

The role of divestitures in horizontal mergers: Evidence from product and stock markets

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Abstract

Horizontal mergers are often accompanied by asset divestitures, either voluntary or else mandated by antitrust authorities. This paper presents the first large-sample evidence that divestitures accompanying horizontal mergers curb the market-power impact of the mergers. We find that the post-merger change in output prices is smaller for mergers that are accompanied by divestitures, particularly when the divested assets are sold to firms outside the industry. In line with the change in output prices, stock price reactions of customer firms are more positive when merging firms sell assets to firms outside the industry. Our findings also indicate that horizontal mergers and the accompanying divestitures alter the relative competitive efficiencies of the acquirer and its rivals. Stock price reactions of the acquirer and rivals suggest that firms in the merging industry are more concerned about maintaining a competitive edge relative to each other than about gaining market power vis-à-vis customers.

Introduction

A sizeable portion of merger activity in the United States is between firms in the same industry. In the last three decades, more than 25% of mergers and acquisitions (M&A) were between rivals and these deals, known as horizontal mergers, constituted almost half of the total dollar value of merger activity.¹ The Federal Trades Commission (FTC) and the Department of Justice (DOJ) routinely scrutinize horizontal mergers to ascertain whether the merger has the potential to reduce competition in the industry. Both the FTC and DOJ state that if a merger is deemed anticompetitive, the most common remedial measure pursued is a divestiture.² Recent industrial organization literature recognizes the prominence of divestitures in merger policy. Kühn (2010) points out that antitrust policy increasingly involves imposing structural remedies rather than a categorical veto of a merger. Kühn also notes that in anticipation of regulatory objections, firms sometimes preemptively adjust the initial merger structure by voluntarily divesting assets.

Considering the importance of divestitures as a merger remedy, it is striking that there is no large-sample study of the role of divestitures in horizontal mergers. Nascent industrial organization theory argues that divestitures limit the price-increasing effect of horizontal mergers (see Vergé, 2010 and Vasconcelos, 2010). This theory also suggests that the effectiveness of a divestiture will depend on whether the assets are bought by an existing rival of the merging firms or by a firm outside the industry. Our primary objective is to provide the first large-sample analysis of the impact of divestitures on post-

¹ Source: Thompson Reuter's SDC Platinum database

² See "Antitrust Division Policy Guide to Merger Remedies" provided by the DOJ and "Negotiating Merger Remedies" provided by the Bureau of Competition of the FTC.

merger product prices and on the shareholder wealth gains of various parties affected by the horizontal merger including the acquirer, its rivals and its customers.

Our second objective is to shed new light on the important debate regarding the market power impact of horizontal mergers. Existing literature examines the market power impact of horizontal mergers extensively. However, the evidence is mixed. Studies focusing primarily on announcement returns conclude that horizontal mergers do not create market power vis-à-vis customers and are motivated primarily by improvements in productive efficiencies (see Eckbo, 1983; Stillman, 1983; Eckbo, 1985; Eckbo and Wier, 1985; Fee and Thomas, 2004; and Shahrur, 2005). On the other hand, research that looks directly at product prices concludes that horizontal mergers result in higher prices for customers (see Barton and Sherman, 1984; Borenstein, 1990; Kim and Singal, 1993; Singal, 1996; Akhavein, Berger and Humphrey, 1997; and Prager and Hannan, 1998). While both streams of research capture the net effect of market power, productive efficiencies and structural remedies on output prices and stock returns, neither explores whether divestitures have any bearing on the market power impact of horizontal mergers.

We conduct two sets of tests. In the industry-level tests, we examine the impact of divestitures on post-merger output prices. In the firm-level tests, we examine the effect of divestitures on merger announcement returns. In all our tests, use two contrasting theoretical viewpoints to help outline the empirical predictions - the Market Power Hypothesis and the Competitive Efficiencies Hypothesis. Although we present these as competing hypotheses, we recognize that these two motives for horizontal mergers are not mutually exclusive.

Horizontal mergers can lead to lower industry competition either through the exercise of unilateral, monopolist market power by the merged firm or through cooperative collusion. Divestitures reduce the size of the merged firm and can consequently limit the merged firm's ability to exercise monopoly power. Thus, under the Market Power Hypothesis, if mergers are accompanied by divestitures the upward pressure on output prices should be weaker than cases in which there are no accompanying divestitures. However, market power is not the only motivation for horizontal mergers. Horizontal mergers create cost efficiencies like economies of scale and opportunities to eliminate redundancies. These cost efficiencies enable merging firms to compete more effectively with rivals and may actually result in lower prices for customers. Under this alternative view, which we refer to as the Competitive Efficiencies Hypothesis, divestitures can limit the merging firms' ability to realize cost efficiencies and, thereby thwart a possible post-merger decline in prices.

The Market Power Hypothesis and Competitive Efficiencies Hypothesis also have contrasting predictions about the impact on output prices if assets are sold to an existing rival rather to a firm outside the industry. If the divested assets are purchased by a firm outside the industry, i.e. to a new entrant, the larger number of players in the market will make it more difficult to monitor and sustain cooperative collusion. Thus, under the Market Power Hypothesis, divestitures would be more effective in keeping output prices down if assets are sold to firms outside the industry. An alternative argument, presented by Verge (2010) and Vasconcelos (2010) is that new entrants cannot be cost efficient enough to compete effectively with the large, merged firm. Vasconcelos' (2010) states that "contrary to general intuition, selling capacity to a new firm (an entrant) is generally

not the best solution for a remedy”. These papers argue that structural merger remedies like divestitures will be more effective in keeping output prices low if assets are sold to existing players in the market, because allowing rivals of the merged firm to become larger and more cost efficient infuses greater competition into the industry.

We test these predictions on a sample of 1,153 horizontal mergers that occurred in manufacturing industries between 1980 and 2010. Industry-level analysis shows that output prices are lower following the merger if either the acquirer or the target divests assets. Conditional on a divestiture, we find that post-merger output prices are higher if a larger fraction of divested assets is purchased by existing rivals rather than by firms outside the industry. Thus, the industry-level results are supportive of the Market Power Hypothesis rather than the Competitive Efficiencies Hypothesis. When examining merger announcement returns, we find weak evidence that customer cumulative abnormal returns (CARs) are higher if a divestiture occurs. Conditional on the occurrence of a divestiture, we find strong evidence that customer CARs are lower if a larger fraction of divested assets are bought by existing rivals. Thus, customer CARs appear to move in line with output prices and are also supportive of the Market Power Hypothesis.

However, these results do not prove that competitive efficiencies do not exist. It is likely that horizontal mergers and accompanying divestitures affect pricing power and also the relative

Next, we look at the stock price reactions of acquirers and rivals firms who do not buy any of the divested assets.³ Although the analysis of output prices and customer CARs provides support for the market power hypothesis, our results do not prove that competitive efficiencies do not exist. It is likely that horizontal mergers and accompanying divestitures affect both pricing power and the relative cost efficiencies of firms in the industry. Therefore, when thinking of stock price reactions of acquirers and rivals, we again consider the net impact of market power and merger-induced productive efficiencies. If horizontal mergers create monopoly power and put an upward pressure on output prices, all firms in the industry, including non-participating rival firms, are expected to benefit from being able to sell at higher prices. However, merging firms and rivals care not just about how mergers change market power relative to customers but also how the relative size and cost efficiencies affect their capacity to compete effectively with each other.

We find that acquirers experience lower CARs for mergers that are accompanied by divestitures. This is consistent with both the Market Power Hypothesis and the Competitive Efficiencies Hypothesis, since divestitures limit the potential for monopoly power and also reduce scale economies. When looking at who buys the divested assets, we find that acquirer returns are significantly lower when firms in the same industry purchase divested assets. Recall that output prices are higher when firms in the same industry purchase divested assets. Thus, for an acquiring firm, concerns about an existing rival growing bigger and realizing scale economies dominates any benefits from gaining market power relative to customer firms.

³ We focus on rivals who do not purchase any divested assets for two reasons. First, predictions about how the divestitures affect stock returns differ for rivals that purchase divested assets and those that don't. Second, our sample of rivals who purchase divested assets is too small for meaningful statistical inference.

When looking at rival firms we again find that concerns of relative competitive efficiencies dominate any benefits of increased market power. Rival stock price reactions are more positive when the merged firm divests assets even though such divestitures result in lower output prices. This suggests that rivals prefer to limit the size of their newly merged competitor even if doing so involves sacrificing pricing power. Finally, rivals (who do not buy divested assets) react negatively if a larger fraction of divested assets are bought by other firms in the same industry. Recall that output prices are higher if a larger fraction of divested assets are bought by other firms in the same industry. Again, this test shows that the daunting prospect of having to compete for market share against larger, potentially more cost-efficient firms in the industry outweighs the benefits of any selling power that the horizontal merger might create.

In our analysis, we recognize that divestitures are endogenous events and are more likely to occur if a merger is expected to be anticompetitive. We control for this endogeneity by using the Heckman model (or the treatment effect model). In the first-stage regression, we model the divestiture as a function of the size of the merging firm, the industry concentration level and whether the deal is officially challenged by the antitrust authorities. Our results hold after controlling for endogeneity.

Our paper is the first large-sample study of the impact of merger-related divestitures on product prices as well as on the shareholder wealth gains of the acquirer, its rivals and its customers. Our industry-level results and customer CARs indicate that divestitures do reduce the market power impact of horizontal mergers and, therefore, benefit customers. However, announcement returns of acquirers and their rivals indicate that maintaining a competitive edge relative to each other matters more to acquirers and

their rivals than gaining market power vis-à-vis customers. Another contribution of our paper is to show that divestitures are more effective as merger remedies if the divested assets are bought by firms outside the merging firms' industry. Finally, our findings suggest that the seemingly contradictory evidence in the product market studies (which find evidence of an increase in selling power after horizontal mergers) and the stock return studies (which conclude that horizontal mergers are motivated by efficiency considerations and not market power) is not contradictory after all. By focusing on the role of merger-related divestitures, we show that horizontal mergers and accompanying divestitures affect both pricing power and productive efficiencies, but the import of these two phenomena differs across parties. Customer stock price reactions primarily reflect the change in product prices, whereas stock price reactions of acquirers and rivals reflect changes in their relative competitive positions within the industry.

2. Hypothesis Development

In this section, we discuss how output prices and stock returns might be expected to change if horizontal mergers are accompanied by asset divestitures. Section 2.1 below focuses on output prices and Section 2.2 discusses implications for announcement returns of acquirers, their rivals and their customers. All predictions discussed below are summarized in Table 1.

2.1. Predictions for industry output prices

The market power hypothesis contends that horizontal mergers can reduce competition in several ways. First, the merged firm can exercise monopoly power by

restricting output and pricing above marginal cost. Second, a dominant firm can generate excess capacity, thereby creating an effective barrier to entry. Third, horizontal mergers reduce the number of firms in an industry and consequently make collusive agreements between firms more sustainable. Antitrust authorities often require merging firms to divest assets in order to mitigate the market power impact of horizontal mergers. It is expected that, by limiting the size of the merged firm, divestitures will dampen the merged firm's ability to exercise unilateral market power. Thus, if mergers create market power, which we refer to as the Market Power Hypothesis, post-merger output prices are expected to be lower if a merger is accompanied by a divestiture than if there is no accompanying divestiture, all else equal.

Merging firms often respond to regulatory authorities with assertions that customers will benefit because the horizontal merger will result in cost economies like economies of scale and elimination of redundancies, and that lower costs will be passed on to consumers in the form of lower prices. For example, when anti-trust authorities objected to the attempted Staples-Office Depot merger in 1997, the firms responded with assertions that the merger would result in cost savings leading to lower prices for customers (see "Office Depot and Staples Merger Halted, New York Times, July 1st, 1997). By this argument, divestitures are not beneficial for customers because divestitures might reduce the merging firm's ability to realize economies of scale and lower output prices. This alternative hypothesis, which we refer to as the competitive efficiency or cost efficiency hypothesis, predicts that horizontal mergers with accompanying divestitures may be followed by higher selling prices as compared to horizontal mergers that have no accompanying divestitures. Table 1, Panel A summarizes

the impact of divestitures on output prices under the Market Power Hypothesis and the Competitive Efficiencies Hypothesis.

If a horizontal merger is accompanied by a divestiture, the price impact of the merger also depends on whether the divested assets are bought by a firm in the same industry or by a new entrant. Dynamic models of cooperative collusion would suggest that divesting assets to an outsider would be more effective in limiting the market power impact of horizontal mergers. Selling assets to a firm outside the industry effectively brings a new player into the market. With more players in the market, it is more difficult for firms to sustain a collusive agreement to keep prices high. This view suggests that divestitures will be more effective in reducing the market-power impact of horizontal mergers if assets are sold to firms outside the industry. Thus, under the market-power hypothesis, industry output prices are lower if the divested assets are sold to a new entrant.

In contrast, the static Cournot models of 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. The intuition is that divesting assets to other firms in the same industry allows existing rivals of the merging firm to become larger and more cost efficient. These larger rivals can compete more effectively with the merged firm as compared with a new entrant because a new entrant will not be sufficiently cost efficient to compete aggressively with the merged firm. The models of Vasconcelos (2010) and Verge (2010) come under the broad umbrella of competitive efficiencies. Thus, under the Competitive Efficiencies Hypothesis output prices following

horizontal mergers are lower if the divested assets are sold to existing firms in the industry.

Although we have set up the Market Power Hypothesis and the Competitive-Efficiencies Hypothesis as competing hypotheses, market power and competitive efficiencies are not mutually exclusive. It is likely that horizontal mergers create market power relative to customers and also generate cost cutting opportunities for the merging firms. The change in output prices following horizontal mergers will reflect the net impact of the opposing forces of market power and competitive efficiencies. We recognize that the relative importance of market power and competitive efficiencies can be different for different scenarios. For example, when examining the binary decision of whether to divest or not, we might find the change in output prices supports the market power argument. However, this would not necessarily imply that the market power effect must dwarf competitive efficiencies when we examine how prices are affected by the identity of the firm buying the divested assets. Which effect dominates and when it dominates is ultimately an empirical question.

2.2. Firm-level predictions

We conduct a series of firm-level tests to see how merger-related divestitures affect the welfares of acquirers, their rival firms as well as customer firms. Specifically, we follow existing research on market power and examine the various parties' stock price reactions to merger announcements (see Eckbo, 1983; Stillman, 1983; Fee and Thomas, 2004; Shahrur, 2005). Our main interest is to see whether and how these price reactions depend on the existence of a divestiture, and who buys the divested assets.

2.2.1. Customers

We begin by outlining the case of customer firms because the impact of a change in selling prices on the welfares of customer firms is straightforward. If output prices are higher (lower) following a merger, customer firms should experience negative (positive) stock returns. As discussed above, under the market-hypothesis, a divestiture limits the merged firm's monopoly power. Therefore, horizontal mergers accompanied by divestitures should elicit positive stock-price reactions from customers as compared with horizontal mergers that have no accompanying divestitures. In contrast, under the competitive efficiencies hypothesis, a divestiture can limit economies of scale. If merged firms are believed to routinely pass on the benefits of scale economies to customers, then mergers accompanied by divestitures will lead to negative stock price reactions from customers. However, if merged firms are known to reserve the benefits of economies of scale for their own shareholders and do not pass on cost savings to customers, then the accompanying divestitures would have no impact on customer returns. Thus, under the competitive efficiencies hypothesis, customer reaction to mergers accompanied by divestitures would be lower or the same as their reaction to mergers without accompanying divestitures.

What about the identity of the firm buying the divested assets? 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 a new entrant. Under the competitive efficiencies hypothesis, the prediction is the opposite. Output prices are lower, and therefore, customer returns

will be higher if an existing rival buys the divested assets. The predictions for customer announcement returns are summarized in Table 1 Panel B.

2.2.2. Acquirers

When considering the stock-price reactions of acquirers, we take into account changes in market power relative to customers, the acquiring firms ability to realize cost cuts, and one additional factor – whether a rival firm becomes larger and more cost effective due to a divestiture. If horizontal mergers are motivated primarily by market power, then acquirer returns will be lower if some assets are divested since the divestiture will limit the acquirer’s ability to exercise unilateral market power. In contrast, if horizontal mergers are motivated primarily to exploit scale economies and eliminate redundancies, and if at least a fraction of this benefit is retained for acquiring shareholders (and not always passed on to customers in the form of lower prices) then divestitures are not good news for acquiring shareholders. Thus, under the cost efficiencies hypothesis, acquirer returns would be lower for horizontal mergers accompanied by divestitures than for horizontal mergers with no accompanying divestitures. Thus, both the competitive efficiencies and market power hypotheses predict that acquirer returns will be lower for mergers accompanied by divestitures than for mergers without accompanying divestitures.

Next we consider how acquirer returns depend on the buyer of the divested assets. Under the market power hypothesis, divesting assets to a buyer outside the industry brings a new player in the market 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 cooperative collusion more sustainable. Under the competitive efficiencies hypothesis, selling assets to existing rivals results in a larger, more cost efficient rival firm who can compete effectively with the merged firm. Thus, under this hypothesis, acquirer returns will be lower if assets are divested to a firm within the industry.

2.2.3. Rivals

The expected impact of divestitures on rival firms follows a similar line of reasoning as the discussion for acquirers above. We focus on rival firms that do not purchase the assets divested by the merging firms. The market power hypothesis argues that non-participating rivals can benefit from a horizontal merger. For example, static models of Cournot competition predicts, when the merged firm reduces output, output prices go up. All firms in the industry, including rivals non-participating in the merger would benefit from the increase in output prices. Alternatively, according to dynamic models of cooperative collusion, a merger reduces the number of firms in the industry, leading to higher sustainability of cartels. Again, if some members of an industry are able to collude to keep prices high, all firms in the industry benefit from the higher selling prices. For this reason, existing research on the market power impact of horizontal mergers often studies the stock price reaction of rival firms to the announcement of a horizontal merger.

We extend existing arguments to the occurrence (or lack thereof) of a divestiture. Under the Market Power hypothesis, a divestiture reduces the monopoly power of the merging firm and output prices do not rise as much as they would have in the absence of

a divestiture. This would negatively affect stock returns of rivals who do not purchase the divested assets. Under the Competitive Efficiencies Hypothesis on the other hand, a divestiture reduces the size of the merged firm and limits its ability to realize economies of scale. This is good news for a rival firm because it has to contend with a somewhat smaller, less cost-efficient merged entity. Thus, if competitive efficiencies relative to the merged firm are more important than market power relative to customers, then stock prices of rivals would react positively to mergers accompanied by divestitures.

Finally, we consider how rivals' stock prices react if a firm outside the industry purchases the divested assets. Here the logic is very similar to the one presented for acquirers above. Under the Market Power Hypothesis, divesting assets to a buyer outside the industry brings a new player in the market and reduces the sustainability of collusive agreements. 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 makes it easier to collude and keep prices high. In contrast, under the Competitive Efficiencies Hypothesis, if the merged firms sell assets to a firm in the same industry, the rivals who do not purchase the divested assets now have two larger firms to compete with – the combined firm resulting from the initial merger and the rival who purchased assets divested by the merging firms. Thus, under the Competitive Efficiencies Hypothesis, stock returns of rival firms will be lower if assets are divested to a different firm within the industry.

3. Data and variables

We obtain from the SDC Platinum database all completed mergers and acquisitions announced between 1980 and 2010 in which more than 50% of target's shares were acquired. From these, we select all horizontal mergers, defined as deals in which the acquirer and target operated in the same 4-digit SIC code. If the acquirer or target operates in multiple segments, we use the three largest segments of each firm to determine whether the firms operate in the same industry segment. To identify horizontal mergers that are likely to have a significant bearing on product markets, we calculate quarterly horizontal merger activity in each industry as the total transaction value of all mergers announced in that quarter divided by industry total assets in that quarter. If merger activity involves more than 5% of industry total assets (based on Compustat firms) we classify that industry as having experienced a horizontal merger event and retain all horizontal mergers contributing to that event. Our sample has 1,153 horizontal mergers that contribute to 813 horizontal merger events in 303 distinct 4-digit SIC codes. Of the 1,153 deals, 434 (i.e. 38%) have at least one divestiture by either the acquirer or the target two years before or two years following merger announcement. Table 1 summarizes the number of merger events by 2-digit SIC code for each of the three decades in our sample. The table also indicates how many of the merger events were associated with at least one divestiture by the acquirer or target. For 77 out of the 434 deals (i.e. 18%), at least one of the divestitures involves selling assets to a firm within the same 4-digit SIC code. For the remaining 357 deals, all the divested assets were sold to firms outside the 4-digit SIC code.

3.1. Industry-level variables

For the industry-level product-market tests, our primary variable of interest is the producer price index (PPI) obtained from the BLS. The PPI measures the average change over time in the selling prices received by domestic producers for their output.⁴ We adjust the PPI for inflation to obtain the real producer price index (RPPI), which serves as our primary variable of interest. We calculate the change in RPPI (Δ RPPI) as the average RPPI during the three years following the industry merger event less the average RPPI during the three years prior to the merger event. In the multivariate analysis of changes in RPPI, we control for input prices and demand conditions. To obtain input prices, we first use the benchmark input-output tables provided by the Bureau of Economic Analysis to identify, for each industry, the two industries that supply the largest fraction of that industry's input. Then we calculate the change in RPPI for the largest supplier (Δ SUP1_RPPI) and for the second largest supplier (Δ SUP2_RPPI) and include these as control variables in the Δ RPPI regressions. We also control for change in wages, where wages are average earnings of production workers obtained from the Annual Survey of Manufacturers. Finally, we control for changes in industry concentration where industry concentration is the 4-firm concentration ratio obtained from the Census Bureau. The 4-firm concentration ratio is the percentage of Value of Shipments (i.e., revenues) accounted for by the four largest firms in the industry. Finally, changes in overall

⁴ The Producer Price Index Series reflect price movements for the net output of goods-producing sectors of the U.S. 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, Producer Prices, BLS Handbook of Methods.

industry demand conditions are captured by Total Industrial Production, which is obtained from the Federal Reserve Board (ΔTP).

Table 3 summarizes the industry level variables before and after the merger event. It is immediately evident from Table 3 that industry consolidations 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 SUP1_RPPI and SUP2_RPPI are also lower after the merger event than before. Industry wages are significantly higher after merger events than before. As expected, industry concentration is significantly higher after horizontal merger events than before. Total industrial production is significantly higher after merger events than before.

These significant differences in industry level variables present a challenge for the industry-level analysis. Horizontal mergers are very likely endogenously determined by changes in industry factors, making it difficult to assess an increase in market power simply by comparing output prices before and after the merger. For example, a downward trend in output prices may trigger horizontal mergers that help shore up prices relative to the counterfactual (i.e. post-merger prices compared to what prices might have been in the absence of the merger). However, output prices after the merger may still be lower than prices before the merger. Thus, a decline in prices is not an indicator that market power was not created. Similarly, an increase in prices subsequent to horizontal mergers 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. For this reason, in our output-price analysis we do not focus on whether average prices are higher

after the merger than before. Rather we examine whether divestitures at the time of the horizontal merger event have any bearing on the change in prices after the merger.

3.2. Firm-level variables

In the firm-level tests, we study cumulative abnormal returns (CARs) for acquiring firms, their rivals, and their customers. For each acquisition deal, we identify rival firms as those in the same 4-digit SIC code as the acquirer and target provided stock price data for the rival are available in CRSP. The set of rivals for each deal excludes the acquirer and the target. We also exclude firms in the same 4-digit SIC code that buy assets divested by the acquirer or the target. On average, we are able to identify 24 rivals for each merger deal. There are 97 publicly traded firms associated with 76 merger deals that would otherwise be identified as rivals, but are excluded because they bought assets divested by the merging firms. We classify these 97 firms separately as ‘buying rivals’.

We identify customer firms using the Benchmark Input-Output tables provided by the Bureau of Economic Analysis. Specifically, for each horizontal merger, we rely on the Use Tables to identify the merging industry’s most dependent customers. We use the Use Tables from the 1987 Census for mergers announced between 1980 through 1989, the Use Tables from the 1997 Census for all mergers announced between 1990 and 1999, and the Use Tables from 2002 Census for all mergers announced between 2000 and 2009.⁵ For each industry that uses the merging firm’s commodity, we follow Shahrur (2005) and calculate a ratio called the Input Coefficient. The Input Coefficient captures the fraction of a customer industry’s total input usage provided by the merging industry. We identify up to 3 most dependent customer industries for each merger provided that at

⁵ Use Tables from the 2007 Economic Census are not yet available at the detailed industry level.

least 5% of the customer industry's input is supplied by the merging industry. Next, we use Compustat to select all publicly traded firms that operate in each customer industry.

We calculate CARs around merger announcement for the acquirer, rivals and customer firms firm using the market model. The 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 and customer firms for a given acquisition can be correlated, for each acquisition we use the value-weighted portfolio return of all rival firms and customer firms. Our main results hold if we use the equal-weighted portfolio return for rivals and customers.

Our initial sample of 1,153 horizontal mergers consists of both public and private acquirers. We are able to calculate acquirer CARs for 644 deals and rival CARs for 985 deals. As shown in Table 4, the mean (median) acquirer's announcement return is 0.90% (0.43%), significant at the 1% (5%) level. The mean (median) rival portfolios' return is 0.04% (-0.04%), insignificantly different from zero. The mean (median) customer portfolios' return is -0.20% (-0.21%), both significant at the 5% confidence level.⁶

Table 4 also presents summary statistics of additional variables that are used in both the industry level and firm level analysis. All non-dummy variables are winsorized at the top and bottom 2.5% percentiles. The main variables of interest are *Divestiture Dummy* and *Buyer Same Industry*. *Divestiture Dummy* takes a value of one if a merger is accompanied by at least one divestiture. The mean value of *Divestiture Dummy* is 0.38, indicating that 38% of the mergers in our sample are associated with at least one

⁶ If we use equal-weighted average return for each rival group, the mean (median) rival portfolios' return is 0.30% (0.13%), significant at the 1% (5%) level.

divestiture by either the acquirer or the target. Buyer Same Industry is the percentage of divestitures in which the buyer of the divested assets belongs to the same industry as the merging firms. It is calculated as the number of divestitures (either by acquirer or target) in which at least one buyer belonged to the same 4-digit SIC code as the acquirer and target divided by the total number of divestitures undertaken by the merging firms. This variable has a missing value if no divestitures took place. The mean value of this variable is 0.18, indicating that in 18% of the 434 divestitures, some divested assets were purchased by an existing rivals. To preserve sample size, in some regression specifications we set Buyer Same Industry equal to 0 (instead of missing) if no divestiture took place. In this case, mean value of Buyer Same Industry is lower at 0.07. Finally, *AT Sales Ratio* is the sum of sales of the acquirer and target divided by total industry sales obtained from the Census Bureau.

4. Industry-level tests of output prices

We use two approaches in the industry level analysis. The first approach is a cross-sectional method in which we calculate the change in RPPI, $\Delta RPPI$, for each industry that experiences a horizontal merger event. $\Delta RPPI$ is calculated as the average RPPI three years after the merger less the average RPPI during the three years preceding the merger. We regress $\Delta RPPI$ on Divestiture Dummy using standard errors clustered by merger year. In this analysis, we have one observation per industry merger event. Out of 813 merger events we have data on $\Delta RPPI$ for 570 events.

Results of the cross-sectional analysis are presented in Panel A of Table 5. The first column of Table 5 shows that the coefficient on divestiture dummy is negative.

Thus, the change in output price is lower with divestitures. In column 2 of the same table, we include changes in input prices of the two main supplier industries as well as changes in industrial production. Requiring data on supplier industry prices results in significant loss of sample size. Nonetheless, Divestiture Dummy is negative and statistically significant again. Including input prices and demand conditions improves the R-squared of the regression considerably. Referring back to the hypothesis summarized in Panel A of Table 1, the negative coefficient on Divestiture dummy is consistent with the Market Power hypothesis.

In column 3, we restrict the sample to industry merger events that were associated with at least one divestiture and use Buyer Same Industry as the primary explanatory variable. Recall that Buyer Same Industry captures the percentage of deals in which assets were divested to one or more buyers within the same industry. We see that the coefficient on Buyer Same Industry is positive indicating that output prices are higher after the merger when more assets are divested within the industry than to new entrants. In column 4 we run the same regression without restricting the sample to only deals with divestitures. We use the full sample including industry events that are not associated with divestitures and set Buyer Same Industry equal to zero for events that had no related divestitures. Buyer Same Industry remains positive and statistically significant in this larger sample. Looking at the predictions summarized in Panel A of Table 1, we see that the positive coefficient on Buyer Same Industry is consistent with the Market Power hypothesis.

In Panel B of Table 5, we check robustness of our results to an alternative approach. Here we take the monthly time series of RPPI (in log differences) from 36

months before the beginning of merger event quarter till 36 months after the end of horizontal merger event and regress it on a dummy variable POST. POST is set equal to 1 for all the months following the end of the quarter in which the merger event occurred and 0 for all months prior to the beginning of the event quarter. To see how Divestiture Dummy and Buyer Same Industry affect prices after the merger, we interact POST with Divestiture Dummy and also with Buyer Same Industry. In this regression, Buyer Same Industry is set equal to zero if there is no divestiture. As control variables, we include the monthly time series of output prices of the two main supplier industries and also the monthly time series of industrial production, both also in log differences. We also include year fixed effects and industry fixed effects (at the two-digit SIC level). This panel regression is estimated using Newey-West standard errors.

Panel B of Table 5 (column 1) shows that POST by itself is not significant. However, the interaction of POST and Divestiture Dummy is negative indicating the output prices are lower after the merger than before if the merger is accompanied by a divestiture. The interaction of POST and Buyer Same Industry is positive indicating that prices are higher if assets are divested to firms within the same industry than to new entrants. In column 2 of the same table, we restrict the analysis to merger events that were accompanied by at least one divestiture and rerun the regression with only Buyer Same Industry and its interaction with POST. We find that the interaction of POST and Buyer Same Industry is positive again indicating that divestitures tend to lower post-merger prices, all else equal. These results are consistent with the findings in Panel A of Table 5 and suggest that divestitures mitigate the market power created by horizontal mergers.

The novel contribution of our study is to show that the market-power potential can be restricted through divestitures. This is the first large-sample evidence that divestitures accompanying horizontal mergers mitigate the price-increasing impact of horizontal mergers. It is also the first evidence that divestitures are more effective in curbing the post-merger increase in output prices if assets are sold to new entrants rather than to existing rivals.

Although our analysis of output prices indicates that the market power impact of horizontal mergers and accompanying divestitures dominates competitive efficiencies, it is by no means evidence that horizontal mergers do not create opportunities for economies of scale and other cost cuts. Existing research on the stock price reactions of acquirers, rivals and customers finds significant evidence in favor of the Competitive Efficiency hypothesis. Therefore, it is likely that both market power and competitive efficiencies co-exist. The firm-level analysis in the next section will help shed more light on this issue.

5. Firm-level tests of stock price reactions

In this section, we examine whether returns to acquiring firm, their rivals, and their customers at the announcement of a merger depend on whether any assets were divested and, if yes, whether the buyer was an existing rival or an outsider.

5.1. Customer CARs

We consider the stock price reactions of customer firms first, since these are the most directly linked to the output price analysis in the previous subsection. In scenarios that lead to higher output prices, customer returns should be negative and vice-versa.

In Table 6, we present regressions of customer CARs on Divestiture Dummy and Buyer Same Industry. Panel A presents OLS regressions. In the first three columns, we use the full sample including deals with and without accompanying divestitures. Buyer Same Industry is set to zero for deals without divestitures. We see that the coefficient on Divestiture Dummy is positive but it is statistically significant in only one of the three regressions. This is weakly consistent with our finding that output prices are lower when assets are divested. The coefficient on Buyer Same Industry is strongly negative in the full sample. In columns 4 and 5, we restrict the sample to deals that were accompanied by divestitures. Again, we see that the coefficient on Buyer Same Industry is strongly negative. The negative sign on Buyer Same Industry is consistent with our previous results that output prices are higher when assets are divested within the industry rather than to a new entrant. Based on the summary of predictions in Panel B of Table 1, we can see that the link between customer CARs and Buyer Same Industry is in line with the market power hypothesis.

Having conducted the OLS regressions, we recognize that divestitures are not exogenous events, in other words, they depend on the deal and industry conditions. In the extreme, if anti-trust authorities are perfectly able to identify and remedy anticompetitive mergers (either through mandated divestitures or through pressuring firms into voluntary divestitures), mergers that are not expected to have a price impact will not be accompanied by divestitures and mergers that are potentially anticompetitive will

be remedied through divestitures. Empirically, there would be no observable differences in the price impact of mergers with divestitures and those without. The fact that we do observe differences suggests that merger remedies, although effective, are not perfect.

Nonetheless, we address the endogeneity of divestitures with the Heckman model (or treatment effect model). In the first-stage regression, we model the Divestiture Dummy as a function of the acquirer's and target's size relative to the industry (AT Sale Ratio), industry concentration, and a dummy variable that equals one if the merger was challenged by antitrust authorities and zero otherwise. As expected, the larger the merging firms, the more concentrated the industry, and when the deal is officially challenged by anti-trust authorities, the more likely there will be divestitures.

Panel B of Table 6 presents the second-stage regression results. The first 3 columns display results of a treatment effect model, where Divestiture Dummy is included for the full-sample of customer CARs. Columns 4 and 5 present a Heckman self-selection model for the subset of deals in which a divestiture occurs. For the full-sample tests (Columns 1-3), although the Divestiture Dummy is insignificant, the coefficient on Buyer Same Industry remains strongly negative and significant. For the tests based on the subsample of deals with divestitures (Columns 4-5), Buyer Same Industry remains consistently negative. Thus, customer CARs are in lock step with output prices. Output prices are higher when assets are divested within the industry and, consequently, customer CARs are lower. This relation between Buyer Same Industry, output prices and customer CARs is supportive of the Market Power Hypothesis. However, the relation between customer CARs and the binary divestiture decision is inconclusive.

5.2. Acquirer's and rivals' CARs

Next, we move on to the CARs of acquirers and rival firms. Recall that we focus on rivals who do not purchase any of the divested assets. Table 7 presents results for acquirers while Table 8 presents results for non-buying rivals. In Panel A of Table 7, we present OLS regressions of acquirer CARs. In column 1 through column 6 we use the full sample including deals both with and without accompanying divestitures. The coefficient on Divestiture Dummy is negative and statistically significant in two of the three regressions. As is evident from the summary predictions in Table 1, the lower stock price reaction of acquirers to the existence of a divestiture is consistent with both the Market Power hypothesis and the Competitive Efficiencies hypothesis. The coefficient on Buyer Same Industry is negative and statistically significant in columns 2 and 3. When we restrict the sample to the subset of deals in which at least one divestiture occurred (columns 4 and 5), the coefficient on Buyer Same Industry remains negative and statistically significant. As indicated in Panel B of Table 1, a negative coefficient Buyer Same Industry is supportive of the Competitive Efficiencies hypothesis. The acquirer is more concerned about an existing rival become larger and potentially more cost efficient than it is about gaining market power relative to customers.

In Panel B of Table 7, we control for the endogeneity of the divestiture decision. Columns 1 through 3 present the second stage regression of a treatment effect model in which the Divestiture Dummy is first modeled as a function of the acquirer's and target's size relative to the industry (AT Sale Ratio), industry concentration, and a dummy variable that equals one if the merger was challenged by antitrust authorities and zero otherwise. The coefficient on Divestiture Dummy is negative and significant as predicted

by both the market power and competitive efficiencies hypotheses. In columns 2 and 3, Buyer Same Industry is again negative and statistically significant. In columns 4 and 5, we present a Heckman model for the subsample of mergers that are accompanied by a divestiture. Buyer Same Industry remain negative and significant. Thus, in all regressions of acquirer CARs, the coefficient on Buyer Same industry is supportive of the competitive efficiencies hypothesis.

In Table 8, we present results for rivals. Panel A of Table 8 presents OLS regressions and Panel B presents treatment effect and Heckman self-selection models. The results are similar in both panels, so we provide an overview of the results from both panels. We see that the coefficient on Divestiture Dummy is always positive and statistically significant in a majority of the regression specifications. Referring to Panel B of Table 1, the positive sign on Divestiture Dummy is supportive of the Competitive Efficiency hypothesis. The benefits of limiting scale economies and other cost efficiencies of the merging firm appear to be more important for the rival than any pricing power that the merger might bring to the industry. Table 8 also shows a negative coefficient on Buyer Same Industry. That is, rival firms (who do not get to buy the assets divested by the merging firms) react negatively when an existing competitor buys the divested assets. The disadvantage of having to compete with larger, potentially more cost-effective rivals outweighs any benefits that might arise the possibilities of future cooperative collusion.

To summarize the findings, output prices and customer CARs are broadly in line with the Market Power hypothesis. Divestitures to firms within the industry result in higher output prices and, consequently customer CARs are strongly negative when assets

are divested within the same industry. However, stock price reactions of acquirers and rivals strongly suggest that competitive efficiencies are a principal concern. Merging firms and rival firms care more about preserving their ability to compete effectively with each other than do about generating market power relative to customers.

6. Conclusions

As noted by Kuhn (2010), divestitures have become an increasingly important merger remedy. In this paper, we present the first large-sample study of how divestitures affect the product market impact of horizontal mergers. In setting up the empirical predictions, we compare two broad motivations for horizontal mergers - (i) enhance market power over customers and (ii) become more cost efficient and competitive by realizing economies of scale, closing overlapping facilities, eliminating labor redundancies, etc.

We find that divestitures mitigate the price-increasing impact of horizontal mergers. Post-merger output prices are lower for mergers that are accompanied by divestitures as compared to mergers that have no accompanying divestitures. Moreover, divestitures are more effective in keeping post-merger output prices lower if the divested assets are sold to a firm outside the industry, i.e. to a new entrant, rather than to an existing rival. Both of these findings are consistent with the hypothesis that horizontal mergers create market power and that the market power impact can be constrained through divestitures. In further support of the market power hypothesis, we find that customer firms experience higher announcement returns if divested assets are bought by firms outside the industry.

Although our evidence indicates that mergers and the associated divestitures change market power relative to customers, the stock returns of acquirers and their rivals indicate that mergers also affect the relative cost efficiencies of the firms. Acquirers and rivals are more concerned about how the merger and accompanying divestitures change their relative size and competitiveness than they are about gaining market power relative to customer firms. Stock price reactions of rival firms are more positive if the merging firms divest assets. Moreover, both acquirers and rivals have lower stock price reactions if a different firm in the same industry buys the divested assets. Both these results indicate the firms would prefer not have their competitors become larger through acquisitions even if the acquisitions increase the industry's market power vis-à-vis customers.

Our paper has three key contributions. First, we are the first to demonstrate that divestitures accompanying horizontal mergers reduce the market-power impact of the mergers, which is precisely what antitrust authorities hope to achieve. Second, we show that divestitures are more effective in reducing the market power impact of horizontal mergers if the assets are sold to firms outside the industry. Third, our paper reconciles the seemingly conflicting finds of existing product market studies which conclude that horizontal mergers create market power and 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 efficiencies. 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 are reflected in the stock price reactions of acquirers and rival firms.

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Table 1
Predictions

This table summarizes the main predictions of the paper under the Market Power hypothesis and the Competitive Efficiencies hypothesis. Panel A presents predictions for industry output prices and Panel B presents predictions for stock price reactions of acquiring firms, their rivals and customers.

Panel A: Industry output prices

	Market Power	Competitive/Cost Efficiency
Divestiture	<p><i>Output prices lower</i></p> <p>Merged firm smaller. Reduced ability to exercise monopoly power or create entry barriers</p>	<p><i>Output prices higher</i></p> <p>Merged firm smaller. Limited ability to realize cost cuts through economies of scale and elimination of redundancies</p>
Buyer same industry	<p><i>Output prices higher</i></p> <p>No new entrant. Fewer players in the market. Collusion more sustainable</p>	<p><i>Output prices lower</i></p> <p>Existing rival becomes larger and more cost efficient. Competes more efficiently with merged firm</p>

Panel B: Announcement returns of acquirers, rivals and customers

	Selling Power	Competitive/Cost Efficiency
Divestiture		
Acquirer	Negative Reduced market power vis-à-vis customers	Negative Reduced ability to realize scale economies and eliminate redundancies
Rivals	Negative Diminished market power externality from merger	Positive Merged firm's ability to become a more cost-efficient competitor is weakened
Customers	Positive Divestiture reduces ability of merged firm to exercise monopoly power	Negative or unchanged Divestiture limits economies of scale. Fewer cost cuts available to pass on to customers
Buyer Same Industry		
Acquirer	Positive Lower number of firms in industry. More opportunities for cooperative collusion	Negative Existing rival becomes larger and more cost efficient.
Rivals	Positive Lower number of firms in industry. More opportunities for cooperative collusion	Negative Now has to compete with two larger firms, more cost-efficient firms - the merged firm and the other rival that purchased divested assets
Customers	Negative More opportunities for cooperative collusion in merging firms' industry	Positive Existing rival becomes larger and more cost efficient. Competes effectively with merged firm

Table 2
Merger events and divestitures by industry and decade

This table summarizes 813 horizontal merger events that occurred in mining and manufacturing industries between 1980 and 2010. Mergers are considered horizontal if the acquirer and target have the same primary 4-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 SIC code. An industry is said to experience a horizontal merger event if the transaction value of all completed, majority stake, horizontal mergers in a given quarter is at least 5% of industry total assets in that quarter. If an industry experiences more than one event in a quarter, only the first event is retained in the sample. A merger event is said to be associated with a divestiture if either the acquiring firm or the target firm divested assets in the two years prior to or two years following the merger event.

	1980-1989		1990-1999		2000-2010	
	Events	Events with divestitures	Events	Events with divestitures	Events	Events with divestitures
10 Metal Mining	4	1	5	2	7	3
12 Coal Mining	5	0	7	0	4	2
13 Oil and Gas Extraction			3	0	7	1
14 Mining and Quarrying of Nonmetallic Minerals, except fuels	5	2	10	5	1	0
15 Building Construction, General Contractors, Operative Build	4	0	7	1	14	2
16 Heavy construction Other than Building Construction Contract	2	0	2	1	2	0
17 Construction Special Trade Contractors	2	0	2	1	7	3
20 Food And Kindred Products	34	18	37	12	52	20
21 Tobacco Products			6	0	2	1
22 Textile Mill Products	8	1	6	3	2	0
23 Apparel	8	3	15	2	9	3
24 Lumber and Wood Products	5	3	7	1	7	1
25 Furniture and Fixtures	7	1	4	1		
26 Paper and Allied Products	5	3	13	5	11	7
27 Printing, Publishing and Allied Industries	11	5	18	12	14	7
28 Chemicals and Allied Products	14	6	12	7	19	9
29 Petroleum Refining and Related Industries	2	0	1	0	3	1
30 Rubber and Plastics	3	2	10	4	4	1
31 Leather and Leather Products	1	0	1	1	5	0
32 Stone, Clay, Glass and Concrete Products	13	5	5	0	9	2
33 Primary Metal Industries	9	3	14	4	12	4
34 Fabricated Metal Products	11	5	17	8	18	6
35 Industrial and Commercial Machinery	23	12	37	17	34	15
36 Electronic and Other Electrical Equipment	11	6	19	4	20	9
37 Transportation Equipment	2	2	12	6	12	4
38 Instruments	13	6	25	13	18	6
39 Miscellaneous Manufacturing Industries	6	0	6	1	11	1
Total	208	84	301	111	304	108
Total Events	813					
Total Events with at least one divestiture	434					

Table 3
Industry level variables

RPPI is the real producer price index of the industry experiencing a horizontal merger event. RPPI is calculated as the producer price index (PPI) of an industry divided by the contemporaneous consumer price index. The PPI measures the average change over time in the selling prices received by domestic producers for their output. 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. The table presents averages of the monthly RPPI over the three years preceding the horizontal merger event and the three years following the merger event. Data on industry level PPI and the CPI are obtained from the Bureau of Labor Statistics. Wage is the mean hourly wage of production works obtained from the Census Bureau's Annual Survey of Manufacturers. It is calculated as dollar wages earned by production workers divided by total production worker hours. Total Production is total industrial production obtained from the Federal Reserve Board. CR4 is the four-firm concentration ratio collected by the Census Bureau every five years. The 4-firm concentration ratio is the percentage of Value of Shipments accounted for by the four largest firms in the industry. The census years within our sample period are 1982, 1987, 1992, 1997, 2002, and 2007. Since annual concentration data from the Census is not available, we assume that industry concentration does not change in the 2 years before and 2 years after the census year. Superscripts ^{***}, ^{**}, ^{*} indicate significance at the 1%, 5% and 10% levels respectively.

	Before	After	Difference
RPPI	0.899	0.875	-0.024 (11.37) ^{***}
Supplier 1 RPPI	0.878	0.847	-0.031 (8.75) ^{***}
Supplier 2 RPPI	0.892	0.836	-0.056 (13.32) ^{***}
Wage	12.58	13.5	0.92 (19.69) ^{***}
Total Production	74.34	79.33	4.99 (38.6) ^{***}
CR4	38.59	40.23	1.64 (8.83) ^{***}

Table 4
Firm-level variables

This table presents cumulative abnormal returns (CAR) around merger announcement for acquirer, their rivals and their customer firms. CARs are calculated based on parameters estimated using the market model. Cumulative abnormal returns are calculated for the three trading days centered on the announcement date. Since returns to rival firms and customer firms for a given acquisition can be correlated, for each acquisition we use the value-weighted portfolio return of all rival firms and customer firms.

Divestiture Dummy takes a value of one if a merger is accompanied by at least one divestiture. *Buyer Same Industry (if divestiture occurs)* is the percentage of divestitures in which the buyer of the divested assets belongs to the same industry as the merging firms. It is calculated as the number of divestitures (either by acquirer or target) in which at least one buyer belonged to the same 4-digit SIC code as the acquirer and target divided by the total number of divestitures undertaken by the merging firms. To preserve sample size, in some regression specifications we set Buyer Same Industry equal to 0 (instead of missing) if no divestiture took place. This modified variable is labeled as *Buyer Same Industry (full sample)*.

	Mean	Median	N
Acquirer CAR	0.90%	0.43%	644
Rival CAR	0.04%	-0.04%	985
Customer CAR	-0.20%	-0.21%	911
Divestiture Dummy	0.38	0	1153
Buyer Same Industry (if divestiture occurs)	0.18	0	434
Buyer Same Industry (full sample)	0.07	0	1153

Table 5
Multivariate analysis of the producer price index

The dependent variable is the change in RPPI of the merging industry after a horizontal merger event. Change in RPPI is calculated as the average monthly RPPI during the three years following a horizontal merger event less the average monthly RPPI during the three years prior to the merger event. Explanatory variables are as follows. *Divestiture Dummy* takes a value of one if any target or acquirer involved in the industry's horizontal merger event undertakes a divestiture during the two years prior to or two years following the event. In Column 2, the sample is restricted to merger events that were associated with at least one divestiture (i.e. *Divestiture Dummy* equal to 1). In this model, *Buyer Same Industry* is the percentage of divestitures in which the buyer of the divested assets belongs to the same industry as the merging firms. It is calculated as the number of divestitures (either by acquirer or target) in which the buyer belonged to the same 4-digit SIC code as the acquirer and target divided by the total number of divestitures undertaken by the merging firms. Columns 3 and 4 include all merger events including events that were not associated with a divestiture. In these models, *Buyer Same Industry* is calculated as described above if an event is associated with a divestiture but is set equal to zero if no divestiture is observed. Change in Supplier 1 (Supplier 2) RPPI is the RPPI of the largest (second largest) supplier industry of the downstream industry experiencing a horizontal merger event. The change is calculated as the average monthly RPPI two years after the event less the average monthly RPPI over the two years prior to the event. Change in total industrial production, mean hourly wage and 4-firm concentration ratio is calculated the same way. Wage is the mean hourly wage of production workers obtained from the Census Bureau's Annual Survey of Manufacturers. It is calculated as dollar wages earned by production workers divided by total production worker hours. Total Production is total industrial production obtained from the Federal Reserve Board. CR4 is the four-firm concentration ratio collected by the Census Bureau every five years. The 4-firm concentration ratio is the percentage of Value of Shipments accounted for by the four largest firms in the industry. t-statistics based on standard errors clustered by merger event year are presented in parenthesis. Superscripts ^{***}, ^{**}, ^{*} indicate significance at the 1%, 5% and 10% levels respectively.

Panel A: Cross-sectional

	1	2	3	4
Divestiture Dummy	-0.016 (2.08)**	-0.021 (2.10)**		-0.028 (2.92)***
Buyer Same Industry			0.058 (2.63)**	0.055 (2.24)**
Change in Supplier 1 RPPi		0.542 (5.24)***	0.615 (5.13)***	0.544 (5.37)***
Change in Supplier 2 RPPi		0.068 (1.63)	0.054 (0.97)	0.071 (1.69)
Change in Total Industrial Production		-0.025 (0.21)	0.120 (0.89)	-0.017 (0.15)
Constant	-0.020 (2.54)**	-0.002 (0.16)	-0.040 (4.06)***	-0.002 (0.20)
Observations	570	199	101	199
R-squared	0.01	0.45	0.49	0.46

Panel B: Panel

	DlnRPPI	
POST	-0.000 (0.53)	-0.001 (1.69)*
POST x Divestiture dummy	-0.001 (1.70)*	
POST x Buyer Same Industry	0.002 (1.92)*	0.002 (2.15)**
Buyer Same Industry	-0.001 (1.04)	-0.001 (1.23)
Divestiture dummy	-0.000 (1.40)	
Supplier 1 RPPI	0.028 (2.68)***	0.000 (0.03)
Supplier 2 2RPPI	0.016 (3.18)***	0.020 (3.32)***
Industrial production	0.020 (1.05)	-0.023 (0.99)
R-squared	0.03	0.06
Observations	14,013	7,152

Table 6
Customer CARs

The dependent variable is the cumulative abnormal return (CAR) of customer firms. CAR is calculated over the (-1,+1) event window based on a benchmark market model. Panel A presents results of an OLS regression. Panel B presents a treatment effect model in which the likelihood of a divestiture is estimated in the first stage. In the first stage (not shown), *Divestiture Dummy* is regressed on *AT Sales Ratio*, *Concentration Ratio* and a dummy variable equal to one if the merger is challenged by FTC and zero otherwise. *AT Sales Ratio* and *Concentration Ratio* are calculated as described in Table 4. In the second stage shown in Panel A, fitted values of *Divestiture Dummy* are included as an explanatory variable. *Buyer Same Industry* is calculated as described in Table 4. If no divestiture is observed *Buyer Same Industry* is set equal to zero. In Panel B, which present the results of a Heckman self-selection model, the sample is restricted to mergers associated with at least one divestiture by either the acquirer or target. t-statistics based on standard errors clustered by merger event year are presented in parenthesis. Superscripts ^{***}, ^{**}, ^{*} indicate significance at the 1%, 5% and 10% levels respectively.

Panel A: OLS					
	vw_car1	vw_car1	vw_car1	vw_car1	vw_car1
Divestiture Dummy	0.002 (1.07)	0.005 (2.25)**	0.003 (1.54)		
Buyer Same Industry		-0.015 (3.03)***	-0.015 (3.19)***	-0.015 (3.03)***	-0.015 (3.15)***
Concentration Ratio			-0.004 (0.68)		0.001 (0.14)
All Cash			0.001 (0.29)		0.000 (0.09)
Public			0.005 (2.26)**		0.005 (1.51)
Hostile			-0.004 (0.50)		-0.002 (0.21)
Competed			-0.016 (1.52)		-0.021 (1.22)
Constant	-0.003 (2.31)**	-0.003 (2.31)**	-0.002 (0.92)	0.002 (1.10)	-0.001 (0.30)
<i>R</i> ²	0.00	0.01	0.02	0.03	0.04
<i>N</i>	911	911	903	351	348

Panel B: Treatment and Heckman models

Divestiture Dummy	0.003 (0.39)	0.002 (0.33)	-0.002 (0.29)		
Buyer Same Industry		-0.013 (2.77)***	-0.015 (2.99)***	-0.014 (2.81)***	-0.015 (3.07)***
Concentration Ratio			-0.001 (0.22)		0.002 (0.25)
All Cash			0.002 (0.93)		0.002 (0.49)
Public			0.006 (2.38)**		0.006 (1.67)*
Hostile			-0.005 (0.68)		-0.002 (0.30)
Competed			-0.017 (1.91)*		-0.021 (1.70)*
Constant	-0.004 (1.08)	-0.002 (0.70)	-0.003 (0.61)	-0.002 (0.39)	-0.008 (1.10)
Hazard lambda	0.000 (0.05)	0.002 (0.47)	0.004 (0.98)		
Mills lambda				0.004 (0.76)	0.008 (1.20)
N	740	740	740	740`	740

Table 7
Acquirer CARs

The dependent variable is the acquirer's cumulative abnormal return (CAR). CAR is calculated over the (-1,+1) event window based on a benchmark market model. Panel A presents a treatment effect model in which the likelihood of a divestiture is estimated in the first stage. In the first stage (not shown), *Divestiture Dummy* is regressed on *AT Sales Ratio*, Concentration Ratio and a dummy variable equal to one if the merger is challenged by FTC and zero otherwise. AT Sales Ratio and Concentration Ratio are calculated as described in Table 4. In the second stage shown in Panel A, fitted values of *Divestiture Dummy* are included as an explanatory variable. *Buyer Same Industry* is calculated as described in Table 4. If no divestiture is observed Buyer Same Industry is set equal to zero. In Panel B, which presents the results of a Heckman self-selection model, the sample is restricted to mergers associated with at least one divestiture by either the acquirer or target. t-statistics based on standard errors clustered by merger event year are presented in parenthesis. Superscripts ^{***}, ^{**}, ^{*} indicate significance at the 1%, 5% and 10% levels respectively.

Panel A: OLS

	acar1	acar1	acar1	acar1	acar1
Divestiture Dummy	-0.012 (2.21)**	-0.007 (1.26)	-0.010 (1.66)*		
Buyer Same Industry		-0.029 (2.76)***	-0.025 (2.01)**	-0.029 (2.76)***	-0.025 (1.97)**
Concentration Ratio			0.022 (1.52)		0.027 (1.50)
All Cash			-0.004 (0.58)		0.003 (0.44)
Public			-0.021 (3.02)***		-0.015 (1.87)*
Hostile			-0.009 (0.65)		-0.011 (0.70)
Competed			-0.034 (2.67)***		-0.041 (2.68)***
Constant	0.015 (3.68)***	0.015 (3.68)***	0.021 (2.61)***	0.008 (2.10)**	0.003 (0.36)
R ²	0.01	0.02	0.06	0.02	0.06
N	644	644	532	345	295

Panel B: Treatment and Heckman self-selection model

Divestiture Dummy	-0.078 (3.39)***	-0.077 (3.32)***	-0.054 (2.38)**		
Buyer Same Industry		-0.028 (2.05)**	-0.027 (1.99)**	-0.029 (2.30)**	-0.027 (2.22)**
Concentration Ratio			0.022 (1.26)		0.034 (1.64)
All Cash			-0.003 (0.45)		0.005 (0.64)
Public			-0.018 (2.68)***		-0.011 (1.45)
Hostile			-0.007 (0.37)		-0.008 (0.42)
Competed			-0.032 (1.89)*		-0.038 (2.07)**
Constant	0.055 (4.19)***	0.057 (4.27)***	0.044 (3.04)***	-0.025 (1.97)**	-0.030 (1.70)*
Hazard lambda	0.040 (2.70)***	0.041 (2.80)***	0.029 (2.02)**		
Mills lambda				0.038 (2.68)***	0.033 (2.33)**
Observations	532	532	532	690	690

Table 8
Rival CARs

The dependent variable is the cumulative abnormal return (CAR) of rival firms that belong to the same 4-digit SIC as the merging firms. CAR is calculated over the (-1,+1) event window based on a benchmark market model. Panel A presents a treatment effect model in which the likelihood of a divestiture is estimated in the first stage. In the first stage (not shown), *Divestiture Dummy* is regressed on *AT Sales Ratio*, Concentration Ratio and a dummy variable equal to one if the merger is challenged by FTC and zero otherwise. AT Sales Ratio and Concentration Ratio are calculated as described in Table 4. In the second stage shown in Panel A, fitted values of *Divestiture Dummy* are included as an explanatory variable. *Buyer Same Industry* is calculated as described in Table 4. If no divestiture is observed Buyer Same Industry is set equal to zero. In Panel B, which presents the results of a Heckman self-selection model, the sample is restricted to mergers associated with at least one divestiture by either the acquirer or target. t-statistics based on standard errors clustered by merger event year are presented in parenthesis. Superscripts ^{***}, ^{**}, ^{*} indicate significance at the 1%, 5% and 10% levels respectively.

Panel A: OLS

	vw_car1	vw_car1	vw_car1	vw_car1	vw_car1
Divestiture Dummy	0.002 (1.17)	0.005 (2.39)**	0.003 (1.42)		
Buyer Same Industry		-0.014 (3.20)***	-0.015 (3.08)***	-0.014 (3.20)***	-0.015 (3.15)***
Concentration Ratio			-0.005 (0.85)		-0.011 (1.20)
All Cash			-0.002 (0.90)		-0.003 (0.82)
Public			0.002 (0.93)		0.002 (0.67)
Hostile			0.015 (1.86)*		0.011 (1.45)
Competed			-0.001 (0.09)		0.002 (0.35)
Constant	-0.000 (0.39)	-0.000 (0.39)	0.003 (1.01)	0.004 (2.62)***	0.009 (1.94)*
R ²	0.00	0.01	0.02	0.03	0.05
Observations	985	985	801	391	336

Panel B: Treatment and Heckman models

Divestiture Dummy	0.018 (2.16)**	0.019 (2.29)**	0.016 (1.94)*		
Buyer Same Industry		-0.012 (2.29)**	-0.011 (2.19)**	-0.012 (2.37)**	-0.012 (2.33)**
Concentration Ratio			-0.015 (2.27)**		-0.013 (1.45)
All Cash			0.001 (0.44)		-0.002 (0.72)
Public			0.002 (0.99)		0.002 (0.49)
Hostile			0.015 (2.07)**		0.011 (1.40)
Competed			-0.001 (0.15)		0.003 (0.35)
Constant	-0.007 (1.70)*	-0.007 (1.61)	-0.002 (0.35)	0.008 (1.56)	0.013 (1.76)*
Hazard lambda	-0.010 (1.94)*	-0.010 (1.83)*	-0.009 (1.62)		
Mills lambda				-0.004 (0.68)	-0.004 (0.65)
Observations	647	647	647	711	711