of the paper is organized as follows: Section 2 develops the hypotheses. Section 3 describes the sample. Section 4 presents announcement returns of customers, acquirers, and rivals. Section 5 explores the role of industry concentration and powerful buyers. Section 6 presents product price analysis. Section 7 concludes.

2. Hypothesis Development

Merging firms often sell assets in the period surrounding a merger, either voluntarily or because they are required to do so by regulatory authorities. Selling assets reduces the size of the firm and can affect the scale of the output produced by the firm. The quantity produced, in turn, has implications for output prices as well as cost economies. Efficient capital markets are expected to reflect the changes occurring in the product markets. This section focuses on how stock prices might be expected to change due to divestitures under the Market Power and Competitive Efficiencies Hypotheses. Since competitive efficiencies and market power can coexist, our tests capture the net effects of the two on customers, acquirers and rivals. All predictions discussed in this section are summarized in Table 1.

2.1. Predictions for customer announcement returns

The Market Power Hypothesis contends that horizontal mergers can result in greater pricing power either through a unilateral reduction in output (e.g., Perry and Porter, 1985; Perry, 1984) or by increasing the opportunities for cooperative collusion (e.g., Green and Porter, 1984; Tirole, 1988; Vasconcelos, 2005). Whether unilateral or cooperative, a reduction in output results in higher prices for customers. Divestiture of assets by the merging firms may limit the merger's market power effect because purchasing firms can deploy the divested assets to preserve long-term competition in the industry. If divestitures are effective merger remedies, then mergers with accompanying divestitures should elicit more positive stock-price reactions from customers compared to mergers without.

However, horizontal mergers can also create economies of scale and eliminate redundancies. Under the Competitive Efficiencies Hypothesis, divestitures might reduce the merging firms' ability to realize economies of scale and pass on cost cuts to customers. If merged firms are believed to routinely pass on the benefits of scale economies to customers, then mergers accompanied by divestitures can lead to more negative stock price reactions from customers.

Some divestitures are expected to be more effective than others at limiting price increases. Under both the market power argument and the competitive efficiencies argument, the industry of the purchasing

firm matters. The logic of the market power hypothesis predicts that divesting assets to a firm outside the merging industry is more effective in limiting the price impact of horizontal mergers. Selling assets to firms outside the industry brings new players into the market and makes the industry more competitive. With more players in the market, it is more difficult for firms to either exercise unilateral market power or collude to restrict output. Thus, under the Market Power Hypothesis, output prices are higher if an existing rival buys the divested assets. This implies a negative stock price reaction for customers if divested assets are bought by an existing rival rather than by a firm outside the industry.

In contrast, relying on cost-efficiency arguments, Vasconcelos (2010) and Verge (2010) predict that divestitures limit the price-increasing impact of horizontal mergers only if the assets are sold to a rival within the same industry. Divesting assets to other firms in the same industry restores symmetry in the industry by allowing existing rivals to also become larger and more cost efficient. These larger rivals can compete more effectively with the merged firm than a new entrant can. Therefore, under the Competitive Efficiencies Hypothesis, customer announcement returns will be higher if an existing rival buys the assets.

Although all our tests include a binary variable to capture whether a divestiture accompanies a merger, we note the potential endogeneity of the divestiture decision. It is possible that mergers with anticompetitive potential are effectively remedied via divestitures, while mergers that are not expected to significantly lower product market competition will not be remedied via divestitures. Thus, if divestiture as a merger remedy is optimally decided, a significant empirical relation between divestiture dummy and output prices, and therefore customer CARs, may not be observable.

In contrast, a variable capturing whether assets are sold to a within-industry buyer or an outsider is less prone to the endogeneity problem. Previous research suggests that typically only one potential buyer actively negotiates to purchase divested assets (Jain, 1985; Sicherman and Pettway, 1987). Thus, an acquirer may not have much flexibility in whether it sells to a within-industry buyer or an outsider. Moreover, while the merger policy guidelines of the FTC and DOJ provide a detailed discussion of circumstances under which a divesture would likely be imposed as a remedy for merger-induced market power, relatively little is said about what characterizes a suitable buyer. As pointed out by Kuhn (2010),

antitrust implications of within-industry and outside-industry divestitures are not well understood. It is this previously unexplored research question that our empirical tests focus on. Table 1 summarizes our predictions based on whether divested assets are purchased by buyers within the industry or by outsiders.

2.2. Predictions for acquirer announcement returns

When considering the stock-price reactions of acquirers, we take into account the change in market power relative to customers, the acquiring firms' ability to realize cost cuts, and one additional factor: whether a rival firm becomes larger due to a divestiture. Under the Market Power Hypothesis, divesting assets to a buyer outside the industry brings a new player to the market. A larger number of firms in an industry limits unilateral market power and reduces the sustainability of collusive agreements. Therefore, acquirer returns will be higher if assets are divested within the industry because doing so keeps the number of firms in the industry lower and makes collusion more sustainable. Under the Competitive Efficiencies Hypothesis, acquirer returns will be lower if assets are divested to a firm within the industry because it results in a larger, more cost-efficient existing rival that can compete aggressively with the merged firm.

2.3. Predictions for rival announcement returns

In their discussion of horizontal mergers, Spiegel and Tookes (2003) argue that rivals benefit from fewer competitors in the market, but are hurt if the merged firm is a much stronger competitor than the standalone firms. Our analysis of divestitures allows for the possibility that both pricing power and productive efficiencies are at play and tests the relative importance of each for rival firms. To do so, we focus on the rival firms that do not purchase the assets divested by the merging firms.

Under the Market Power Hypothesis, divesting assets to a buyer outside the industry brings a new player in the market and increases competition. Therefore, rival returns will be higher if assets are divested within the industry because doing so keeps the number of firms in the industry lower and prices higher. In contrast, under the Competitive Efficiencies Hypothesis, if the merged firms sell assets within the industry, rivals who do not purchase the divested assets now have two larger firms to compete with: the combined

firm resulting from the merger and the rival that purchases the divested assets. This implies lower stock returns for the rival firm.

3. Sample description

3.1. Identifying horizontal mergers

We obtain from SDC Platinum all completed mergers and acquisitions announced between 1980 and 2018 in the mining and manufacturing sectors (SIC codes between 1000 and 4000) provided the following conditions are met – (i) both acquirer and target are headquartered in the US (ii) the merger transaction value is reported (iii) the merger does not involve an acquisition of divested assets, i.e. both counterparties are stand-alone firms, and (iv) more than 50% of the target's shares were acquired.

From these, we select horizontal mergers defined as deals in which the acquirer and target operate in the same four-digit SIC code. If the acquirer or target operates in multiple segments, we use Compustat segment sales data to identify up to three largest segments of each firm. Of these, if the acquirer and target operate in at least one overlapping segment, the merger is classified as a horizontal merger and the overlapping SIC is considered to be the industry in which the horizontal merger occurred. Using this approach, we obtain a sample of 4,550 horizontal mergers. Not all horizontal mergers are significant enough to affect competition. We focus on a subset of large mergers that are likely to affect product market competition and therefore, face regulatory scrutiny. We calculate acquisition size as merger transaction value divided by the total industry assets in the year before the merger occurs and keep all deals that fall above the sample median of this ratio. This results in a sample of 2,269 horizontal mergers. The distribution of horizontal mergers by 2-digit SIC code is tabulated in Table 2.

3.2. Identifying divestitures

Next, we determine whether a horizontal merger was accompanied by divestitures. We again use SDC Platinum to obtain divestiture transactions by the acquirer or target firm.[3] Since we examine the stock price reactions around the merger announcement, we focus on core-asset divestitures by either the acquirer or the target in the year prior to merger announcement. Focusing on the year preceding merger announcement helps avoid the look-ahead bias. We also focus on the relative short period of one year preceding the merger announcement so that the divestiture is likely motivated by the merger or has an impact on the merger. In robustness checks, we include divestitures during the two years before and two years after the merger announcement. Our main results hold.

We do not limit our sample to only divestitures mandated by antitrust authorities because a very small number of mergers are explicitly challenged by DOJ or FTC. We review all Hart-Scott-Rodino annual reports (in which DOJ and FTC report their merger challenge/enforcement activities) between 1980 and 2018 and find that only 2.7% of the deals in our sample were challenged. According to a summary by the law firm Cadwalader, Wickersham & Taft LL, during the period of 2014-2018, 2.2% of all reportable mergers (mergers that send notifications to regulators) were challenged.[4] Thus, the fraction of challenged deals in our sample is a little higher than that in the general merger universe, which is to be expected as we focus on large deals only.

The small number of official challenges does not mean that other deals are all free of antitrust concerns. In fact, firms often divest assets preemptively to avoid an antitrust investigation.[5] In the antitrust

[3] Specifically, we identify divestitures in which the immediate or ultimate parent of the divested entity is the target or the acquiring firm of the horizontal merger.

[4] The summary information can be found at: https://www.cadwalader.com/resources/clients-friends-memos/hart-scott-rodino-annual-report-for-fiscal-year-2018-decreases-in-second-requests-but-increased-likelihood-of-challenged-deal-where-second-request-issued .

[5] For example, in the months prior to completing its merger with L3 Technologies, Harris Corp divested its overlapping night vision business in order to be proactive in its regulatory process with the DOJ. In 2012, before announcing its acquisition of Dollar Thrifty, Hertz decided to divest its Advantage Budget business (which overlaps with Dollar Thrifty's low budget rental business). In both cases, the CEOs acknowledged anti-trust considerations of the divestiture decision. For the Harris and L3 deal, see "Harris Sells Night Vision to See L3 Deal Through**"** by Tom Terrarosa, The Deal, 4/5/2019. For the Hertz deal, see "Hertz and Dollar Thrifty Announce Definitive Merger Agreement" by Richard Broome, Cision PR Newswire, 8/26/2012.

literature, such transactions are well recognized and are termed fix-it-first remedies. Gotts (2001) argues that antitrust authorities favor successful fix-it-first remedies as they save government resources. Firms have strong incentives to preempt an antitrust challenge due to the high costs associated with it (Gotts, 2001; Gelfand and Brannon, 2016). The Antitrust Division Policy Guide to Merger Remedies issued by the DOJ also recognizes the advantages of fix-it-first remedies.[6] By focusing on divestitures announced during the one year preceding merger announcement, our sample includes fix-it-first divestitures.

To further ensure that a divestiture is likely to matter from an antitrust perspective, we only include core-asset divestitures, i.e., where the divested assets are in the same line of businesses as the merging firms. For that purpose, we exploit the fact that SDC Platinum reports the 4-digit SIC code at the divestiture level. We identify divestitures that have the same 4-digit SIC as one of the acquirer or target's three largest segments and refer to these as divestitures of core assets. If a horizontal merger is matched to at least one divestiture of core assets in the year preceding merger announcement, we assign a value of one to a dummy variable called *Divestiture Dummy*. If no divestitures of core assets are found in this window, the dummy variable takes a value of zero. Of the 2,269 horizontal mergers in our sample, 351 (15%) are associated with at least one divestiture of core assets in the preceding year.

Finally, we determine whether the divested core assets were bought by a firm that operates in the same industry as the merging firms or by firms operating in other industries. Since an acquisition can be associated with more than one divestiture, we define a variable called *Pct_SameInd* which measures the fraction of divested assets sold to firms in the same industry. For each merger accompanied by divestiture of core assets, we calculate this ratio as the number of divestitures for which the buyer of divested assets operates in the same 4-digit SIC code as the horizontal merger divided by the total number of divestitures. We find that 139 mergers involve at least one divestiture in which assets are purchased by a firm in the same industry. The mean value of *Pct_SameInd* across 351 mergers with accompanying divestitures is 0.24. That is, on average, 24% of divestitures per merger involve sale of core assets to firms within the same

[6] See page 27 of The Antitrust Division Policy Guide to Merger Remedies issued by the DOJ (2004).

industry. We also calculate an unconditional version of this variable, called *Pct_SameInd_All*, which is set equal to *Pct_SameInd* if a divestiture occurs and is set equal to zero if it does not. The mean value of this variable is 0.04. Summary statistics of these variables are presented in Panel A of Table 3.

Panel B of Table 3 presents summary statistics of several control variables that are expected to affect merger announcement returns. The control variables are defined in the appendix. In our sample, 52% of deals are all cash financed. In 39% of deals, the target firm is publicly traded. About 1% of the deals involve a hostile bid. Just under 3% of the deals are challenged by the FTC or DOJ. Also, about 3% of deals face a competing bid. The acquirer and target sales as a ratio of total industry sales (based on Compustat data) is on average 25%, which indicates that horizontal mergers in our sample are on average quite large. The four-firm concentration ratio CR4, defined as the market share of the four largest firms in the industry is on average 37%.

3.3. Identifying customers and rivals

We identify customer firms using the Benchmark Input-Output (IO) tables compiled by the Bureau of Economic Analysis (BEA). Specifically, for each merger, we rely on the Use Tables to identify the merging industry's most dependent customers.[7] For each customer industry (i.e., an industry using the merging firm's commodity), we follow Shahrur (2005) and calculate a ratio called the Input Coefficient that captures the fraction of the customer industry's total input usage provided by the merging industry. We

[7] We rely on the BEA Use tables for the years 1987, 1997, 2002, and 2012. BEA tables are collated either by IO codes or by NAICS codes, while our horizontal mergers are defined based on SIC codes. We use the IO Code-to-1987SIC crosswalk provided by the Census Bureau to convert the 1987 IO-code based tables to SIC-based tables. We use the Census Bureau's 1997NAICS-to-1987SIC crosswalk to convert the 1997 BEA tables to SIC. We use the 2002NAICS-to-1987SIC crosswalk to convert both the 2002 and 2012 tables to SIC codes. SIC codes and NAICS codes do not always have a one-to-one match. If an SIC code matches to more than one NAICS code, we retain all the matches and take the average input coefficient across all matched industries to identify the three most dependent customer industries. Also note that for mergers occurring between the years 1980 and 1992, we identify customers using the 1987 Use tables. For mergers occurring between 1993 and 1999, we find customers using the 1997 Use tables. For mergers occurring in years 2000 through 2007, we identify customers using the 2002 Use tables. Finally, for mergers occurring from 2008 through 2018, we identify customers using the 2012 Use tables. For mergers that do not match to customer industries using 'time-matched' BEA Use tables, we attempt to identify customer industries using the 2002 BEA Use tables. Finally, for mergers that are still unmatched to customer industries, we use 3-digit SIC codes instead of 4-digit SIC codes to identify downstream industries using the 2002 Use tables only. Observations in the last step make up less than 2% of the sample.

identify the most dependent customer industries for each merger as the three customer industries with the largest input coefficients, provided the input coefficients are 10% or greater. That is, at least 10% of the customer industry's input is supplied by the merging industry. We then use Compustat to select all publicly traded firms that operate in the customer industry.

We identify rivals of the acquiring firm using the Hoberg and Phillips Text-based Network Industry (TNIC) classification at the 3-digit SIC granularity. This choice is based on evidence in Hoberg and Phillips (2010, 2016) that the text-based classification offers economically large improvements relative to SIC codes in the ability to explain differences in key firm characteristics such as profitability, sales growth, and market risk across industries. Equally important, TNIC classification also better explains the extent to which managers mention high competition in the Management's Discussion and Analysis section of the 10-K and the specific firms mentioned by managers as being competitors. We exclude rivals that buy divested assets, thereby focusing on "nonbuying" rivals only. On average, we are able to identify about 50 TNIC rivals for each merger.

For acquirers, rivals, and customers, we calculate cumulative abnormal returns (CARs) around merger announcements using the market model. Market model parameters are estimated during the period of trading days [−271, −21], relative to the announcement date of the merger. Cumulative abnormal returns are calculated for the three trading days centered on the announcement date. Since the returns to rival firms for a given acquisition can be correlated, for each acquisition we use the value-weighted portfolio return of all rival firms. Similarly, we use the value-weighted portfolio return of customer firms in a certain customer industry. Our main results hold if we use the equal-weighted portfolio return for rivals and customers.

Our sample of 2,269 horizontal mergers consists of both public and private acquirers. We are able to calculate acquirer CARs for 1,786 mergers and TNIC-rival portfolio CARs for 1,254 mergers. We are able to calculate CARs for 1,859 customer industries relating to 933 mergers. Panel C of Table 3 reports that the mean (median) acquirer announcement return is 0.84% (0.42%), significant at the 1% (5%) level. The mean (median) rival portfolios' return for TNIC rivals is 0.33% (0.25%), significant at the 1% level. The mean (median) customer portfolios' return is −0.19% (−0.17%), significant at the 1% level. These

average announcement returns are consistent with existing studies that generally find positive returns for the combined merging firms and nonnegative average returns for rivals (e.g., Eckbo, 1983; Fee and Thomas, 2004; Shahrur, 2005). The positive announcement returns for the acquirer and TNIC rivals and the negative announcement returns for customers are indicative of market power, i.e., both the acquirer and the rivals benefit (and customers suffer) from the increased market power of the merging industry after a horizontal merger.

4. Main Results

In this section, we describe our main findings regarding stock price reactions at the announcement of horizontal mergers conditional on the occurrence of a pre-merger divestiture and on whether divested assets were sold to a firm within the same industry or outside the industry. Section 4.1 focuses on customer announcement returns. Section 4.2 focuses on acquirer announcement returns and Section 4.3 is devoted to announcement returns of rivals of the merging firms. In Section 4.4., we present two-stage models to account for the possible endogeneity of the merger decision. In Section 4.5, we conduct a placebo test to ensure that the results are not driven by some secular trend.

4.1 Customer Announcement Returns

Table 4 presents ordinary least-squares regressions (OLS) of customer CARs on our main explanatory variables: Pct_SameInd_All (if the full sample is used), and Pct_SameInd (if only the sample with accompanying divestitures is used). Under the Market Power Hypothesis, the coefficient on Pct_SameInd_All should be negative, while under the Competitive Efficiencies Hypothesis, the coefficient on Pct_SameInd_All should be positive. Columns 1 and 2 present analyses on the full sample including acquisitions without pre-merger divestitures. The sample in columns 3 and 4 is restricted to the subsample in which a divestiture is observed. The regressions include industry fixed effects at the 2-digit SIC code and year fixed effects. All regressions use heteroskedasticity-consistent robust standard errors. The coefficients on Pct_SameInd_All and Pct_SamedInd are negative and statistically significant in all columns,

indicating that customer CARs are lower if a greater fraction of divested assets is bought by firms within the industry. This result is consistent with the Market Power Hypothesis which predicts that output prices are higher when assets are divested to firms within the industry rather than to firms outside the industry. A key takeaway from this analysis is that divestitures are more effective as a remedy for merger-induced market power when assets are sold to a firm outside the industry. In Section 6 below, we explore whether change in product prices after the merger does indeed depend on the percentage of assets sold to within-industry buyers.

4.2 Acquirer Announcement returns

Table 5 presents OLS regressions of acquirer CARs on our main explanatory variables: Pct_SameInd_All (if the full sample is used), and Pct_SameInd (if only the sample with accompanying divestitures is used). Columns 1 and 2 present analyses on the full sample including acquisitions without pre-merger divestitures. The analysis in columns 3 and 4 is restricted to the subsample in which a divestiture is observed. As before, the regressions include industry fixed effects and year fixed effects. All regressions use heteroskedasticity-consistent robust standard errors. The negative coefficients on Pct_SameInd and Pct_SameInd_All, which are mostly statistically significant indicate that the industry of the buyer of divested assets also matters for acquirers' returns. The negative reaction of the acquirer's stock price to the sale of assets within the same industry indicates that the expected loss to the acquirer from an existing rival becoming larger and potentially more cost-efficient outweighs any market power gains relative to customers. Thus, this result supports the Competitive Efficiencies Hypothesis.

4.3 Rival Announcement Returns

In Table 6 columns 1 and 2, we present analysis of the announcement returns of rival firms using the full sample of mergers. Pct_SameInd_All is negative and statistically significant at the 5% level in both columns. This evidence supports the Competitive Efficiency Hypothesis, which predicts a negative stock price reaction for rivals of the merging firms. We further conjecture that not all rivals are similarly affected

by the horizontal merger. Smaller rivals are more likely to be at a competitive disadvantage after the merger due to the scale economies the merging firms can achieve. Indeed, anecdotal evidence suggests that firm size matters in the response of rival firms to horizontal mergers. On March 20, 2011, when AT&T announced a proposed acquisition of T-Mobile, Sprint Nextel Corp, the smaller of its two rivals with a market capitalization of $13 billion experienced a drop in share price of 13.6%. In contrast, the larger rival, Verizon Communications, with a market capitalization of $102 billion, experienced a small increase in share price of 1.7%. The proposed acquisition faced a long-drawn out battle with antitrust regulators and on December 19th AT&T announced its plan to abandon the attempted acquisition. The next day Sprint's stock price jumped up by 9.2% while Verizon's stock price increased by a relatively muted 1.5%. In light of this, we look within subsamples of small and large rivals, where small (large) rivals are defined as those with below (above) median market capitalization in the announcement year.

Columns 3 and 4 of Table 6 present an analysis of the announcement returns of small rivals (using the full sample of acquisitions with and without pre-merger divestitures). We see that Pct_SameInd_All is negative and statistically significant in both regression specifications. In contrast, in Columns 5 and 6, which present announcement returns for large rivals, the coefficients on Pct_SameInd_All are insignificant in both regressions. Thus, stock prices of large rival firms do not react negatively when assets are divested within the industry. Overall, the results in Table 6 indicate that for small rival firms, the disadvantage of having to compete with larger, potentially more cost-effective rivals is high and outweighs any benefits that might arise from industry market power. In untabulated tests, we find that these results are qualitatively similar if we limit the sample only to acquisitions with divestitures.

A key finding of prior studies that support the Competitive Efficiencies Hypothesis rather than the Market Power Hypothesis is that rivals' stock prices react positively when a merger is challenged by regulators (Eckbo, 1983; Stillman, 1983; Eckbo and Wier, 1985; Fee and Thomas, 2004). This suggests that instead of worrying that industry participants will lose market power vis-à-vis customers, rival firms are relieved that a larger competitor might not be created. Our results conditioned on divestitures are consistent with these prior studies. Our results also indicate that rivals are more concerned about

competition among industry peers than about selling power versus customers. However, none of these findings rule out the possibility that mergers create market power. In fact, our analysis of customer CAR shows evidence of market power.

4.4 Treatment effect model

We recognize that divestitures are not exogenous events and are likely to depend on deal characteristics and industry conditions. We address the endogeneity of divestitures with a treatment effect model. In the first-stage regression, we model Divestiture Dummy as a function of the combined size of the acquirer and target relative to the industry (AT Sales Ratio), industry concentration (CR4), redeployability of the merging firms' assets, asset liquidity in the merging industry, and a dummy variable called Challenged that equals one if the merger was challenged by antitrust authorities and zero otherwise. We collect data on antitrust challenges by searching all HSR Annual Reports to Congress between 1980 and 2018 made by the FTC or DOJ. As discussed before, only 62 of the 2,269 deals in our sample (i.e., 2.7%) were explicitly challenged by the FTC or DOJ.

Following Kim and Kung (2016), *Redeployability* for the merging industry is calculated using the Bureau of Economic Analysis (BEA) 1997 capital flows table as the weighted average of the redeployability scores of all assets the industry uses, where the weights are the industry's expenditure on each asset. The redeployability score of a specific asset is the weighted average of the use of that asset across all industries, where the weight assigned to an industry is the total market capitalization of all Compustat firms in that industry.[8] Following Schlingemann et al. (2002), *Liquidity Index* is measured as the sum of the transaction values of all the corporate control transactions in a year within the overlap (i.e. merging) industry, divided by the total book value of assets within that industry.

Table 7 presents the two-stage model for customers CARs, acquirers CARs, and CARs of small rivals. Column 1 of Table 7 presents the first-stage regression coefficients. As expected, divestitures are

[8] Our results are robust if we use the number of firms as the weighting variable or if we use an equal weighted asset redeployability score.

more likely when the merging firms have larger market share, when antitrust authorities challenge the deal, and when asset liquidity is high in the industry. The coefficients on industry concentration and the redeployability index are insignificant.

The second stage regressions show consistent results as before. That is, after controlling for the endogenous choice of divestiture, in the regressions of customers CARs we see a negative and statistically significant coefficient on Pct_SameInd_All. This continues to support the Market Power Hypothesis. The coefficient on Pct_SameInd_All continues to be negative and statistically significant for acquirers and small rivals, solidifying evidence that for acquirers and rivals, the main concern is the prospect of competing with a larger, potentially more cost-efficient rival.

4.5 Placebo test and other robustness checks

It could be argued that the announcement returns of acquirers, rivals and customers are not attributable to the information content of the acquisition announcement. Rather, there may be secular trends or structural changes in the industry during our sample period that affect some acquirers differently and these acquirers tend to undertake divestitures for strategic reasons unrelated to the merger itself. In this section, we employ placebo tests to address endogeneity concerns of this type. Specifically, for each acquisition, we identify a random date during the six months surrounding the actual merger announcement and treat this date as a hypothetical event date. We examine the relation between CARs of acquirers, rivals and customers and the percentage of assets sold to firms in the same industry (Pct_SameInd_All and Pct_SameInd). In unreported tests, we find insignificant results.

The lack of significance in the placebo tests indicates that our results are not due to secular trends in the industry during our sample period. Rather, the horizontal merger is a significant information event and it matters who buys the assets divested by the merging firms. The sale of assets to firms outside the industry conveys more positive information for customers, acquirers, and rivals, albeit for different reasons.

We conduct several additional robustness checks. In our main analysis, we focus on divestitures of core assets in the one-year preceding merger announcement. Recall that we define core divestitures as those

involving sale of assets in the same SIC code as the merger. Our results are qualitatively similar, but statistically weaker, if we examine core divestitures occurring from one year before the merger announcement till one year after merger announcement. In alternate specifications, we use (i) core divestitures occurring in the two years before till two years after merger announcement and (ii) all divestitures (core and non-core) occurring in the two years before till two years after merger announcement. Our findings for customer CARs are qualitatively similar, and those for rival CARs are also similar, albeit weaker. Results for acquirer CARs are insignificant. Since our analysis focuses on abnormal returns on merger announcement day, the weaker results in these alternative specifications are possibly due to the introduction of a look-ahead bias induced by including divestitures that occur after the merger is announced.

5. The role of industry competitiveness and powerful customers

In highly competitive industries, individual firms' output decisions have little impact on product prices, and horizontal mergers are unlikely to affect pricing power. Due to the high degree of competition, divestitures that accompany horizontal mergers are also less likely to have a significant impact on product prices. Thus, we expect merger-related divestitures act as check on market power only in concentrated industries. That is, the customer CAR results presented in Section 4.1 are likely driven by concentrated industries.

The merger policy guidelines issued by FTC and DOJ focus on industry concentration measures as the primary indicators of pricing power, but they also list other possible indicators of selling power, such as the presence of powerful customers. In Section 5.1 below, we explore the role of industry concentration on the stock price reactions of customer firms. In Section 5.2 we look at the role of powerful customers.

5.1. Industry competitiveness

We divide the sample into two groups based on a common measure of industry concentration, i.e., the four-firm concentration ratio (CR4). CR4 is the percentage of value of shipments accounted for by the four largest firms in the industry. We split the sample into above-median and below-median values of CR4.

We then estimate customer CARs regressions as those in Table 4 separately for the two subsamples. The variable of interest is *Pct_SameInd_All,* which captures the percentage of divestitures in which a rival within the industry purchases the divested assets. For brevity, we tabulate the results for the full sample which includes mergers with and without divestitures, but not for the divestiture-only subsample in which a divestiture is observed. The main results are robust for the divestiture-only subsample.

Table 8 presents the regression results. Columns 1 and 2 report the OLS results. For the subsample of concentrated industries (high CR4), the divestiture dummy is positive, indicating that customer stock prices react positively when the merger has a accompanied divestiture. The coefficient on Pct_SameInd_All is negative, indicating that customer returns are lower when divested assets are bought by an existing rival rather than by a new entrant. The magnitudes of both coefficients are larger than those in Table 4 Column 2. In the competitive industries (low CR4), however, neither the divestiture dummy nor Pct_SameInd_All is significant. The results suggest that the link between customer CARs and divestitures is driven by concentrated industries.

Next, we check whether this result holds up to an endogeneity correction. Columns 3 and 4 report the results of a treatment effect model as described in Section 4.4. Column 3 shows the second-stage results for the sample of concentrated industries. Divestiture dummy is insignificant. However, Pct_SameInd_All remains negative and statistically significant, and the value changes little from the OLS regression. This confirms the OLS result that when industry concentration is high, customer returns are lower if existing rivals buy divested assets. Column 4 shows that this result does not hold in the low industry concentration sample. That is, when an industry is competitive it doesn't matter to customers whether a new entrant or an existing rival purchases divested assets.

The findings above are in line with the emphasis antitrust authorities place on industry competitiveness when deciding whether a merger should be challenged. For robustness, we look at several other industry concentration measures. Specifically, we look at the 20-firm concentration ratio (CR20), the 50-firm concentration ratio (CR50), and the Herfindahl-Hirschman Index (HHI). For each of these measures, we run regressions similar to the ones shown in Table 8. That is, we divide our sample into

measures of high and low CR20, CR50, and HHI, and rerun the customer CAR regression in each subsample with Pct_SameInd_All as the main variable of interest. The results of all these regressions are provided in Table 9. In the interest of space, we show only the coefficients on the two key variables but not those on the control variables.

In Panel A of Table 9, which presents OLS regressions, Divestiture Dummy is insignificant in most of the specifications. The exceptions are the high-HHI subsample, in which Divestiture Dummy is positive and statistically significant. Thus, we find some evidence that in concentrated industries, customer CARs are higher if a horizontal merger is accompanied by a divestiture. The occasional significantly positive relation between customer CARs and Divestiture Dummy in the high concentration subsamples is supportive of the Market Power Hypothesis.

Next, we look at the coefficient on Pct_SameInd_All. We see that in all subsamples of high industry concentration (i.e., high CR20, high CR50, high HHI), the coefficient on Pct_SameInd_All has a significantly negative coefficient. That is, in concentrated industries, customer stock price reaction is less positive when the divested assets are purchased by an insider. In contrast, Pct_SameInd_All is statistically insignificant in all subsamples of low industry concentration. Thus, our results are driven by the subsample of industries with high concentration.

In Panel B of Table 9, we present the second-stage regression results from a treatment effect model. The results are similar as in OLS. Specifically, Pct_SameInd_All is significant and negative in all subsamples of high industry concentration, but insignificant in all subsamples of low industry concentration. Overall, our results indicate that divestitures impact customer returns only in concentrated industries. The traditional measures of concentration all help identify cases in which divestitures can limit pricing power. Thus, our results give credence to the emphasis the DOJ and FTC place on industry concentration when evaluating the anti-competitive potential of a merger.

5.2 Powerful customers

The pricing power of the merging industry depends not only on the competitiveness of the industry itself, but also on the bargaining power of their customers. A large customer can concentrate its purchases to a single supplier and, in return for lower prices, provide the supplier with the certainty of volume as well as save the supplier advertising and other marketing costs. Large customers can also use their bargaining power to foster upstream competition (Fee and Thomas, 2004; Bhattacharyya and Nain, 2011). Galbraith (1952) argues that in a market of few sellers, the active restraint to keep prices near marginal cost is provided not by competitors but by large customers. Snyder (1996) presents a dynamic theory of countervailing power in which large buyers obtain lower prices from colluding sellers. Snyder argues that the presence of large buyers can increase profits for all buyers by countervailing upstream market power. Hovenkamp et al. (2016) suggest that, when deciding whether to challenge a horizontal merger, antitrust agencies take into account the ability of powerful customers to constrain price increases. Indeed, the 2010 Horizontal Merger Guidelines issued by the FTC and DOJ considers the possibility that powerful customers constrain the ability of merging parties to raise prices.

If pricing power is constrained by the presence of powerful customers, then our results should be driven by industries without powerful customers. We use two methods to capture powerful customers. First, we identify large customer firms for the acquiring firm. Specifically, we use the Compustat segment data to find customer firms that account for at least 10% of the acquirer's sales. We classify the industries these large customer firms belong to as "with large customers present". We expect that our results are stronger in the customer industries without such large players. Second, we use the 4-firm concentration ratio of a customer industry to capture powerful customers. If the customer industry sales are concentrated in the hands of a few large firms, these large customers are more likely to be able to countervail upstream market power.

Table 10 presents customer CAR analysis for subsamples based on both our measures of powerful customers. Column 1 presents results for industries with a large customer firm present, while column 2

presents results for industries with no large customer firms.[9] We see that Pct_SameInd_All is significantly negative only in the latter subsample. Any market power concerns that might arise when merging firms sell assets to existing rivals appear to be limited to customer industries without large buyers. This finding is consistent with the argument that large customer firms act as a constraint on upstream market power.

In columns 3 and 4 we find similar evidence using 4-firm concentration ratio (CR4) of the customer industry. In customer industries with high concentration, Pct_SameInd_All is insignificant. That is, we find no evidence in support of the Market Power Hypothesis concerning horizontal mergers. In contrast, in customer industries with low concentration, Divestiture Dummy is positive and significant while Pct_SameInd_All is negative and significant, both of which support the Market Power Hypothesis. This finding reinforces the importance of powerful customers in countervailing potential upstream market power created via horizontal mergers.

6. Product Price Analysis

In Sections 4 and 5, we presented robust findings that customer CARs are lower if the acquirer and target sell assets to firms within the industry rather than to firms outside the industry. We have interpreted these results as evidence that greater pricing power is maintained in the industry if assets are bought by existing rivals. In this section, we look for corroborating evidence in product prices. Specifically, we examine industry-level output prices conditional on the occurrence of divestitures and fraction of within-industry divestitures.

To examine industry-level output price data, we convert our sample of large horizontal mergers into industry-level merger events. An industry-quarter is classified as having a merger event if it contains any of the 2,269 above-median sized horizontal mergers in our sample. If more than one merger event occurs in 12 consecutive quarters in an industry, we keep only the first merger. There are 321 merger-events that occur in 170 industries.

[9] In column 1, the dummy variable *hostile* is dropped because there are no hostile deals in this subsample.

For industry-level output price of the merging industry, we rely on the monthly producer price index (PPI) obtained from the Bureau of Labor Statistics (BLS). The PPI measures the average selling prices received by domestic producers for their output.[10] We calculate real PPI (RPPI) as PPI divided by the contemporaneous consumer price index. We calculate the change in RPPI (ΔRPPI) as the average monthly RPPI in the 3 years following the industry merger event divided by the average RPPI in the three years prior to the merger event, minus one.

In the multivariate analysis of ΔRPPI, we follow Bhattacharyya and Nain (2011) and control for input prices and demand conditions. Higher input prices and higher demand are expected to put upward pressure on selling prices. To obtain input prices, we first use the benchmark input-output tables provided by the Bureau of Economics Analysis to identify, for each industry, the two upstream industries that supply the largest fraction of that industry's input. Then we calculate ΔRPPI for the largest and the second largest supplier industries in the same manner as described for the merging industry. To capture changes in overall demand conditions in the economy, we use changes in Total Industrial Production, which is obtained from the Federal Reserve Board. The production index measures real output and is expressed as a percentage of output in the base year 2007. Finally, we control for pre-merger industry concentration. We use the four-firm concentration ratio obtained from the Census Bureau as a control variable (CR4). The four-firm concentration ratio is the percentage of Value of Shipments accounted for by the four largest firms in the industry and includes all establishments in the industry, both privately held and public.

[10] The Producer Price Index (PPI) Series reflect price movements for the net output of goods-producing sectors of the US economy. To the extent possible, prices used in constructing the indexes are the actual revenue or net transaction prices producers receive for sales of their outputs. Scientific (probability) sampling techniques are used to select reporting establishments, products, and transactions for all types and volumes of output. The PPI measures changes in prices received by domestic producers; imported products are not priced in the survey. More details can be found in chapter 14 of the BLS Handbook of Methods. The PPI data from BLS are arranged by NAICS code. We use the Census Bureau crosswalks between NAICS and SIC code to match the data to our sample. For the years 1999 and before we use the 1997 NAICS-1987 SIC crosswalk to match SIC codes to NAICS codes. For years 2000 and later we use 2002 NAICS-1987SIC crosswalk. For SIC codes that do not match to NAICS after this initial step, we attempt a match using either the 1997 crosswalk or the 2002 crosswalk.

Table 11, Panel A presents the summary statistics of these industry-level variables before and after merger events. It is evident that horizontal merger events are accompanied by significant changes in the industry. The average output price in the merging industry (RPPI) is significantly lower after the merger than before. Input prices, Supplier 1 RPPI and Supplier 2 RPPI, are also lower. Total industrial production is higher after merger events. As expected, industry concentration is higher after horizontal merger events than before. These significant differences present a challenge for the industry-level analysis. Horizontal mergers are likely endogenously determined by changes in industry factors, thus making it difficult to assess market power simply by comparing output prices before and after the merger. A downward trend in output prices may trigger horizontal mergers that help shore up prices relative to the counterfactual (i.e., relative to what prices might have been in the absence of the merger). However, post-merger output prices may still be lower than pre-merger prices. Thus, a decline in prices is not an indicator that pricing power was not created. Similarly, an increase in prices after a horizontal merger is not in itself evidence of an increase in market power since industry demand factors that cause an upward trend in prices may also drive merger activity. Finally, a firm's willingness to sell assets may depend on the anticipated effect of an imminent merger on product prices, thus inducing a possible reverse causality in the product price analysis. Our analysis focuses on changes in post-merger output prices conditional on the fraction of assets divested to buyers within the industry, a relationship we believe is less subject to endogeneity problems. Nonetheless, we avoid making causal statements in our industry-level analysis and present the results as supplementary tests.

Panel B of Table 11 presents regressions of ΔRPPI on Divestiture Dummy and Pct_SameInd_All. Column 1 excludes year and industry fixed effects, column 2 includes year fixed effects only, column 3 includes only industry fixed effects, and column 4 includes both industry and year fixed effects. The coefficient on Divestiture Dummy is insignificant in all four regressions. The coefficient on Pct_Same_All is positive and statistically significant in three out of the four regression specifications. The positive coefficients on Pct_SameInd_All indicate that post-merger output prices are higher when a greater fraction of assets divested by the merging parties are purchased by firms within the industry. These results are

consistent with the Market Power Hypothesis and offer an explanation for why customer CARs are lower when Pct_SameInd_All is higher.

7. Conclusions

Horizontal mergers that are expected to decrease competition in the industry are often remedied via divestitures. These divestitures are sometimes undertaken voluntarily by merging firms in an effort to avoid a lengthy and expensive antitrust investigation. Economic theory suggests that the effectiveness of divestures as a remedy for merger-induced market power depends on whether the divested assets are bought by established players in the industry or new entrants. We test this prediction in the first large-sample study of how divestitures affect the product market impact of horizontal mergers. Assuming that stock markets are efficient and correctly reflect underlying changes in the product market, we examine the stock market reactions of the acquiring firm, their rivals, and customers.

We argue that some divestitures are more effective than others in limiting the market power impact of mergers. Specifically, we show that customer firms experience higher announcement returns if divested assets are bought by firms outside the industry. Our product price analysis provides an explanation for this finding: post-merger output prices are lower if the divested assets are sold to a firm outside the industry than to existing rivals. We conclude that divestitures are more effective in mitigating the price-increasing impact of horizontal mergers if divested assets are purchased by newcomers into the industry and not by existing players. These results are stronger where the market power potential of horizontal mergers is higher, i.e., when the merging industry is more concentrated and when large, powerful customers are absent.

The stock returns of acquirers and their rivals indicate that mergers also affect the relative cost efficiencies of the firms. In fact, for acquirers and rivals, improving their relative competitive position within the industry is more important than gaining market power relative to customers. Both acquirers and rivals have lower stock price reactions if a different firm in the same industry buys the divested assets. For rival firms, the results are driven by the subset of small rivals. These results indicate the firms would prefer

not to have their competitors become larger through acquisitions even if the acquisitions increase the industry's market power vis-à-vis customers.

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Table 1
Predictions

This table summarizes the predictions for stock price reactions of acquiring firms, their rivals, and customers to merger announcement conditional on whether assets divested by the merging firms are purchased by buyers within the same industry or outside the industry. We present predictions under the Market Power Hypothesis and the Competitive Efficiencies Hypothesis.

Expected stock price reaction if the buyer of divested assets is in the same industry:		
	Market Power Hypothesis	Competitive Efficiencies Hypothesis
Customer	Negative	Positive
	Fewer firms in industry means greater pricing power in merging industry.	Existing rival becomes larger and more cost efficient. Competes effectively with merged firm, putting downward pressure on prices.
Acquirer	Positive	Negative
	Fewer firms in industry leads to greater unilateral market power and more opportunities for cooperative collusion.	Existing rival becomes larger and more cost efficient.
Rival	Positive	Negative
	Fewer firms in industry means greater pricing power for all industry participants.	Now has to compete with two larger, more cost-efficient firms (the merged firm and the rival that purchased divested assets)

Table 2
Mergers and Divestitures by Industry

This table summarizes our sample, which includes 2,269 large mergers announced in the mining and manufacturing industries between 1980 and 2018. Mergers are considered horizontal if the acquirer and target have the same primary four-digit SIC code. For multiple segment firms, a merger is defined as horizontal if any of the three largest segments of the acquirer and target have the same four-digit SIC code. A merger is said to be associated with a divestiture if either the acquiring firm or the target firm divested assets in the one year before the merger announcement year, and that divestiture has the same 4-digit SIC as one of the acquirer or target's three largest divisions. We call these 'core' divestiture. A divestiture is considered to be within the same industry if the buyer of the divested assets has the same four-digit SIC code as the horizontal merger.

SIC	Industry Description	Deals	Deals with divestitures	Deals with within-industry divestitures
10	Metal Mining	27	5	1
12	Coal Mining	32	6	2
13	Oil and Gas Extraction	162	61	43
14	Mining and Quarrying of Nonmetallic Minerals, except fuels	7	2	0
15	Building Construction, General Contractors, Operative Build	53	6	1
16	Heavy construction Other than Building Construction Contract	40	0	0
17	Construction Special Trade Contractors	43	0	0
20	Food and Kindred Products	143	11	3
21	Tobacco Products	7	1	1
22	Textile Mill Products	27	2	0
23	Apparel	44	3	0
24	Lumber and Wood Products	33	1	1
25	Furniture and Fixtures	35	3	0
26	Paper and Allied Products	40	9	1
27	Printing, Publishing and Allied Industries	211	50	32
28	Chemicals and Allied Products	21	3	1
29	Petroleum Refining and Related Industries	44	2	1
30	Rubber and Plastics	14	2	0
31	Leather and Leather Products	32	2	0
32	Stone, Clay, Glass and Concrete Products	67	8	5
33	Primary Metal Industries	88	7	0
34	Fabricated Metal Products	261	33	2
35	Industrial and Commercial Machinery	254	43	19
36	Electronic and Other Electrical Equipment	87	7	2
37	Transportation Equipment	335	59	14
38	Instruments	75	3	1
39	Miscellaneous Manufacturing Industries	87	22	9
Total		2,269	351	139

Table 3
Deal-level Variables

This table presents descriptive statistics for merger and divestitures characteristics as well as cumulative abnormal returns (CARs) around merger announcement. Panel A summarizes the occurrence of divestitures at the deal level. *Divestiture Dummy* takes a value of 1 if a horizontal merger is accompanied by a core divestiture in the one year prior to the merger year. See legend of Table 2 for definition of core divestitures. *Pct_SameInd* captures the fraction of core divestitures that involved at least one within-industry buyer. It is calculated as the number of core divestitures per merger for which at least one of the buyers operates in the same 4-digit SIC code as the merging firms divided by the total number of core divestitures per merger. *Pct_SameInd_All* is set equal to *Pct_SameInd* if a divestiture occurs and equal to 0 if there is no divestiture.

Panel B provides summary statistics for deal characteristics. *All cash* is a dummy variable equal to 1 if all the transaction value of the deal is paid in cash and 0 otherwise. *Public* is a dummy variable equal to 1 if the target is a public firm and 0 otherwise. *Hostile* is a dummy variable equal to 1 if the attitude of the target's management was hostile toward the merger and 0 otherwise. *Competed* is a dummy variable equal to 1 if there is a competing offer for the target and 0 otherwise. *AT Sales Ratio* is the sum of sales of the acquirer and target obtained from Compustat divided by total industry value of shipments obtained from the Census Bureau. Challenged is a dummy equal to one if the merger is reported as challenged by the FTC or DOJ in the HSR Annual Competition Reports.

Panel C summarizes the cumulative abnormal returns (CARs) around merger announcement. CARs are calculated for three trading days centered on the announcement date, based on parameters estimated using the market model. For each acquisition we use the value-weighted portfolio return of all rival firms and customer firms. t-statistic are in parentheses. The median difference test uses the Wilcoxon matched-pairs signed-rank test. Superscripts ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

Panel A: Core Divestiture Summary Statistics

	N	Mean	Median	Std. Dev.
Divestiture Dummy	2269	.155	0	.362
Pct_SameInd	351	.241	0	.364
Pct_SameInd _All	2269	.037	0	.167

Panel B: Deal Characteristics

	N	Mean	Median
All cash	2269	0.519	1
Public	2269	0.392	0
Hostile	2269	0.011	0
Competed	2269	0.027	0
AT Sales Ratio	1970	0.250	0.091
Challenged	2269	0.027	0
CR4	1895	0.370	0.340

Panel C: Cumulative Abnormal Returns Summary Statistics

	N	Mean	Median
Acquirer CARs	1786	0.838%	0.417%
		(5.337)***	(4.33)**
TNIC Rival CARs	1254	0.33%	0.25%
		(4.1)***	(3.75)***
Customer CARs	1859	−0.19%	−0.17%
		(-2.84)***	(-2.88)***

Table 4
Customer CARs

This table presents Ordinary Least Squares (OLS) regression results. The dependent variable is the value-weighted cumulative abnormal returns (CARs) of customer firms. CARs are calculated over the [-1, +1] event window surrounding merger announcement based on the market model. The first two columns provide the results using the full sample of 933 deals announced in the mining and manufacturing industries between 1980 and 2018. Columns 3 and 4 present the results using the sample of deals that divested assets in the one year before the merger year. All other variables are defined in the appendix. *t*-statistics based on robust standard errors are presented in parentheses. Superscripts ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Full Sample		Divestitures Only	
	1	2	3	4
Pct_SameInd_All	-0.011**	-0.012***		
	(-2.488)	(-2.776)		
Pct_SameInd			-0.012**	-0.017***
			(-2.288)	(-2.813)
Divestiture Dummy	0.004*	0.004		
	(1.957)	(1.634)		
All cash		-0.001		-0.002
		(-0.530)		(-0.368)
Public		0.004**		0.005
		(2.280)		(0.932)
Hostile		0.005		-0.001
		(0.682)		(-0.062)
Competing		-0.002		-0.011
		(-0.388)		(-1.274)
AT Sales Ratio		-0.005*		-0.008
		(-1.885)		(-0.839)
CR4		0.000		0.000
		(0.113)		(0.935)
Constant	-0.002***	-0.003	0.003	-0.004
	(-2.898)	(-1.235)	(1.239)	(-0.460)
2-Digit SIC FE	Yes	Yes	Yes	Yes
Year-FE	Yes	Yes	Yes	Yes
Observations	1,859	1,707	321	294
R-squared	0.044	0.055	0.102	0.119

Table 5
Acquirer CARs

This table presents OLS regression results. The dependent variable is the cumulative abnormal returns (CARs) of acquiring firms. CARs are calculated over the [-1, +1] event window surrounding merger announcement based on the market model. The first two columns provide the results using the full sample of 1,786 deals announced in the mining and manufacturing industries between 1980 and 2018. Columns 3 and 4 present the results using the sample of deals that divested assets in the one year before the merger year. All other variables are defined in the appendix. *t*-statistics based on standard errors clustered by merger are presented in parentheses. Superscripts ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Full Sample		Divestitures Only	
	1	2	3	4
Pct_SameInd_All	-0.027***	-0.030***		
	(-2.723)	(-2.775)		
Pct_SameInd			-0.022**	-0.020
			(-2.071)	(-1.463)
Divestiture Dummy	-0.006	0.004		
	(-1.331)	(0.777)		
All cash		0.004		0.028***
		(1.133)		(2.988)
Public		-0.023***		-0.041***
		(-5.964)		(-4.077)
Hostile		0.003		-0.013
		(0.237)		(-0.788)
Competing		-0.017*		-0.009
		(-1.845)		(-0.405)
AT Sales Ratio		0.005		0.002
		(1.049)		(0.114)
CR4		0.000		-0.000
		(0.992)		(-0.080)
Constant	0.011***	0.013**	-0.000	0.021
	(6.076)	(2.400)	(-0.012)	(1.002)
2-Digit SIC FE	Yes	Yes	Yes	Yes
Year-FE	Yes	Yes	Yes	Yes
Observations	1,785	1,507	302	236
R-squared	0.076	0.100	0.237	0.319

Table 6
CARs of TNIC Rival

This table presents OLS regression results. The dependent variable is the cumulative abnormal returns (CARs) of rival firms. CARs are calculated over the [-1, +1] event window surrounding merger announcement based on the market model. Columns 1 and 2 present results using CARs of all TNIC rivals (3-digit SIC granularity) of the acquirer. Columns 3 and 4 (5 and 6) focus on CARs of small (large) rivals where small (large) rivals are defined as those with below (above) median market capitalization in the announcement year. In all columns, we use the full sample of 1,254 deals announced in the mining and manufacturing industries between 1980 and 2018. All variables are defined in the appendix. *t*-statistics based on robust standard errors presented in parentheses. Superscripts ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	All Rivals		Small Rivals		Large Rivals	
	1	2	3	4	5	6
Pct_SameInd_All	-0.006**	-0.007**	-0.011**	-0.016***	-0.005	-0.004
	(-2.034)	(-2.098)	(-2.374)	(-2.814)	(-1.537)	(-1.360)
Divestiture Dummy	0.000	0.002	0.000	0.000	0.001	0.002
	(0.176)	(0.768)	(0.017)	(0.006)	(0.552)	(0.995)
All cash		-0.000		-0.000		-0.001
		(-0.221)		(-0.171)		(-0.406)
Public		0.000		0.003*		0.001
		(0.153)		(1.679)		(0.925)
Hostile		0.035***		0.025**		0.025***
		(3.002)		(2.413)		(4.001)
Competing		-0.008		-0.005		-0.007
		(-1.520)		(-1.091)		(-1.311)
AT Sales Ratio		0.003		-0.003		0.003
		(1.409)		(-1.320)		(1.617)
CR4		-0.000		-0.000		-0.000
		(-1.283)		(-0.116)		(-0.586)
Constant	0.001	0.004	0.004***	0.004	-0.001	-0.001
	(1.389)	(1.307)	(4.264)	(1.402)	(-1.610)	(-0.497)
2-Digit SIC FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,253	1,041	1,247	1,036	1,196	990
R-squared	0.047	0.056	0.053	0.071	0.045	0.053

Table 7
Two-Stage Treatment Model

This table presents a treatment effect model in which the likelihood of a divestiture is estimated in the first stage. *Challenged* is a dummy variable equal to 1 if a merger is challenged by antitrust authorities and 0 otherwise. All other variables are defined in the appendix. *t*-statistics based on robust standard errors are presented in parentheses. All regressions below include year fixed effects and 2-digit SIC industry fixed effects in both the 1st stage and 2nd stage of the treatment model regressions. Superscripts ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Customers		Acquirers		Small Rivals	
	Stage 1	Stage2	Stage 1	Stage 2	Stage 1	Stage 2
	(1)	(2)	(3)	(4)	(7)	(8)
Pct_SameInd_All		-0.011		-0.031		-0.015
		(2.40)**		(2.55)**		(2.67)***
Divestiture Dummy		-0.011		0.002		0.033
		(0.65)		(0.06)		(1.39)
All cash		-0.001		0.005		-0.001
		(0.56)		(1.27)		(0.26)
Public		0.003		-0.024		0.004
		(2.14)**		(6.36)***		(1.86)*
Hostile		0.006		0.003		0.024
		(0.74)		(0.18)		(1.42)
Competing		-0.002		-0.018		-0.004
		(0.56)		(1.58)		(0.62)
Liquidity Index	4.912	0.041	3.751	0.022	2.478	-0.021
	(2.56)**	(1.03)	(2.39)**	(0.32)	(1.37)	(0.50)
Redeployability	-35.117	2.259	-38.820	-2.731	6.556	3.761
	(0.68)	(2.36)**	(0.63)	(1.05)	(0.09)	(2.53)**
AT Sales Ratio	0.239	-0.005	0.015	0.005	-0.112	-0.003
	(1.75)*	(1.80)*	(0.12)	(1.17)	(0.78)	(1.13)
Challenged	0.388	0.008	0.647	0.003	0.617	-0.007
	(2.03)**	(1.75)*	(3.19)***	(0.29)	(2.71)***	(1.00)
CR4	-0.003	0.000	-0.002	0.000	-0.010	0.000
	(1.05)	(0.15)	(0.60)	(1.05)	(3.27)***	(0.72)
Constant		0.016		0.025		-0.005
		(0.85)		(0.50)		(0.49)
Hazard		0.008		0.001		-0.019
		(0.87)		(0.04)		(1.42)
N	1,707	1,707	1,508	1,508	1,035	1,035

Table 8
Customer CARs Conditional on Industry Concentration

This table presents regressions of 3-day cumulative abnormal returns (CARs) of customer firms around the announcement of horizontal mergers. CARs are calculated over the [-1, +1] event window surrounding merger announcement based on the market model. The sample of mergers is divided into two groups based on industry concentration. The High (Low) CR4 group comprises of industries with the four-firm concentration ratio above (below) the sample median. All variables are defined in the appendix. *t*-statistics based on robust standard errors are presented in parentheses. Superscripts ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	OLS: High and Low Concentration (CR4)		2-Stage Treatment Model (2nd Stage Reported)	
Concentration	High	Low	High	Low
	(1)	(2)	(3)	(4)
Pct_SameInd_All	-0.021***	-0.005	-0.018***	-0.005
	(-3.010)	(-0.768)	(-2.96)	(-0.90)
Divestiture Dummy	0.008**	0.001	0.065	-0.089*
	(2.395)	(0.206)	(1.43)	(-1.83)
Controls	Yes	Yes	Yes	Yes
2-Digit SIC FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	843	863	844	863
R-squared	0.1	0.093		

Table 9
Customer CAR and Different Measures of Concentration

This table presents results from regressions of 3-day cumulative abnormal returns (CARs) of customer firms in subsamples based on various measures of industry concentration. Customer CARs are regressed on Divestiture Dummy, Pct_SameInd_All, as well as all control variables shown in Table 3, but only coefficients on Divestiture Dummy and Pct_SameInd are shown. The High (Low) concentration subgroups comprises of industries with a concentration ratio above (below) the sample median. Industry concentration measures are as follows. CR20 is the percentage of Value of Shipments accounted for by the twenty largest firms in the industry. CR50 is the percentage of Value of Shipments accounted for by the fifty largest firms in the industry. HHI is calculated by summing the squares of the individual company market shares for the fifty largest firms or the universe, whichever is lower. All variables are defined in the appendix. *t*-statistics based on robust standard errors are presented in parentheses. Superscripts ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

Panel A: Coefficients from OLS

	High Concentration			*Low Concentration*		
	CR20	CR50	HHI	CR20	CR50	HHI
	(1)	(2)	(3)	(5)	(6)	(7)
Pct_SameInd_All	-0.014	-0.013	-0.014	-0.005	-0.004	0.001
	(-2.270)**	(-2.130)**	(-1.910)*	(0.630)	(0.540)	(0.000)
Divestiture Dummy	0.005	0.003	0.008	0.001	0.002	-0.001
	(1.500)	(0.880)	(1.970)**	(0.180)	(0.470)	(-0.280)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
2-Digit SIC FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	881	898	708	822	799	706

Panel B: Coefficients from second stage of Treatment effect model

	High Concentration			*Low Concentration*		
	CR20	CR50	HHI	CR20	CR50	HHI
	(1)	(2)	(3)	(5)	(6)	(7)
Pct_SameInd_All	-0.013	-0.012	-0.015	-0.005	-0.002	0.000
	(-2.150)**	(-1.984)**	(-1.969)**	(-0.734)	(-0.530)	(0.000)
Divestiture Dummy	0.014	0.003	0.023	-0.104	-0.112	-0.063
	(0.461)	(0.008)	(0.897)	(-2.511)**	(-2.712)***	(-1.334)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
2-Digit SIC FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	871	888	695	813	790	698

Table 10
Customer Industry CARs and Presence of Powerful Customers

This table repeats the OLS analysis from Table 4 but partitions the sample on customer industry characteristics. The dependent variable is the value-weighted cumulative abnormal returns (CARs) of customers of the merging firm. CARs are calculated over the [−1, +1] event window based on the market model. Large customers are customer firms that account for more than 10% of the acquirer's total sales. Column 1 (column 2) presents CAR analysis for customer industries that have a large customer firm present (absent). CR4 is the four-firm concentration ratio of the downstream industry. The dependent variable is the cumulative abnormal returns (CARs) of customers of the merging firm. All other variables are defined in the appendix. *t*-statistics based on robust errors are presented in parentheses. Superscripts ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Large Customers		Customer Industry Concentration (CR4)	
	Present	Absent	High	Low
	1	2	3	4
Pct_SameInd_All	-0.007	-0.011**	-0.008	-0.016**
	(-0.553)	(-2.193)	(-0.802)	(-2.556)
Divestiture Dummy	0.005	0.003	0.001	0.007**
	(0.674)	(1.126)	(0.166)	(2.029)
All cash	-0.004	-0.001	-0.002	0.002
	(-0.898)	(-0.577)	(-0.671)	(0.716)
Public	-0.001	0.003	0.000	0.007***
	(-0.314)	(1.568)	(0.106)	(2.902)
Hostile	-	0.007	0.004	0.001
	-	(1.117)	(0.638)	(0.117)
Competing	-0.001	-0.003	-0.004	0.001
	(-0.124)	(-0.645)	(-0.631)	(0.180)
AT Sales Ratio	0.008	-0.003	-0.006	-0.005
	(0.651)	(-0.936)	(-1.365)	(-1.448)
CR4	-0.000	-0.000	-0.000	-0.000
	(-0.532)	(-0.017)	(-0.048)	(-0.187)
Constant	-0.001	-0.001	0.000	-0.006
	(-0.137)	(-0.543)	(0.145)	(-1.414)
2-Digit SIC FE	Yes	Yes	Yes	Yes
Year-FE	Yes	Yes	Yes	Yes
Observations	344	1,359	726	759
R-squared	0.199	0.063	0.085	0.102

Table 11
Summary Statistics for Output Price Analysis

Panel A presents summary statistics of the following industry-level variables over the three years preceding the horizontal merger event and the three years following the merger event. RPPI is the producer price index (PPI) of the merging industry divided by the contemporaneous consumer price index (CPI). Supplier 1 RPPI is the RPPI of the industry that provides the largest fraction of the merging industry's input. Supplier 2 RPPI is the RPPI of the industry providing the second largest fraction of the merging industry's input. Total Production is total industrial production. CR4 is the four-firm concentration ratio collected by the Census Bureau every five years. It is the percentage of Value of Shipments accounted for by the four largest firms in the industry.

Panel B presents a multivariate analysis of the change in the real producer price index (ΔRPPI) of industries experiencing a horizontal merger event. The dependent variable, ΔRPPI, is calculated as the average RPPI in the 3 years following the industry merger event divided by the average RPPI in the three years prior to the merger event, minus one. Change in Supplier 1 (Supplier 2) RPPI is the average monthly RPPI of the largest (second largest) supplier industry three years after the event, divided by the average monthly RPPI over the three years prior to the event, minus one. Change in total production is calculated the same way. All other variables are defined in the appendix. *t*-statistics based on standard errors clustered by merger event year are presented in parentheses. Superscripts ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

Panel A: Summary statistics of industry level variables

				Mean		
	Mean	Median	Std. Dev.	Pre-merger	Post-merger	Difference
RPPI	0.863	0.838	0.259	0.870	0.867	-.0131
						(-2.933)***
Supplier 1 RPPI	0.819	0.807	0.217	0.817	0.796	-0.022
						(-2.939)***
Supplier 2 RPPI	0.792	0.785	0.225	0.802	0.759	-0.039
						(-7.114)***
Total Production	0.071	0.073	0.066	4.339	4.401	.0703
						(29.651)***
CR4	41.354	37.950	18.809	38.112	38.930	1.112
						(6.217)***

Panel B: Multivariate Analysis of Output Prices

	Dependent variable = ΔRPPI			
	1	2	3	4
Pct_SameInd_All	0.039*	0.041**	0.031	0.046*
	(1.799)	(2.042)	(1.176)	(1.734)
Divestiture Dummy	0.003	0.001	0.004	0.001
	(0.372)	(0.154)	(0.488)	(0.057)
Change in Supplier 1 RPPI	0.257***	0.271***	0.248***	0.257***
	(6.164)	(6.006)	(5.188)	(5.060)
Change in Supplier 2 RPPI	0.075	0.087*	0.078	0.087
	(1.421)	(1.713)	(1.361)	(1.607)
Change in total production	-0.083	-0.097	-0.091	-0.095
	(-1.227)	(-0.318)	(-1.361)	(-0.305)
CR4	-0.000	-0.000	-0.000	-0.000
	(-0.171)	(-0.166)	(-0.608)	(-0.878)
Constant	0.002	0.004	0.010	0.016
	(0.254)	(0.242)	(0.793)	(0.728)
2-Digit SIC FE	No	No	Yes	Yes
Year-FE	No	Yes	No	Yes
Observations	268	266	267	265
R-squared	0.347	0.442	0.401	0.492

Appendix: Description of Variables

Industry-level variables

CR4, CR20, CR50 is the four-firm (twenty-firm or fifty-firm) concentration ratio collected by the Census Bureau every five years. It is the percentage of Value of Shipments accounted for by the four (twenty or fifty) largest firms in the industry.

CR4, CR20, CR50 and HHI are obtained from Census Bureau and are available every five years, when an economic census is conducted. The census years within our sample period are 1982, 1987, 1992, 1997, 2002, and 2007. We match concentration data from the most recent census prior to the merger. If concentration data from the most recent census year are missing, we match concentration data from the first economic census conducted after the merger.

CUST_CR4 is the four firm concentration ratio of the merging industry's most dependent customer industry. It captures the percentage of value of shipments of the customer industry that is accounted for by the four largest firms. This variable is obtained from the Census Bureau.

Change in RPPI (ΔRPPI) is calculated as the average RPPI (real producer price index) of the merging industry in the 3 years following the industry merger event, divided by the average RPPI in the three years prior to the merger event, minus one.

Change in Supplier 1 RPPI is the average monthly RPPI (real producer price index) of the largest supplier industry three years after the event, divided by the same average monthly RPPI over the three years prior to the event, minus one.

Change in Supplier 2 RPPI is the average monthly RPPI (real producer price index) of the second largest supplier industry three years after the event, divided by the same average monthly RPPI over the three years prior to the event, minus one.

Change in Total Production is total production in the three years after an event divided by the total production in the three years before an event, minus one.

HHI Herfindahl-Hirschman Index is calculated by summing the squares of the individual companies' percentage share of Value of Shipments for the fifty largest firms or the universe, whichever is lower.

Liquidity Index is measured as the sum of the transaction values for all the corporate control transactions in a year within the 2-digit SIC code of the overlap (or merging) industry, divided by the total book value of assets within that 2-digit SIC industry.

Redeployability Index is defined as the weighted average of the redeployability score of the assets the overlap (merging) industry uses, where the weight is the industry's expenditure on each asset. The redeployability score for each asset is the weighted average of the use of the asset across industries, where the weight is the total market cap of all Compustat firms in an industry.

Supplier 1 RPPI is the RPPI (real producer price index) of the industry that provides the largest fraction of the merging industry's input.

Supplier 2 RPPI is the RPPI (real producer price index) of the industry providing the second largest fraction of the merging industry's input.

Total Production is total industrial production obtained from the Federal Reserve Board.

Merger-level control variables

All cash is a dummy variable equal to one if all the transaction value of the deal is paid in cash and zero otherwise.

AT Sales Ratio is the sum of sales of the acquirer and target obtained from Compustat (if missing, we use SDC data) divided by total industry value of shipments obtained from the Census Bureau, which includes sales of all firms in the industry, both Public and private.

Challenged is a dummy variable equal to 1 if a merger is challenged by antitrust authorities and 0 otherwise.

Competed is a dummy variable equal to one if there was a Competing offer for the target and zero otherwise. Since mergers between larger firms are likely to have a bigger impact on output prices, we also include the combined market share of the acquirer and target as a control variable in the CAR analysis.

Hostile is a dummy variable equal to one if the attitude of the target's management was Hostile toward the merger and zero otherwise.

Public is a dummy variable equal to one if the target is a public firm and zero otherwise.