Product similarity and the motives for related mergers

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Abstract

What motivates mergers between firms producing similar products? Using Hoberg and Phillips' (2014) text-based product similarity measure, we find that when an acquirer's product is more similar to those of its rivals, a merger results in a greater post-merger product selling price for the combined firm. In addition, cumulative abnormal returns (CARs) at the merger announcement are higher for the combined firm and for product market rivals, but lower for reliant corporate customers along the supply chain. The evidence from both product market and stock market consistently suggests that market power is an important motive for related mergers.

1. Introduction

There is a long-standing debate on whether mergers are anticompetitive. Large sample studies of merger motives generally find no evidence on increased market power. Instead, they provide various explanations such as increased operating efficiencies and cost savings (e.g., Bradley, Desai and Kim, 1988; Maksimovic and Phillips, 2001; Jovanovic and Rousseau, 2002; Fee and Thomas, 2004; Shahrur, 2005; Li, 2013; Sheen, 2013; Bernile and Lyandres, 2013), enhanced buying power (e.g., Bhattacharyya and Nain, 2011),[1] reduced holdup inefficiency (e.g., Shenoy, 2012; Fresard, Hoberg, and Phillips, 2013), asset complementarities and product innovation (e.g., RhodesKropf and Robinson, 2008; Hoberg and Phillips, 2010; Phillips and Zhdanov, 2013; Bena and Li, 2014), and disciplining target management (e.g., Morck, Shleifer, and Vishny, 1989).[2] Although there is evidence from some case studies and industry-specific studies supporting market power considerations (e.g., Barton and Sherman, 1984; Borenstein, 1990; Kim and Singal, 1993; Singal, 1996; Akhavein, Berger, and Humphrey, 1997; Prager and Hannan, 1998; Aktas, de Bodt, and Derbaix, 2004), it is questionable whether this evidence provides insights that are generalizable.

Stigler (1964) posits that mergers enable more effective anticompetitive collusion by reducing the number of firms that produce similar products. But previous studies testing this market power hypothesis usually examine horizontal mergers based on the Standard Industrial Classification (SIC) or the North American Industrial Classification System (NAICS), assuming firms that operate in the same SIC or NAICS industries produce similar products.[3] Both the SIC and the NAICS, however, classify firms according to the relatedness of their production processes rather than their product features.[4] Constructing a horizontal merger sample using a process-based system faces two problems. First, it sometimes misclassifies deals between firms producing very different products as horizontal, which

[1] The literature uses market power to refer to market selling power against customers, and buying power to refer to monopsonistic or countervailing power against suppliers. In the rest of this paper, market power refers to market selling power, if not otherwise specified.

[2] Previous literature on merger waves reports drivers such as managerial timing of market overvaluation (e.g., Shleifer and Vishny, 2003; Rhodes-Kropf, Robinson, and Viswanathan, 2005), and neoclassical explanations based on industry shocks and capital liquidity (e.g., Gort, 1969; Mitchell and Mulherin, 1996; Harford, 2005), neither of which support the market power hypothesis.

[3] Among others, Fee and Thomas (2004), Shahrur (2005), and Bhattacharyya and Nain (2011) use the SIC to define horizontal mergers, and Bernile and Lyandres (2014) use the NAICS to define horizontal mergers in their industry-level analysis.

[4] The SIC was developed to "classify establishments by the type of activity in which they are primarily engaged". The principles of the NAICS suggest that "producing units that use identical or similar production processes will be grouped together in NAICS" (source: http://www.naics.com/history-naics-code/). The U.S. Census Bureau states that "NAICS results in industries that group units undertaking similar activities using similar resources but does not necessarily group all similar products or outputs" (source: http://www.census.gov/eos/www/naics/reference_files_tools/NAICS_Update_Process_Fact_Sheet.pdf).

reduces the power to detect anticompetitive effects. For example, Amazon's 1988 acquisition of Junglee is a horizontal merger on this basis, as they share the primary SIC code 7375, despite Amazon and Junglee competing in different product markets, one in online book and music retailing, the other in online virtual database technology.[5] Second, it excludes anticompetitive mergers between competing firms that offer close products but use differing production technologies. For example, although both firms operate and compete in the fluid milk and milk products market, Suiza resides in the SIC industry "wholesale trade-non-durable goods" (5143) whereas Dean Foods resides in the SIC industry "food and kindred products" (2026).[6] SIC-based horizontal merger samples would exclude the 2001 merger between Suiza and Dean Foods. To summarise, many previous large sample studies include unrelated mergers or exclude truly anticompetitive mergers, both of which bias results against finding an anticompetitive effect.

The product similarity system of Hoberg and Phillips (2010, 2014) enables us to identify related mergers between firms that produce similar products. Specifically, we define a merger as related if the target resides in the acquirer's product space, using Hoberg and Phillips' (2014) Text-based Network Industry Classification (TNIC).[7] We ask whether these related mergers are driven by anticompetitive or efficiency motives. Since product similarity is not confined to particular firms or a specific industry, we can examine a large sample of related mergers covering the entire economy.

Our hypothesis about the anticompetitive effect of related mergers builds on Stigler's (1964) oligopoly theory. Stigler (1964) points out that a business combination reduces the number of competing firms, making it easier for the merged firm to collude with its competitors. When the products sold in a merging firm's product market are more homogenous, it is easier for incumbent firms to obtain collusive profits and maintain a collusive agreement. To capture the potential collusive effect, we use the average of the acquirer's product similarity to its rivals in its TNIC. The higher the average product

[5] Hoberg and Phillips (2014) point out that since the late 1990s, a large number of new technology firms and web-related firms have belonged to the SIC "business services" industry. This supports our argument that it is inappropriate to use the SIC to define horizontal mergers, since an SIC-based definition classifies deals between any computer related service providers in this SIC industry as horizontal mergers despite their end products being dissimilar.

[6] For details of the merging parties' relatedness and the business fit of this deal, see Siebert, Schwart, Pritchard, and Seidenberger (2000).

[7] Since Hoberg and Phillips' (2014) TNIC can be defined at any granularity, we follow their TNIC-3 classification, which is a TNIC with the same coarseness as a three-digit SIC, to define related mergers. As Hoberg and Phillips (2014) explain, for a three-digit SIC classification, 2.05% of all possible firm-pairs are in the same SIC industry. For a TNIC-3 classification, a 21.32% minimum firm-by-firm pairwise similarity threshold generates the same probability of any two firms being in the same TNIC-3 industry.

similarity, the greater is the potential to generate market power and monopolistic rents from merger-induced product market collusion. We call this the *market power hypothesis*.

There is a possible offsetting effect, however. In particular, related mergers can lead to operating efficiencies and cost savings (e.g., Bradley, Desai and Kim, 1988; Maksimovic and Phillips, 2001; Jovanovic and Rousseau, 2002; Lambrecht, 2004), which give merging firms a competitive advantage over product market rivals. By reducing the marginal costs of production for a given level of output, these synergies also increase equilibrium production quantities of the merging firms (Bernile and Lyandres, 2013). In a more homogenous product market, the products of merging firms are closer substitutes to those of its rivals. This results in the merged firm's competitors facing a less steep residual inverse demand curve; rivals face a higher risk of their market shares being eroded by a merged firm that has a competitive advantage arising from merger synergies. Therefore, the higher an acquirer's average product similarity to its rivals, the greater is the gain from achieving competitive advantages over rivals via efficiency-enhancing mergers. Efficiency considerations can drive related mergers in homogeneous product markets. We label this the *efficiency hypothesis*.

We test our hypotheses on the motives for related mergers using a sample of 493 deals in non-financial and non-regulated industries announced between 1998 and 2009, half of which are between firms residing in different four-digit SIC industries. The acquirer's average product similarity is from Hoberg and Phillips (2014).[8]

Since the motives for related mergers manifest themselves directly in a product market effect and indirectly in a stock market effect, we first examine the post-merger changes in in real performance, i.e. product selling price measured by the Producer Price Index (PPI). We find that the acquirer's average product similarity relates positively to a post-merger selling price increase. Notably, the impact of the merger strengthens over a three-year horizon. This evidence suggests that related firms merge to increase market power via collusion.

For indirect evidence, we follow Eckbo (1983), Stillman (1983) and Mullin, Mullin, and Mullin (1995) and distinguish the market power and efficiency motives by examining the announcement abnormal returns of merging firms, product market rivals, and corporate customers. Any merger-induced anticompetitive effect results in a wealth transfer from corporate customers to merging firms and other incumbent firms in the product market. This wealth transfer should be most obvious for reliant corporate customers along the supply chain

[8]We are grateful to Gerard Hoberg and Gordon Phillips for sharing the data in their data library, available at http://alex2.umd.edu/industrydata/. Section 3 further describes how the average similarity index captures product features. See Hoberg and Phillips (2014) for the detailed construction of the index.

because reliant customers have a higher upstream material purchase dependence. We indeed find that merging firms and product market rivals have positive abnormal returns while reliant corporate customers have negative abnormal returns at the merger announcement. Moreover, the acquirer's average product similarity is positively associated with the wealth effect of merging firms and product market rivals, and negatively associated with that of reliant corporate customers. The evidence from product and stock markets supports the market power hypothesis.

An issue with our research design is that the changes in real performance could be due to secular time trends independent of the mergers. To examine this issue, following Bhattacharyya and Nain (2011), we construct a pseudo-sample with random event dates. We find that all the impacts of the acquirer's average product similarity disappear in the pseudo-event sample. This confirms that the effects on real performance are due to the related mergers.

Our study makes the following contributions. First, we provide original, broad evidence of merger-induced market power arising from potential collusion in homogeneous product markets. In contrast to most existing studies that use static and production process-based industry classifications to define horizontal or related mergers, we define related mergers using the dynamic and product similarity-based TNIC of Hoberg and Phillips (2014), which is more appropriate for examining the merger-induced market power hypothesis. The only other paper we are aware of that groups mergers using the TNIC is Bernile and Lyandres (2014).[9] But their focus is on management-forecast merger synergies, which differs from the objective of our study. Our evidence complements previous case-study and industry-specific evidence on market power created by horizontal mergers (e.g., Kim and Singal, 1993; Akhavein, Berger, and Humphrey, 1997; Prager and Hannan, 1998). Our study highlights the need for further formalisation of the anticompetitive consequences of mergers between firms producing similar products, to rank with existing theoretical studies modelling upstream collusion facilitated by vertically related mergers (Nocke and White, 2007) and industry monopoly facilitated by horizontal mergers (e.g., Stigler, 1964; Salant, Switzer, and Reynolds, 1983; Deneckere and Davidson, 1985; Perry and Porter, 1985). As merger motives are not necessarily mutually exclusive (Berkovitch and Narayanan, 1993), our evidence on anticompetitive market power allows us to form a more complete picture of merger motives. Importantly, our findings imply that the antitrust authorities are overlooking some situations

[9] Bernile and Lyandres (2014) use TNIC to define horizontal mergers in their firm-level analysis.

where anticompetitive mergers exist. This view differs from that of Bhattacharyya and Nain (2011), who assume an efficient antitrust deterrence effect. As they note, "horizontal mergers expected to increase selling power and result in higher prices for customers will be anticipated to be blocked by antitrust authorities. Thus, mergers which clearly enhance selling power may never be observed when one looks for evidence in product or stock markets" (Bhattacharyya and Nain 2011, p.98). Since the related mergers that we examine are completed transactions that pass antitrust scrutiny, the anticompetitive market power evidence from post-merger real performance that we observe suggests that regulators can do more to improve antitrust effectiveness and protect consumers from anticompetitive mergers between firms producing similar products. For instance, the antitrust agencies should focus on consolidations based on product markets rather than on SIC or NAICS industries when screening mergers. Our study also complements previous research on buying power (e.g., Bhattacharyya and Nain, 2011) in the sense that a merger-induced anticompetitive effect can manifest itself in buying power that squeezes upstream suppliers or in product market power against downstream customers.

Second, our study adds to the literature on the importance of product features for firms' strategic decisions. Recent literature has explored the importance of firm pairwise product similarity on acquisition choices and merger effects (Hoberg and Phillips, 2010), the importance of average product similarity on sell-side analysts' coverage decisions (Hsu, Li and Ma, 2013), cash holdings (Morellec, Nikolov, and Zucchi, 2013), and capital structure (Rauh and Sufi, 2012), and the importance of product market fluidity on payout policy (Hoberg, Phillips, and Prabhala, 2014). We study the relative importance of the market power and efficiency effects of related mergers defined by acquiring firms' product features. We show that an acquirer's average product similarity is positively associated with anticompetitive rents due to the enhanced net benefit of collusion arising from related mergers.

The remainder of the paper continues as follows. Section 2 develops testable hypotheses. Section 3 describes the sample and construction of variables. Section 4 reports the univariate and multivariate results. Section 5 summarises and concludes.

2. Literature review and hypothesis development

2.1 Previous literature on merger motives

Neoclassical theories of merger motives suggest firms merge to obtain increased operating efficiency (e.g., Lambrecht, 2004), discipline target management (e.g., Jensen and

Ruback, 1983; Morck, Shleifer, and Vishny, 1989), respond to economic shocks (e.g., Gort, 1969), and pursue market power (e.g., Stigler, 1950; Deneckere and Davidson, 1985; Perry and Porter, 1985).[10] Previous large sample empirical studies testing these neoclassical theories of merger motives generally report efficiency-related gains as the main driver and find no systematic evidence for market power. For example, Bradley, Desai and Kim (1988) study successful acquisitions achieved through tender offers and suggest synergistic gains underlie the value creation. Maksimovic and Phillips (2001) analyze the market for corporate assets and find that asset sales of plants and divisions improve the allocation of resources. Li (2013) uses plant-level data and shows that improved productivity through more efficient use of capital and labour drives the value creation from mergers. Jovanovic and Rousseau (2002) compare takeovers during the periods of the electricity and internal combustion engine spread and the Information Age and suggest a major role of takeovers in speeding up the diffusion of new technology. Fan and Goyal (2006), Shenoy (2012), and Fr*é*sard, Hoberg, and Phillips (2013) report evidence consistent with efficiency gains and reduced holdup inefficiency from vertical takeovers. Gort (1969), Mitchell and Mulherin (1996), and Harford (2005) find that firms merge to better compete and respond to economic shocks. Jensen and Ruback (1987) and Morck, Shleifer, and Vishny (1989) suggest that takeovers occur to replace inefficient target management and increase management efficiency. Recent studies highlight the dimension of product innovation. For instance, RhodesKropf and Robinson (2008) model asset complementarities as a merger motive, and Hoberg and Phillips (2010) provide supporting empirical evidence by developing text-based measures and show that asset complementarities between merging firms prompt product innovation. Phillips and Zhdanov (2013) find large firms acquire smaller R&D firms to gain cutting-edge R&D outcomes, which facilitates their product innovation. Bena and Li (2014) indicate that technological overlap between firms increases the likelihood of mergers and facilitates more patent generation post-merger.

A strand of literature, originating with Eckbo (1983) and Stillman (1983), focuses on horizontal or related mergers and finds no systematic evidence of market power. Most of these studies use SIC codes to define horizontal mergers and examine merger motives based

[10] Bernile, Lyandres, and Zhdanov (2012) group explanations of firms' merger motives into behavioural and agency theories and neoclassical theories. The former views takeovers as resulting from investors' or managers' cognitive biases or conflicts of interest between managers and investors (e.g., Shleifer and Vishny, 2003; Rhodes-Kropf, Robinson, and Viswanathan, 2005), whereas the latter views them as firms' value-enhancing responses to industry- or economy-wide shocks. In this classification, neoclassical theories are more relevant to the market power hypothesis.

on the stock market reactions for firms in the same industry and along the supply chain.[11] By examining the announcement wealth effect on rivals, customers, and suppliers of merging firms, Shahrur (2005) and Fee and Thomas (2004) conclude that horizontal mergers create value due to efficiency improvements. Bhattacharyya and Nain (2011) find that horizontal mergers exert price pressure on dependent suppliers and conclude that merging firms extract rents from enhanced buying power. Sheen (2013) analyzes the quality and price of merging firms' products using a hand-collected product-brand level sample, and reports evidence consistent with operational efficiencies and cost savings.

Despite the absence of systematic evidence of market power motives from large sample studies, some case studies or industry-specific studies report findings supportive of an anticompetitive motive. These studies look at product prices directly or examine the announcement returns of firms potentially affected by horizontal mergers. For example, Barton and Sherman (1984) trace the actual transaction price effect and profit consequence of Xidex's acquisitions of two major competitors in the duplicating microfilm industry, and find market power substantially increased after the acquisitions. Kim and Singal (1993) study price changes after airline consolidation, and show that prices increased on routes served by the merging firms relative to the prices of unaffected routes, which suggests that the impact of efficiency gains on airfares is more than offset by the increased market power subsequent to horizontal mergers.[12] Other industry-specific studies that look at product prices directly and find market power evidence include Akhavein, Berger, and Humphrey (1997), Prager and Hannan (1998), and Focarelli and Panetta (2003) (for short-run pricing impact) on the banking industry, Chipty and Snyder (1999) on the cable television industry, and Ashenfelter and Hosken (2008) on consumer products. By studying the horizontal, downstream and upstream announcement returns of mergers in the car industry, Aktas, de Bodt, and Derbaix (2004) report evidence consistent with anti-competitive business practices such as predatory pricing and the combined firm engaging in the abuse of a dominant position and improper exploitation of customers, suppliers, and competitors. Probably due to data availability, these studies are restricted to specific cases or industry sectors. The broader extant evidence based

[11] Earlier studies focus on industry rivals' reactions to horizontal merger announcements or antitrust challenge announcements, e.g., Eckbo (1983, 1985, 1992), Stillman (1983), Song and Walkling (2000). More recent studies extend this to examine the stock market and operating performance of corporate customers in downstream industries and suppliers in upstream industries, e.g., Fee and Thomas (2004), Shahrur (2005), Bhattacharyya and Nain (2011). For details, see the survey paper of Betton, Eckbo and Thorburn (2008).

[12] Borenstein (1990) and Singal (1996) also study the pricing effect after mergers in the airline industry and find market power evidence.

on large samples seems to suggest either the antitrust authorities are deterring potentially anticompetitive mergers or, as Eckbo (1992) states, there is little to deter.

2.2 Hypothesis development

Stigler (1964) in his theory of oligopoly points out that business combinations in the same market reduce the number of competing firms, making it easier for the combined firm to collude with its rivals. For instance, the cost of detecting any secret price-cut is lower when there are fewer firms in the market. Further, when the products sold on a market are more homogenous, it is more likely the firms have an overlapping customer base, which lowers the cost of maintaining the outputs and price structure collusively determined by all producers in the market. For instance, a retaliatory price-cut in response to a breach of a collusive agreement is more effective when the products and the customer base are more similar. Therefore, a related merger should have a stronger anticompetitive effect when the bidder is in a more homogeneous product market. To capture the potential collusive effect, we use Hoberg and Phillips' (2014) average similarity index of the acquirer's TNIC. The average similarity measures the degree of product homogeneity in the product market that experiences consolidation through related mergers.

If related mergers create market power through collusion, we expect this effect to manifest itself directly in product market performance. In particular, we hypothesize that related mergers in more homogenous markets allow colluding firms to maintain a higher product selling price post-merger. We follow Bhattacharyya and Nain (2011) and examine the effects over a three-year post-deal completion period. This is because the merger induced product market effects may take time to appear. Therefore, our hypothesis on real performance is as follows.

H1: *The change in product market selling price is higher in the three years after a related merger the greater is the acquirer's average product similarity.*

Real performance changes induced by related mergers should translate into stock market performance. Eckbo (1983) and Stillman (1983) establish a methodological framework to distinguish market power from efficiency incentives by examining the abnormal returns to the merging firms and their industry rivals at merger announcements. Mullin, Mullin, and Mullin (1995) apply this framework to customer companies, arguing one should detect any merger-induced anticompetitive effect through a wealth transfer from customers of the merging industry. We examine this wealth transfer effect using reliant customers because this customer group is more dependent on the merging industry's output and so is most affected

by the upstream consolidation. If a related merger gives rise to greater market power through product market collusion, we hypothesize as follows.

H2: C*ombined firms in related mergers experience positive abnormal returns at the merger announcement.*

H3: *Product market rivals of combined firms in related mergers experience positive abnormal returns at the merger announcement.*

H4: *Reliant corporate customers of combined firms in related mergers experience negative abnormal returns at the merger announcement.*

Since product market homogeneity can facilitate the effective enforcement of collusive agreements among product market players, we hypothesize that related mergers in more homogenous markets result in greater gains to the combined firms and product market rivals, and greater losses to reliant customers at the merger announcement.

H5: *Abnormal returns to the combined firm at a related merger announcement are higher the greater is the acquirer's average product similarity.*

H6: *Abnormal returns to product market rivals of the combined firm at a related merger announcement are higher the greater is the acquirer's average product similarity.*

H7: *Abnormal returns to reliant corporate customers at a related merger announcement are lower the greater is the acquirer's average product similarity.*

We recognize that the average product similarity in the consolidated product market has a possible effect offsetting the potential collusive effect, however. In particular, related mergers may lead to improved operating efficiencies and cost savings (e.g., Fee and Thomas, 2004; Shahrur, 2005), enabling the merged firm to gain a competitive advantage over product market rivals. Bernile and Lyandres (2014) show that an efficient horizontal merger reduces the marginal cost of production for a given level of output, and increases equilibrium production quantities of the combined firm. In a more homogenous product market, incumbent firms face a greater substitution effect. As a result, it is easier for a more efficient merged firm to erode the market shares of product market rivals. Therefore, if related mergers create value through improved efficiency, we expect a higher acquirer's average product similarity to result in greater gains from competitive advantages over product market rivals. This is the rationale underlying the efficiency hypothesis.

Reflected in stock market valuations, the efficiency argument predicts positive abnormal returns to combined firms and a positive relation between average product similarity and the wealth effect on the combined firm. The effects on product market selling price and reliant customers depend on whether the merging industry passes the merged-induced efficiency

gains downstream. If it does, we predict that average product similarity relates negatively to changes in the post-merger product selling price and positively to abnormal returns to reliant customers, who experience a positive wealth effect at the merger announcement. If the merging industry does not pass on the efficiency gains, the product selling price and reliant customers are unaffected. The merger announcement effect on product market rivals is unrestricted. On the one hand, improved efficiency of combined firms causes a competitive disadvantage to product rivals. On the other hand, an efficient merger signals a higher merger probability to rivals, who can realize similar synergies by merging with product market peers (Song and Walkling, 2000). Likewise, the efficiency argument does not have a clear prediction on the relation between the rival wealth effect and average product similarity. Table 1 summarizes these competing hypotheses.

3. Data

3.1 Related merger sample construction

To examine the merger-induced anticompetitive effect in the product market, we need a sample of related mergers between firms offering similar end products. As conventional industry classifications such as SIC or NAICS are static and process-based and do not properly capture the product features and the dynamics of end products offered by firms, we use Hoberg and Phillips' (2014) TNIC, which is based on the end product similarity within each industry cluster. To justify this choice, we briefly describe their procedure and refer readers to their original papers for more detail. Constructing the TNIC involves three main steps. First, Hoberg and Phillips extract all firms' product descriptions from annual 10-K statements filed with the Securities and Exchange Commission (SEC) and build a dictionary of all unique words in these documents in a given year after applying certain word-exclusion screens. They then form a normalised word vector representation for each firm. Since 10-K product description statements are legally required to be correct and filed each year, the vector representations reflect the updated product features of a firm. Second, using a cosine similarity methodology, they calculate firm-by-firm pairwise similarity scores for each year, which dynamically measure the extent to which two firms' products are similar.[13] Third, they classify a relevant product market for each firm by imposing a minimum threshold of the

[13] The cosine similarity is the inner product of normalized vectors of any two firms and is higher when two firms use more of the same words. Since two firms producing similar products tend to cluster product description vocabulary, the cosine similarity of any two firms measures the extent to which their products are similar. For a more detailed description of the firm-by-firm pairwise similarity calculation, see Hoberg and Phillips (2014) Appendix 1.

pairwise similarity score relative to the reference firm. This relevant product market is the TNIC industry of the reference firm. Using TNIC industries to define related mergers ensures that merging parties produce similar end products and compete in relevant product markets.

By design the TNIC industry can be defined at any granularity. We follow Hoberg and Phillips' (2014) TNIC-3 classification, which is a TNIC with the same coarseness as a three-digit SIC, to define related mergers.[14] As they explain, for a three-digit SIC classification, 2.05% of all possible firm-pairs are in the same SIC industry. For a TNIC-3 classification, a 21.32% minimum pairwise similarity threshold generates the same probability of any two firms being in the same TNIC-3 industry. We define a merger as related if the target resides in the acquirer's TNIC-3 industry.

We begin by extracting all mergers and acquisitions announced between January 1, 1998 and December 31, 2009 from the Securities Data Corporation (SDC) Mergers and Acquisitions database.[15] We apply the following screening criteria to form our related merger sample. First, the bidder does not own a majority stake in the target before the transaction and is seeking to obtain a majority interest through the transaction. Second, both the bidder and target are publicly listed U.S.-based firms and have data available from the Centre for Research in Security Prices (CRSP) to calculate abnormal returns surrounding transaction announcement and from Compustat to identify four-digit primary SIC codes. Third, the deal was completed. Fourth, we exclude transactions with bidders residing in financial and regulated industries (primary SIC codes not 6000–6999, 4000–4099, 4500–4599, or 4800–4999) since financial and regulated industries do not have regular input-output relations that reflect supply and demand of production, and PPI data for our primary test is mostly provided for industrial products. Fifth, the target resides in the acquirer's TNIC-3 industry in the year before merger announcement.

The procedure identifies 493 related mergers during 1998–2009 that meet these criteria. Table 2 reports the distribution of related mergers over the sample period. Considerable variation is evident in the frequency by year. There are 261 deals announced between 1998 and 2001, accounting for 53% of the sample. The average ratio of target to bidder firm

[14] A finer TNIC industry classification tends to lead to a small number of identified related mergers. A coarser classification is likely to sacrifice the degree of end product relevance of merging firms. We believe the TNIC-3 granularity balances product relevance between merging firms and sample size.

[15] The reason for restricting the sample period to start from 1998 is that the consistent TNIC of Hoberg and Phillips (2014) is only available from 1997. They electronically gather firms' business descriptions by searching the Edgar database for 10-K statements, and the electronic filing with Edgar first became required in 1997. We define related mergers based on the ex ante TNIC industry membership of the acquirer and target in the year before the merger announcement. Therefore, we apply a one-year lag to the period with available TNIC.

market value of equity is 0.30, which is comparable to existing studies. For example, Fee and Thomas (2004) report an average ratio of target to bidder firm equity market value of 0.45 for horizontal mergers defined by four-digit SIC codes. Akbulut and Matsusaka (2010) report a figure of 0.19 for related mergers defined by three-digit SIC codes. However, the average deal size of related mergers is $3,254 million, which is larger than the average deal value of mergers reported in studies with a comparable sample period. For instance, Li (2013) reports an average deal value of $2,184 million during 1998–2002 for all public mergers. In terms of log total size of merging firms, our related merger sample has an average log total size of 7.8, larger than the 5.5 that Hoberg and Phillips (2010) report for all mergers during 1997–2006.

Of the identified related mergers, 51% are between firms residing in different four-digit SIC industries, confirming our conjecture that the SIC system misclassifies mergers between firms producing similar products. Appendix 1 lists the 34 related mergers that fall in the top quartile of the acquirer's average product similarity but reside in different two-digit SIC codes. The firms on the list suggest there is a high end-product and business relatedness between the merging firms although they have different production processes. For example, food stores and eating and drinking places are highly related. Food stores can provide ready-to-eat food and drink that eating and drinking places also provide, as Food Hall does. Therefore, the merger between Diedrich Coffee Inc (SIC code 5499, food stores) and Coffee People Inc (SIC code 5812, eating and drinking places) in 1999 is highly related and expected to impact the dynamics in their competing product market.

3.2 Average product similarity

We use Hoberg and Phillips' (2014) average similarity index to measure the acquirer's product similarity to its rivals (*Acquirer's average product similarity*). This captures the degree of product homogeneity in the product market where merging firms compete. Hoberg and Phillips (2014) use the following procedures to calculate the average similarity index. For reference firm *i*, they subtract the minimum threshold of the pairwise similarity score relative to reference firm *i*, i.e., 21.32% for firm *i*'s TNIC-3 industry, from each pairwise similarity score between firm *i* and its TNIC-3 rivals to obtain net pairwise similarity scores, and sum these to obtain firm *i*'s total similarity index. They divide the total similarity index by the number of firms (except for the reference firm) in the reference firm's TNIC-3 industry to derive the average similarity index. Since both the pairwise similarity score between firm *i* and its TNIC-3 rivals and the number of rivals in firm *i*'s TNIC-3 industry may change from

year to year, firm *i*'s average similarity index is time varying, reflecting the dynamics of a firm's relevant product market.

3.3 Competition measures

Recent empirical studies show the importance of distinct dimensions of competition in determining firm decisions (e.g., Li, 2010; Morellec, Nikolov, and Zucchi, 2013). For example, Li (2010) reports potential entrants and existing rivals have different effects on firm voluntary disclosures. It is therefore important to control for dimensions suggested by previous literature other than the product homogeneity. We consider both existing competition and potential entry threats when accounting for the competitive environment. Consistent with industrial organization theory (see Tirole, 1988), we use the Herfindahl-Hirschman Index (HHI) to proxy for the intensity of competition from existing rivals. In particular, we use both the TNIC-based and SIC-based HHI (*Acquirer's product concentration* and *Acquirer's SIC HHI*). Since these two industry systems classify firms according to distinct criteria, the two concentration measures contain distinct information on the competitive environment (Hoberg and Phillips, 2014).[16] These concentration measures are constructed based on market shares, and reflect competition pressure from a backward-looking perspective.

Baumol, Panzar, and Willig (1982) suggest that entry threat is an important source of competition pressure. If firms merge horizontally to reduce competition and pursue a post-merger collusion in output markets, the reduced level of competition would attract new entrants to the industry, and this potential entry would discourage incumbent firms from merging to collude in the first place (Bernile, Lyandres, and Zhdanov, 2012). Therefore, we control for potential entry threats when exploring related merger motives. We use product market fluidity (*Acquirer's product market fluidity*), developed by Hoberg, Phillips, and Prabhala (2014) to proxy for entry threat.[17] The product market fluidity for firm *i* is the cosine similarity between firm *i*'s own word usage vector and the aggregate change vector reflecting the overall changes in rivals' usage of firm *i*'s words. It captures how rivals are changing their product words to move towards firm *i*'s product space, hence reflects forward-looking changes in products (Hoberg, Phillips, and Prabhala, 2014). Table 3 shows a correlation matrix for the average product similarity and competition measures. All the

[16] The TNIC-based concentration index is available from http://alex2.umd.edu/industrydata/. See Hoberg and Phillips (2014) for construction procedures.

[17] Product market fluidity is available from http://alex2.umd.edu/industrydata/. See Hoberg, Phillips, and Prabhala (2014) for construction procedures.

correlations are small and do not exceed 0.5. In particular, the correlation between *Acquirer's product concentration* and *Acquirer's SIC HHI* is 0.4, suggesting these two concentration measures reflect different perspectives on existing competition. The correlation between *Acquirer's product concentration* and *Acquirer's product market fluidity* is −0.3, suggesting a high market concentration of existing product market players relates to low entry threats from potential competitors.

3.4 Real performance measure

We follow Bhattacharyya and Nain (2011) and use the PPI to examine merger-induced changes in selling prices. Ideally, we should trace changes in selling prices for the consolidating TNIC-3 industry. However, prices are difficult to measure at the TNIC level. This is because the TNIC industry scope changes each year, and there is no ready-to-use data source on product selling prices that can be unambiguously mapped to each TNIC industry. A TNIC industry usually spreads across several SIC industries. On average, about 40% of all TNIC-3 firms share the same four-digit primary SIC industry as the acquirer, and the acquirer's four-digit primary SIC represents the largest four-digit SIC group within the TNIC-3 industry. As about 88% of firms in the acquirer's primary SIC industry compete in the same TNIC-3 industry as the merging firms, it is reasonable to assume that price changes in the acquirer's four-digit primary SIC industry are mainly merger-induced. Since PPI data from the Bureau of Labor Statistics (BLS) is based on NAICS codes, which can be consistently mapped to SIC codes,[18] we measure merger-induced price changes in the acquirer's four-digit primary SIC to examine price changes caused by related mergers.

For each merger, we obtain the monthly PPI series and map this to the acquirer's four-digit primary SIC code from the BLS starting from the 12th month before the merger announcement until the 36th month after the merger completion. We adjust the PPI series using the GDP price deflator to derive the real PPI (*RPPI*). The pre-merger product selling price is measured as the log RPPI (*Ln RPPI*) averaged over 12 months (year −1) before the merger announcement, whereas the post-merger product selling price over each of the three years post-merger is measured as the average *Ln RPPI* over the 1−12, 13−24, and 25−36 months after the merger completion (labelled years 1, 2, and 3). To examine price changes over time, we calculate price differences (Δ*Ln RPPI*) between year −1 and each of the three years following the merger, and the median change over the three time horizons.

[18] We use 1997 NAICS–SIC correspondence tables provided by the U.S. Census Bureau to convert NAICS to SIC codes, available from http://www.census.gov/eos/www/naics/concordances/concordances.html.

3.5 Measuring stock market performance

We use the event study methodology to estimate the wealth effects of merging firms, product market rivals, and reliant customers. For completeness, we also report the wealth effects of the acquirer's primary suppliers. We do not perform the full range of analysis on the suppliers because our focus in not on buying power. Following Bradley, Desai, and Kim (1988) and Fee and Thomas (2004), we value-weight the cumulative abnormal returns (CARs) over a five day window (−2, 2) to the acquirer and target to get the combined wealth effect of merging firms (*Combined CAR*). Abnormal return is calculated using $AR_{it} = R_{it} - \widehat{\alpha_i} - \widehat{\beta_i} R_{mt}$, where $\widehat{\alpha_i}$ and $\widehat{\beta_i}$ are estimated using the market model. The weights are the relative equity market values of the acquirer and target before the merger, excluding the value of any pre-merger holdings in the target by the acquirer.

We define product market rivals as all firms that compete in the acquirer's TNIC-3 industry except for the acquirer and target. Our identification of rivals differs from previous research. Previous research either uses SIC or NAICS to define industry rivals or defines product market rivals as firms belonging to the acquirer's or target's TNIC-3 industry. On average, we identify 225 product market rivals (median of 125) in each deal. We calculate both equal- and value- weighted portfolio CARs to product market rivals for each transaction. As we cannot rely on rival CAR to infer market power, since both the market power and efficiency hypotheses may predict a positive market return to rivals, we treat the rival CAR analysis as an auxiliary and confirming analysis and rely on the abnormal return analysis to reliant customer portfolios to infer which motive dominates.

Consistent with previous literature (e.g., Shahrur, 2005; Fan and Goyal, 2006; Bhattacharyya and Nain, 2011; Ahern, 2012; Ahern and Harford, 2014), we use the Use table from the Bureau of Economic Analysis (BEA) Benchmark Input–Output (IO) accounts to identify firms that operate along the merged entities' supply chains. The Use table is a matrix giving estimates of the dollar value of an upstream industry's output used by its downstream industries as input for any pair of downstream–upstream industries. Ideally, we should trace corporate customers to all firms in the consolidating TNIC-3 industry. However, the Use table is constructed based on IO code, and there is no directly usable matching table between an IO code and a firm's TNIC-3. Given that the IO codes can be consistently mapped to four-digit SIC codes, we address this problem by looking for the downstream customers to the major SIC industry, i.e., the acquirer's four-digit primary SIC industry, in the consolidating

TNIC-3. This is because the acquirer's primary SIC industry is the major SIC in the consolidating TNIC-3, and most of the acquirer's primary SIC industry firms reside in the consolidating TNIC-3. Therefore, it is reasonable to posit that the reaction of the downstream firms to the acquirer's four-digit primary SIC industry at the related merger announcement reflects any merger-induced changes. In other words, we observe the downstream effect of the consolidating TNIC-3 from the firms downstream to the acquirer's primary SIC. Specifically, we use the 1997 Use table to identify all customers downstream to the acquirer's four-digit primary SIC industry.[19] We construct the IO–SIC conversion map to identify customers as any firms in the downstream SIC industries to the acquirer's primary SIC industry.[20] For each downstream–upstream industry pair, we calculate a *Customer Input Coefficient* (*CIC*), i.e., the upstream industry's output value sold to the downstream industry divided by the downstream industry's total output value. A customer firm is reliant if it operates in a downstream industry with the highest *CIC*. We retain a most reliant downstream industry for each merger. In contrast to Shahrur (2005), when defining downstream customer industries, we do not apply the 1% *CIC* threshold to account for the low dependence of some downstream industries on the acquirer industry. Since about 5% of our identified reliant customers have a *CIC* of less than 1%, we believe low dependence is not a problem in our reliant customer analysis. For robustness, we apply the 1% *CIC* threshold and it does not change our results. By design, this procedure identifies potential customers instead of actual customers, which is consistent with Shahrur (2005). Moreover, in line with Shahrur (2005), to derive a clean downstream effect of a merger, we restrict our reliant customer analysis to single-segment firms covered by CRSP and Compustat. This avoids a downstream effect being attenuated by unrelated operating segments. This procedure gives an average of 18 (median of 11) reliant customers for 295 related mergers in our sample. Having identified reliant customers, we construct a portfolio of these firms and estimate portfolio CARs with equal- and value-weights to capture the overall effect on customer firms.

In the interest of completeness, we also form portfolios of primary suppliers and examine their reactions to related merger announcements. The method is analogous that for reliant

[19] The 1997 Use table is available at http://www.bea.gov/industry/io_benchmark.htm.

[20] The 1997 Use table uses six-digit IO codes as identifiers and there is no direct IO–SIC mapping available, we adopt the conversion strategy suggested by Bhattacharyya and Nain (2011). First, we use the IO–NAICS conversion tables provided by the BEA to convert IO codes to NAICS codes. The IO–NAICS concordance for 1997 is available in Appendix A of "Benchmark Input-Output Accounts of the United States, 1997", available at http://www.bea.gov/scb/pdf/2002/12December/1202I-OAccounts2.pdf. Then we use the correspondence table provided by the U.S. Census Bureau to convert NAICS to SIC codes. The 1997 NAICS–SIC concordance table is available at http://www.census.gov/eos/www/naics/concordances/concordances.html.

customer portfolios. We define primary suppliers as firms in the upstream industry from which the acquirer's primary SIC industry purchases most for production. On average, we identify 24 primary suppliers (median of 13) for each deal. We then calculate both equal- and value-weighted portfolio CARs to primary suppliers for each transaction. However, our focus is on the anticompetitive effect on the consolidating industry and downstream firms, which is different from Bhattacharyya and Nain (2011) who study buying power against suppliers.

4. Empirical results

4.1 Univariate analysis

Table 4, panel A reports changes in real performance after related merger completions. For the entire sample, the difference between the median product selling price over the three-years post-merger and the selling price in year −1 is −0.017 (t = −4.69). However, scrutinising subsamples defined by quartiles of average product similarity, we find that related mergers with the lowest average product similarity are associated with the lowest changes in product selling price. In particular, $\Delta Ln\ RPPI$ from year −1 to the post-merger median horizon is a significant −0.028 (t = −5.22) for deals in the lowest quartile of average product similarity, compared with an insignificant −0.001 (t = −0.19) for deals in the highest quartile. The difference between the pair of figures is statistically significant (t = 3.41 for $\Delta Ln\ RPPI$). This pattern is largely consistent with monopoly rents generated from product market collusion.

The evidence on stock market performance in panel B strengthens this conjecture. There are two important observations. First, for the entire sample, merged firms realize significantly positive abnormal returns of 1.3%, whereas reliant customers lose −0.6% for the equally weighted portfolio CAR and −0.8% for the value weighted portfolio CAR. These results support H2 and H3, and show a wealth transfer from customers to merging firms. In other words, related mergers enable merging firms to gain at the expense of reliant customers. Notably, our abnormal returns to reliant customers differ from those of previous studies. For example, Shahrur (2005) reports insignificant positive CARs of reliant customer portfolios for SIC-based horizontal mergers. Fee and Thomas (2004) and Bernile and Lyandres (2014) examine the wealth effect to the corporate customer portfolio of horizontally merging firms, and find insignificant results. Bernile and Lyandres (2014) interpret the lack of significance of customer CARs as resulting from the offsetting effects of merger synergies and monopoly rents. The significantly negative customer CARs we find suggest that the net effect of related mergers is increased market power. Second, combined firms gain the most (3.6%) in mergers

in the highest quartile of average product similarity. Product market rivals' CARs have a similar pattern, 2.9% for an equally weighted portfolio and 1.0% for a value-weighted portfolio for mergers in the highest quartile of average product similarity. The mean differences between subsamples in the lowest and highest quartiles of average product similarity are statistically significant for both combined firms (t = 2.97) and product market rivals (t = 5.75 for equally weighted portfolio and t = 2.00 for value-weighted portfolio). For reliant customers, the lowest abnormal returns occur in the second top similarity group.

In addition, product market rivals realize a positive announcement CAR of 1.1% over a (−2, 2) window for the equally-weighted portfolio, supporting H3. This is in line with previous literature, which finds rivals benefit from horizontal mergers. However, the magnitude of our findings is slightly larger, compared with a 0.56% CAR over an eleven-day window in Song and Walkling (2000), a 0.24% CAR over a three-day window in Fee and Thomas (2005), and a 0.39% CAR over a five-day window in Shahrur (2005). Although we cannot tell whether the higher rival returns are due to an increased merger probability effect (Song and Walkling, 2000) or to industry-wide monopoly benefits (Stigler, 1964), the finding provides auxiliary evidence that TNIC is a more relevant industry classification to capture the effects of related mergers. Primary suppliers are generally unaffected, which is consistent with by Shahrur (2005) who finds the CARs to main suppliers are insignificant.

These univariate results contrast with the conclusion of most prior large sample studies that firms merge horizontally for efficiency reasons rather than to pursue monopoly rents (e.g., Fee and Thomas, 2004; Shahrur, 2005). It suggests that market power exists in mergers between firms producing similar products. However, because changes in real performance and stock market valuations may be affected by various non-mutually exclusive factors, we conduct cross-sectional tests to explore whether a multivariate setting confirms these preliminary findings.

4.2 Real performance results

We first test H1, which hypothesizes that the change in product selling price is higher after a related merger when the acquirer's product similarity is greater. Put differently, if market power is the real motive for related mergers, the acquirer's average product similarity should be positively related to the product selling price change because collusion is more likely in a more homogeneous product market. In our regression, we account for existing and potential competition pressures facing the merging firms. Given PPI can be affected by

shocks to input prices and other factors, we follow Bhattacharyya and Nain (2011) and explicitly control for changes in primary input prices, labour costs, and demand shocks that the acquirer's primary SIC industry may face. Specifically, we estimate the following OLS regressions with standard errors robust to heteroskedasticity and clustering at the industry level.

$$\begin{aligned}\Delta Ln\ RPPI_j = {} & a_0 + a_1 Acquirer's\ average\ product\ similarity_j \\ & + a_2 Acquirer's\ product\ concentration_j \\ & + a_3 Acquirer's\ product\ market\ fluidity_j \\ & + a_4 Acquirer's\ SIC\ HHI_j + a_5 \Delta Ln\ RPPI_{Sup_j} \\ & + a_6 \Delta Ln\ Wage_j + a_7 \Delta Ln\ TP + a_8 Other\ ctrl_j + \varepsilon_j \end{aligned} \quad (1)$$

where Δ*Ln RPPI* is the change in Ln *RPPI* of the acquirer's four-digit primary SIC industry, *Acquirer's average product similarity* is the key explanatory variable, *Acquirer's product concentration* is the sales-based concentration of the acquirer's TNIC industry, *Acquirer's Product market fluidity* measures the potential competitive threats to the acquirer in its product market, *Acquirer's SIC HHI* is the sales-based concentration of the acquirer's four-digit primary SIC industry, Δ*Ln RPPI*$_{Sup}$ is the change in Ln *RPPI* of the primary supplier's industry, Δ*Ln Wage* is the change in the logarithm of average hourly earnings of production workers compiled by the BLS, Δ*Ln TP* is the change in the logarithm of the total industrial production index obtained from the Federal Reserve Board, which measures the real output changes in manufacturing, mining, and electric and gas utilities industries and reflects changes in demand conditions in the economy, and *Other ctrl* includes *Same SIC-4 ind dummy*, *Target relative size*, and *Log total size*, which are mainly consistent with Hoberg and Phillips (2010). Appendix 2 defines all the variables. All change variables are measured from year −1 to each of the three years post-merger and to the median over the three horizons.

In table 5, models (1), (3), and (5) present the results of estimating *Eq.* (1) over time horizons from year −1 to year 1, 2, and 3 respectively, and model (7) presents the result for the median change. Models (2), (4), (6), and (8) add year effects to *Eq.* (1). In all the regressions, the acquirer's average product similarity has a significantly positive effect on *ΔLn RPPI*. Therefore, the positive effect of the acquirer's average product similarity is robust to the length of time horizon and the year in which a deal is announced. In addition, the coefficients on *Acquirer's average product similarity* increase monotonically over the three years post-merger, suggesting the monopolistic effect grows over time after industry consolidation. It also translates into an economically large magnitude. A one standard

deviation increase in *Acquirer's average product similarity* leads to a 0.9% greater increase in Ln *RPPI* in the first year after merger completion, growing to 1.6% in the third year. This evidence supports findings from previous studies based on specific cases or industries. For example, Kim and Singal (1993) find that the airline industry merger between a failing-firm and a healthy peer enables the merging and rival firms to increase their airline route fares by 40% and 45% during the completion period, which suggests that merger-induced greater collusion among the remaining airlines overwhelmingly dominates any efficiency gain that may arise in the merger. Ashenfelter and Hosken (2008) employ retail scanner data and use familiar panel data program evaluation estimation procedures, and report price experiences a 3−7% increase following mergers in the consumer product industry.

A remaining concern is that the changes in product market prices may be a result of secular time trends rather than the related mergers. For instance, the product market prices of the consolidating product market may be trending upwards in the absence of related mergers in the industry. We follow Bhattacharyya and Nain (2011) to address this concern by creating a pseudo-sample with the same set of acquirers but with randomly generated event dates between 1998−2009 drawn from a uniform distribution. We replace the actual announcement dates with the random event dates and recalculate the variables. We report the pseudo-sample results in tables 6. The coefficients on *Acquirer's average product similarity* turn statically insignificant in all models. The contrast between results from the actual and the pseudo-sample confirms that the changes in product market prices are attributable to the related mergers. Overall, the evidence on real performance is in favour of the market power motive and contrasts with the predictions of the efficiency motive.

4.3 Stock market results

In this section, we examine how the stock market performances of the consolidating product market (including the merging firms and product market rivals) and downstream customer firms relate to the acquirers' product similarity, in the spirit of Eckbo (1983), Stillman (1983) and Mullin, Mullin, and Mullin (1995). We first test H3, which predicts the abnormal returns to the combined firm at the related merger announcement date are higher the greater is the acquirer's average product similarity, using the following OLS specification.

$$Combined\ CAR_j = a_0 + a_1 Acquirer's\ average\ product\ similarity_j + a_2 Acquirer's\ product\ concentration_j + a_3 Acquirer's\ product\ market\ fluidity_j$$

$$+ a_4 Acquirer's\ SIC\ HHI_j + a_5 Other\ ctrl_j + \varepsilon_j \quad (3)$$

where *Combined CAR* is the value-weighted acquirer and target CARs as defined in section 3.4. In addition to the control variables in Eq. (2), we include two dummy variables, *Hostile takeover* and *Offer includes Stock*, suggested in the previous literature (e.g., Shahrur, 2005). *Hostile takeover* equals one if the deal is hostile, and zero otherwise. *Offer includes Stock* equals one if the bid includes stock, and zero otherwise.

Table 7, model (1) shows the results of estimating Eq. (3), and model (2) adds year effects. As expected, the coefficient of *Acquirer's average product similarity* is significantly positive (10% for model 1 and 5% for model 2). This positive effect translates into a 1.1% announcement gain to the combined firm for a one standard deviation increase in the acquirer's average product similarity. Since enhanced market power implies an increase in profit, this finding is consistent with H2 and shows that the stock market rewards firms that merge with others producing similar products. Standing alone however, this result is silent on the sources of gains from related mergers because there could be market power or efficiency gains from related mergers in a more homogeneous product market.

Next, we examine whether the acquirer's average product similarity affects rival firms. We use Eq. (4) to test H3.

$$\begin{aligned} Rival\ CAR_j = a_0 &+ a_1 Acquirer's\ average\ product\ similarity_j \\ &+ a_2 Acquirer's\ product\ concentration_j \\ &+ a_3 Acquirer's\ product\ market\ fluidity_j \\ &+ a_4 Acquirer's\ SIC\ HHI_j + a_5 Other\ ctrl_j + \varepsilon_j \end{aligned} \quad (4)$$

where *Rival CAR* is the product market rival portfolio CAR, and the explanatory variables are as in Eq. (3). Table 8 presents the results, with models (1) and (2) using an equal-weighted CAR and models (3) and (4) using a value-weighted CAR as the dependent variable. Odd numbered models report results for Eq. (4), while even numbers control for year effects. Consistent with H3, the coefficient on *Acquirer's average product similarity* is positive for either weighting method across models (1)–(4), significant at 1% for equal-weighting and 10% for value-weighting. This positive effect of the acquirer's average product similarity translates to a sizable announcement gain, 0.9% for equal-weighted and 0.6% for value-weighted scheme, to product market rivals for a one standard deviation increase in the acquirer's average product similarity. As previously explained, while this evidence is in line with the collusion story, it is also consistent with the efficiency story. The existence of

alternative explanations requires an examination of the impact on downstream customers to disentangle the two stories.

We examine how the abnormal returns to the reliant customer firms are associated with the acquirers' average product similarity. An anticompetitive merger must result in a value decrease for customer firms but an efficiency-enhancing merger should benefit or not affect customers depending on whether the efficiency gain is passed downstream or not. H4 predicts a negative relation between the acquirers' average product similarity and *Reliant Customer CAR*. We estimate the following OLS regression.

$$\begin{aligned} Reliant\ Customer\ CAR_j = a_0 &+ a_1 Acquirer's\ average\ prod\ similarity_j \\ &+ a_2 Acquirer's\ product\ concentration_j \\ &+ a_3 Acquirer's\ product\ market\ fluidity_j \\ &+ a_4 Acquirer's\ SIC\ HHI_j + a_5 Other\ ctrl_j + \varepsilon_j \end{aligned} \quad (5)$$

where *Reliant Customer CAR* is the abnormal returns to reliant customer firms over the period (−2, 2). Apart from the control variables in Eq. (2), we account for the characteristics of the customer industry. Consistent with Shahrur (2005), we control for the customer industry structure, i.e., the concentration ratio of reliant customer industry (*Reliant customer ind SIC HHI)*, and the degree to which the customer industry relies on the acquirer industry, i.e., the *CIC* of reliant customer industry (*Reliant customer ind dependence*). Since larger downstream firms have more buyer power to countervail upstream market power, we also control for the average reliant customer size (*Reliant customer log size*) to take the buyer power suggested by Fee and Thomas (2004) and Bhattacharyya and Nain (2011) into consideration.

Table 9 presents estimates of Eq. (4) without and with year effects. Models (1) and (2) use the equal-weighted portfolio CAR while models (3) and (4) use the value-weighted portfolio CAR of reliant customers. The point estimates of the coefficient on *Acquirer's average product similarity* are negative across models (1)–(4), significant at 5% for models (3)–(4), but insignificant for models (1)–(2). This shows that large customers are hurt more than small customers. From model (4) for instance, there is a 0.7% announcement loss for reliant customers for one standard deviation increase in the acquirer's average product similarity. As is predicted by H4, this suggests that reliant customers suffer more from upstream consolidation if the upstream market is more homogenous. Taken together, the opposite impacts of acquirers' average product similarity on the CARs of merging firms, product market rivals, and reliant customers conform to the view that there is a wealth

transfer from downstream customers to the merging product market, due to the potential for collusion. This links back to our results on product prices. Combined, we conclude that the merger-induced consolidation in more homogenous product markets enables merging firms to gain greater anticompetitive rents at the expense of reliant customers that now incur higher purchasing price for their inputs.

Taking together, our direct and indirect evidence shows that product prices are higher after a related merger, when the consolidating product market is more homogeneous. Customers lose more while merging firms and product market rivals gain more in response to a merger announcement when the consolidating market is more homogeneous.

4.4 Robustness

Our results are robust with respect to various checks. First, we examine whether our results are due to horizontal mergers between firms with the same production process, defined by traditional static and process-based industry classifications. We define a horizontal merger dummy (*Same SIC-4 ind dummy*) that equals one if both the acquirer and target reside in the same four-digit SIC industry, and control for this dummy in our multivariate analysis. The effects of the acquirer's average product similarity do not change whether we include or exclude this variable from a regression.

Second, we examine whether the findings are affected by the stringency of antitrust enforcement. Since Ghosal (2011) reports that the Democrats initiated more civil cases than the Republicans after the antitrust regime shift of U.S. antitrust enforcement in the mid-to-late 1970s, we define a democratic administration dummy (*Democratic administration*), which equals one if the merger is initiated in democratic administration years (1998–2001 during the Clinton administration and 2009 during the Obama administration) and rerun our tests with this dummy added. Our main findings still hold.

Third, Bernile, Lyandres, and Zhdanov (2012) show that the state of industry demand affects firms' strategic incentives to engage in horizontal mergers. We examine whether our findings on product and stock market performance are affected by industry demand status. In the spirit of Bernile, Lyandres, and Zhdanov (2012), we proxy industry demand by industry median sales growth (*Industry growth*), which is the acquirer's TNIC-3 industry median ratio of the difference between sales in a given year and sales in the previous year to sales in the previous year. Adding this variable to the regressions does not change our main findings.

5. Conclusion

What are the motives for related mergers? Using Hoberg and Phillips' (2014) text-based product similarity measure, we find that when an acquirer's product is more similar to its rivals, a related merger results in a greater post-merger product selling price of the consolidating industry. The impact of the acquirer's average product similarity on real performance consistently strengthens over three years after the product market consolidation. We find a wealth transfer from reliant corporate customers to the consolidating product market. Moreover, the announcement wealth effects are more positive for the combined firm and product market rivals, and more negative for reliant corporate customers along the supply chain when the acquirer has a greater product similarity to its rivals. Based on this complementary evidence on real performance and stock market reactions, we conclude that the primary motive for a related merger is to increase market power through product market collusion. Our study is the first to provide broad evidence of merger-induced market power owing to potential collusion in homogeneous product markets being a primary merger motive. We also contribute to the literature on the importance of product features to firms' strategic decisions by demonstrating the importance of the product homogeneity of the consolidating product market on merger motives.

Our study has two important antitrust implications. First, our findings suggest that in antitrust initial screening and scrutiny, antitrust agencies should focus more on consolidations within a product market rather than in SIC or NAICS industries. The U.S. antitrust agencies follow the market concentration doctrine and pay close attention to proposed deals in concentrated industries. According to current 2010 DOJ/FTC *Horizontal Merger Guidelines*, the key benchmark the Department of Justice (DOJ) or Federal Trade Commission (FTC) use to classify concentrated industries is the market concentration data from the BEA survey, which is conducted every five years and defined based on NAICS industries.[21] Our findings suggest that it may be more relevant to detect potential anticompetitive effects by examining product homogeneity in the consolidating TNIC, and apply TNIC-based concentration thresholds for initial screening, which are updated annually and defined for relative product markets. Second, our findings imply that when conducting an in-depth investigation of a merger's anticompetitive effect, antitrust authorities should carefully examine reliant downstream customers to the merging industry. Interpreting price reactions for downstream

[21] According to the *2010 DOJ/FTC Horizontal Merger Guidelines*, the U.S. antitrust agencies use BEA-based HHI to measure market structure. They classify industries into unconcentrated (HHI less than 1500), moderately concentrated (HHI between 1500 and 2500), and concentrated (HHI greater than 2500). The *2010 DOJ/FTC Horizontal Merger Guidelines* is available at http://www.justice.gov/atr/public/guidelines/hmg-2010.html. BEA Census data is available at http://www.census.gov/econ/concentration.html.

customers could be complex if the market anticipates antitrust interventions.[22] In addition, our findings suggest a mechanism that may lead to systematic propagation of merger waves and extends existing literature. Upstream industry consolidation may lead to downstream consolidation to counteract the monopoly power created through the initial upstream mergers (Galbraith, 1952; Snyder, 1996). Ahern and Harford (2014) show that merger waves propagate across the network through customer–supplier links, and merger activity transmits to closer industries quickly. Our study suggests future research can explore whether mergers travel from a consolidating product market along the supply chain to downstream firms, and more quickly to downstream industries with a greater material purchase dependence on the initially consolidating product market.

[22] If antitrust agencies always correctly challenge anticompetitive deals, and the market always fully anticipates such antitrust interventions, then customers' stock price would never react to anticompetitive mergers (because all necessary interventions are correctly made and anticipated). However, in reality, antitrust intervention is unlikely to be complete, therefore, the customer's stock price response to anticompetitive concerns may provide some useful information to the antitrust agencies. However, antitrust agencies may need to consider the hypothetical effect on reliant customers if the merger proceeded.

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Table 1
Summary of testable hypotheses
Summarised predictions of hypotheses on merger-induced changes in product markets and the stock market.

Merger motive	Direct/indirect evidence	Product/stock market performance	Stock market valuation	Net relation between product/stock market performance and acquirers' average product similarity
Market power hypothesis	Product market (direct)	Product selling price		Positive
	Stock market (indirect)	Wealth effect to merged firm	Positive	Positive
		Wealth effect to rivals	Positive	Positive
		Wealth effect to reliant customers	Negative	Negative
Efficiency hypothesis	Product market (direct)	Product selling price		Negative or zero
	Stock market (indirect)	Wealth effect to merged firm	Positive	Positive
		Wealth effect to rivals	Positive or negative	Positive or negative
		Wealth effect to reliant customers	Positive or zero	Positive or zero

Table 2
Sample description
Distribution of related mergers in nonfinancial and unregulated industries during 1998–2009. The initial merger sample is from the SDC, with required data available on CRSP and Compustat. A related merger is between two firms in the same TNIC industry classified by Hoberg and Phillips (2014). The last column reports the percentage of deals with both firms residing in the same four-digit primary SIC industry over related deals defined by TNIC.

Year	TNIC-related mergers	Sample percentage	Deal size ($ millions)	Target market value of equity/ bidder market value of equity	Acquirer's average product similarity	% of four-digit SIC deal over TNIC-horizontal deal
1998	87	17.65	2,029.61	0.45	6.41	51.72
1999	70	14.20	2,716.90	0.29	5.46	48.57
2000	61	12.37	2,832.97	0.29	6.66	50.82
2001	43	8.72	3,387.21	0.27	6.42	48.84
2002	28	5.68	2,051.85	0.23	5.17	50.00
2003	35	7.10	1,552.99	0.26	5.69	54.29
2004	25	5.07	2,098.88	0.30	6.42	52.00
2005	36	7.30	7,955.72	0.26	4.81	52.78
2006	36	7.30	3,288.10	0.23	8.31	38.89
2007	30	6.09	3,741.72	0.32	6.10	50.00
2008	26	5.27	3,986.58	0.22	5.73	50.00
2009	16	3.25	8,382.59	0.13	5.68	81.25
Total	493	100	3,254.16	0.30	6.13	50.91

Table 3
Pearson correlation coefficients
Pearson correlation coefficients for the related merger sample in nonfinancial and unregulated industries during 1998–2009. Appendix 2 defines all variables. All the variables are winsorized at the 1st and 99th percentile.

Variable	*Acquirer's average product similarity*	*Acquirer's product concentration*	*Acquirer's product market fluidity*	*Acquirer's SIC HHI*
Acquirer's product concentration	0.449			
Acquirer's product market fluidity	−0.125	−0.337		
Acquirer's SIC HHI	0.208	0.414	−0.311	
Same SIC-4 ind dummy	0.043	0.007	−0.140	−0.164

Table 4
Summary statistics
Summary statistics for the full sample and by quartiles of the acquirers' average product similarity. Panels A and B report ex post mean changes in real performance and announcement abnormal returns (in %) respectively. We test for mean differences between subsamples in the lowest and highest quartiles of average product similarity. *t*-statistics are reported in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%. Panel C reports statistics of the acquirer's TNIC industry features. Panel D reports statistics of variables related to changes in input prices and the aggregate economy. Panel E reports statistics of other merger related control variables. Panel F reports statistics of reliant customer features. Appendix 2 defines all variables. All the variables are winsorized at the 1st and 99th percentile.

Dependent Variable	Subsample by Quartiles of *Acquirer's average product similarity*					Full Sample	
	Q1 Mean (Low)	Q2 Mean	Q3 Mean	Q4 Mean (High)	Q1 vs. Q4 Mean dif.	Mean	Std. Dev.
Panel A: Ex post change in real performance							
Acquirer industry's product selling price							
Ln RPPI : Y −1	2.154***	2.066***	2.174***	2.200***	0.045	2.138***	0.198
(Full sample N = 259)	(94.32)	(112.01)	(65.59)	(112.25)	(1.41)	(173.83)	
Δ*Ln RPPI*:							
Y −1 to Y 1	−0.016***	−0.016***	0.002	0.002	0.018***	−0.009***	0.041
(Full sample N = 259)	(−4.82)	(−3.35)	(0.31)	(0.36)	(3.23)	(−3.47)	
Y −1 to Y 2	−0.028***	−0.019**	0.002	0.002	0.030***	−0.013***	0.064
(Full sample N = 259)	(−4.87)	(−2.50)	(0.25)	(0.30)	(3.47)	(−3.33)	
Y −1 to Y 3	−0.043***	−0.038***	−0.002	−0.002	0.041***	−0.025***	0.080
(Full sample N = 259)	(−5.71)	(−4.21)	(−0.22)	(−0.28)	(3.79)	(−4.91)	
Y −1 to post-merger med.	−0.028***	−0.025***	−0.003	−0.001	0.027***	−0.017***	0.056
(Full sample N = 259)	(−5.22)	(−3.74)	(−0.38)	(−0.19)	(3.41)	(−4.69)	
Panel B: Announcement wealth effects							
Merging firms							
Combined firms	0.292	0.024	1.299	3.634***	3.342***	1.301***	0.089
(Full sample N = 482)	(0.42)	(0.03)	(1.64)	(4.09)	(2.97)	(3.20)	
Acquirer	−3.327***	−3.319***	−2.763***	−1.433*	1.894*	−2.720***	0.091
(Full sample N = 482)	(−4.31)	(−3.91)	(−3.33)	(−1.70)	(1.66)	(−6.60)	
Target	30.186***	20.885***	23.428***	24.131***	−6.055*	24.674***	0.244
(Full sample N = 482)	(12.30)	(9.52)	(11.11)	(11.83)	(−1.89)	(22.20)	
Rivals							
Equal-weighted portf.	0.571***	0.345	0.710***	2.883***	2.411***	1.120***	0.031
(Full sample N = 482)	(2.99)	(1.49)	(3.25)	(7.58)	(5.75)	(8.01)	
Value-weighted portf.	0.079	0.030	−0.393	1.013***	1.063**	0.180	0.038
(Full sample N = 482)	(0.21)	(0.10)	(−1.35)	(2.65)	(2.00)	(1.05)	
Reliant customers							
Equal-weighted portf.	−0.572	0.213	−1.651**	−0.173	0.388	−0.573*	0.051
(Full sample N = 295)	(−0.99)	(0.39)	(−2.60)	(−0.29)	(0.47)	(−1.92)	
Value-weighted portf.	−0.470	−0.501	−1.598**	−0.757	−0.359	−0.841***	0.055
(Full sample N = 295)	(−0.67)	(−0.86)	(−2.40)	(−1.31)	(−0.39)	(−2.62)	
Primary suppliers							
Equal-weighted portf.	0.206	−0.053	−0.215	0.369	0.114	0.059	0.042
(Full sample N = 333)	(0.52)	(−0.13)	(−0.43)	(0.70)	(0.18)	(0.25)	
Value-weighted portf.	0.212	−0.301	−0.711	−0.137	−0.579	−0.211	0.048
(Full sample N = 333)	(0.43)	(−0.58)	(−1.40)	(−0.25)	(−0.78)	(−0.80)	

Table 4 (continued)

Independent Variable	Mean	Std. Dev.	Min	Median	Max	Obs.
Panel C: Acquirer's TNIC industry feature						
Acquirer's average product similarity	6.130	4.618	1.664	4.537	27.133	493
Acquirer's product concentration	0.109	0.103	0.018	0.073	0.514	493
Acquirer's product market fluidity	0.083	0.034	0.019	0.080	0.177	493
Panel D: Acquirer product pricing related control variable						
Change in input price ($\Delta Ln\ RPPI_{Sup}$)						
Y −1	2.109	0.129	1.840	2.075	2.461	259
Y −1 to Y 1	−0.011	0.053	−0.117	−0.012	0.155	259
Y −1 to Y 2	−0.020	0.079	−0.187	−0.015	0.174	259
Y −1 to Y 3	−0.030	0.107	−0.248	−0.023	0.221	259
Y −1 to post-merger med.	−0.020	0.079	−0.187	−0.016	0.167	259
Change in wage ($\Delta Ln\ Wage$)						
Y −1	1.303	0.136	0.964	1.299	1.581	259
Y −1 to Y 1	0.023	0.019	−0.022	0.022	0.067	259
Y −1 to Y 2	0.039	0.028	−0.024	0.043	0.091	259
Y −1 to Y 3	0.054	0.035	−0.022	0.056	0.119	259
Y −1 to post-merger med.	0.039	0.027	−0.020	0.042	0.091	259
Change in total production ($\Delta Ln\ TP$)						
Y −1	1.900	0.016	1.850	1.904	1.925	259
Y −1 to Y 1	−0.009	0.021	−0.062	−0.002	0.023	259
Y −1 to Y 2	−0.015	0.027	−0.067	−0.013	0.034	259
Y −1 to Y 3	−0.019	0.029	−0.066	−0.027	0.040	259
Y −1 to post-merger med.	−0.013	0.023	−0.051	−0.013	0.034	259
Panel E: Other merger related control variable						
Acquirer's SIC HHI	0.184	0.144	0.020	0.137	0.689	493
Same SIC-4 ind dummy	0.509	0.500	0.000	1.000	1.000	493
Target relative size	0.296	0.387	0.002	0.148	2.133	493
Log total size	0.881	2.052	−3.277	0.818	5.283	493
Hostile takeover	0.014	0.118	0.000	0.000	1.000	493
Offer includes stock	0.596	0.491	0.000	1.000	1.000	493
Panel F: Reliant customer feature						
Reliant customer ind SIC HHI	0.185	0.241	0.000	0.083	0.807	295
Reliant customer dependence	0.113	0.152	0.000	0.072	0.562	295
Reliant customer log size	5.853	1.791	1.593	5.696	11.022	295

Table 5

Cross-sectional regressions of changes in acquirer industry product selling price (related merger sample)

This table reports the results of regressions of changes in product selling price on the acquirers' average product similarity. The change in product selling price (Δ*Ln RPPI*) is the difference between the pre- and post-merger *Ln RPPI* of the acquirer's four-digit primary industry. The regressions are estimated on the related merger sample in nonfinancial and unregulated industries during 1998–2009. Appendix 2 defines all variables. All the variables are winsorized at the 1st and 99th percentile. *t*-statistics (in parentheses) are adjusted for clustering at the acquirer's primary SIC industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	Δ*Ln RPPI*							
	Y −1 to 1		Y −1 to 2		Y −1 to 3		Y −1 to post-merger median	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Acquirer's average product similarity	0.003***	0.003***	0.004***	0.004***	0.005**	0.005**	0.004***	0.004***
	(3.27)	(3.00)	(2.75)	(2.66)	(2.57)	(2.38)	(2.84)	(2.75)
Acquirer's product concentration	−0.061	−0.058	−0.121*	−0.098	−0.154**	−0.128	−0.110*	−0.087
	(−1.47)	(−1.40)	(−1.78)	(−1.39)	(−1.91)	(−1.58)	(−1.91)	(−1.47)
Acquirer's product market fluidity	0.037	0.019	0.024	0.014	−0.038	0.008	0.058	0.040
	(0.60)	(0.26)	(0.19)	(0.09)	(−0.22)	(0.05)	(0.53)	(0.31)
Δ*Ln RPPI*$_{Sup}$	0.172	0.175	0.251	0.254	0.243	0.253	0.203	0.208
	(1.36)	(1.53)	(1.32)	(1.46)	(1.40)	(1.54)	(1.28)	(1.45)
Δ*Ln Wage*	−0.450*	−0.428**	−0.222	−0.245	−0.126	−0.136	−0.320	−0.366
	(−1.97)	(−2.05)	(−0.85)	(−0.83)	(−0.70)	(−0.70)	(−1.22)	(−1.28)
Δ*Ln TP*	0.230	0.378	0.470	0.670	0.504	0.595	0.430	0.455
	(0.74)	(0.88)	(1.22)	(1.25)	(1.26)	(0.97)	(1.20)	(0.88)
Acquirer's SIC HHI	−0.033	−0.037	−0.055	−0.076	−0.058	−0.066	−0.034	−0.053
	(−1.18)	(−1.28)	(−1.02)	(−1.40)	(−0.78)	(−-0.90)	(−0.71)	(−1.13)
Same SIC-4 ind dummy	0.001	−0.000	0.004	0.000	−0.004	−0.006	−0.001	−0.005
	(0.22)	(−0.04)	(0.37)	(0.04)	(−0.35)	(−0.44)	(−0.13)	(−0.52)
Target relative size	0.006	0.006	0.005	0.005	0.008	0.008	0.006	0.006
	(1.03)	(0.98)	(0.46)	(0.45)	(0.76)	(0.65)	(0.59)	(0.58)
Log total size	0.001	0.001	0.002	0.002	0.003	0.003	0.002	0.003
	(0.73)	(0.74)	(0.98)	(0.85)	(1.04)	(0.92)	(0.93)	(0.99)
Year effects		Y		Y		Y		Y
R^2	0.18	0.22	0.21	0.25	0.21	0.23	0.21	0.25
Observations	259	259	259	259	259	259	259	259

Table 6

Cross-sectional regressions of changes in acquirer industry product selling price (pseudo sample)

This table reports the results of regressions of changes in product selling price on the acquirers' average product similarity. The regressions are estimated on the pseudo-sample in nonfinancial and unregulated industries during 1998–2009. We construct the pseudo-sample using randomly generated event dates between 1998 and 2009. Appendix 2 defines all variables. All the variables are winsorized at the 1st and 99th percentile. *t*-statistics (in parentheses) are adjusted for clustering at the acquirer's primary SIC industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	ΔLn RPPI							
	Y −1 to 1		Y −1 to 2		Y −1 to 3		Y −1 to post-merger median	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Acquirer's average product similarity	0.001	0.001	0.002	0.002	0.003	0.003	0.002	0.002
	(1.21)	(1.42)	(0.84)	(1.12)	(1.48)	(1.58)	(1.27)	(1.60)
Acquirer's product concentration	0.002	−0.005	0.022	0.004	−0.022	−0.012	0.002	−0.016
	(0.08)	(−0.15)	(0.39)	(0.09)	(−0.36)	(−0.19)	(0.04)	(−0.38)
Acquirer's product market fluidity	−0.025	−0.023	−0.070	−0.117	−0.138	−0.126	−0.060	−0.107
	(−0.31)	(−0.23)	(−0.47)	(−0.68)	(−0.74)	(−0.64)	(−0.43)	(−0.67)
$\Delta Ln\ RPPI_{Sup}$	0.099	−0.017	0.239**	0.132	0.359***	0.276***	0.245**	0.131
	(1.15)	(−0.17)	(2.43)	(1.52)	(4.31)	(3.44)	(2.35)	(1.44)
ΔLn Wage	0.294*	0.198	1.042***	0.834***	1.127***	1.049***	0.981***	0.760**
	(1.86)	(0.69)	(3.81)	(2.71)	(3.50)	(2.96)	(3.58)	(2.36)
ΔLn TP	0.347	0.956**	0.127	−0.383	0.723	−0.217	0.243	0.100
	(1.07)	(2.10)	(0.23)	(−0.34)	(1.52)	(−0.31)	(0.44)	(0.09)
Acquirer's SIC HHI	−0.034	−0.027	−0.013	−0.017	−0.062	−0.065	−0.025	−0.027
	(−0.97)	(−0.77)	(−0.29)	(−0.34)	(−1.06)	(−0.98)	(−0.54)	(−0.56)
Same SIC-4 ind dummy	0.001	−0.000	−0.001	−0.003	−0.000	−0.001	−0.00	−0.002
	(0.28)	(−0.04)	(−0.21)	(−0.49)	(−0.02)	(−0.15)	(−0.00)	(−0.31)
Target relative size	0.003*	0.003*	0.003	0.004	0.006*	0.006*	0.004	0.004*
	(1.72)	(1.83)	(1.57)	(1.64)	(1.96)	(1.91)	(1.61)	(1.72)
Log total size	0.000	0.000	−0.000	−0.001	−0.000	−0.001	−0.001	−0.001
	(0.08)	(0.02)	(−0.08)	(−0.19)	(−0.00)	(−0.13)	(−0.22)	(−0.33)
Year effects		Y		Y		Y		Y
R^2	0.08	0.14	0.15	0.22	0.28	0.34	0.16	0.22
Observations	176	176	176	176	176	176	176	176

Table 7

Cross-sectional regressions of combined firms' abnormal returns (related merger sample)

This table reports the results of regressions of abnormal returns to the merged firms on the acquirers' average product similarity. Models (1) and (2) are estimated on the related merger sample in nonfinancial and unregulated industries during 1998–2009. Appendix 2 defines all variables. All the variables are winsorized at the 1st and 99th percentile. *t*-statistics (in parentheses) are adjusted for clustering at the acquirer's primary SIC industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	Combined CAR	
	(1)	(2)
Acquirer's average product similarity	0.002*	0.003**
	(1.81)	(2.03)
Acquirer's product concentration	−0.007	−0.021
	(−0.11)	(−0.33)
Acquirer's product market fluidity	−1.137	−0.098
	(−1.03)	(−0.72)
Acquirer's SIC HHI	0.022	0.029
	(0.78)	(0.96)
Same SIC-4 ind dummy	−0.002	0.001
	(−0.28)	(0.07)
Target relative size	0.012	0.010
	(0.78)	(0.61)
Log total size	−0.009***	−0.009***
	(−5.05)	(−4.73)
Hostile takeover	0.013	0.017
	(0.75)	(1.07)
Offer includes stock	−0.036***	−0.039***
	(−5.22)	(−4.52)
Year effects		Y
R^2	0.10	0.13
Observations	482	482

Table 8
Cross-sectional regressions of product market rivals' wealth effect (related merger sample)
This table report the results of regressions of abnormal returns to the product market rivals on the acquirers' average product similarity. Models (1)−(4) are estimated on the related merger sample in nonfinancial and unregulated industries during 1998–2009. Appendix 2 defines all variables. All the variables are winsorized at the 1st and 99th percentile. *t*-statistics (in parentheses) are adjusted for clustering at the acquirer's primary SIC industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	Product market rival CAR			
	Equal weighted		Value weighted	
	(1)	(2)	(3)	(4)
Acquirer's average product similarity	0.002***	0.002***	0.001*	0.001*
	(3.51)	(3.49)	(1.81)	(1.80)
Acquirer's product concentration	0.035	0.033	−0.008	−0.011
	(1.51)	(1.35)	(−0.29)	(−0.39)
Acquirer's product market fluidity	−0.085**	−0.086**	−0.031	−0.017
	(−2.56)	(−2.44)	(−0.56)	(−0.33)
Acquirer's SIC HHI	−0.008	−0.008	−0.011	−0.006
	(−0.89)	(−0.92)	(−0.80)	(−0.46)
Same SIC-4 ind dummy	−0.001	−0.001	−0.003	−0.003
	(−0.46)	(−0.35)	(−0.86)	(−0.71)
Target relative size	−0.005	−0.005	0.006	0.004
	(−1.40)	(−1.47)	(1.48)	(0.93)
Log total size	0.000	0.000	0.000	0.000
	(0.43)	(0.27)	(0.42)	(0.27)
Hostile takeover	−0.007	−0.009	−0.005	0.001
	(−0.94)	(−1.20)	(−0.54)	(0.11)
Offer includes stock	−0.003	−0.003	−0.003	−0.003
	(−1.13)	(−1.04)	(−0.98)	(−0.73)
Year effects		Y		Y
R^2	0.18	0.19	0.03	0.06
Observations	482	482	482	482

Table 9
Cross-sectional regressions of reliant customers' wealth effect (related merger sample)
This table reports the results of regressions of abnormal returns to reliant corporate customers on the acquirers' average product similarity. Models (1)−(4) are estimated on the related merger sample in nonfinancial and unregulated industries during 1998–2009. Appendix 2 defines all variables. All the variables are winsorized at the 1st and 99th percentile. *t*-statistics (in parentheses) are adjusted for clustering at the acquirer's primary SIC industry level. *, **, and *** denote significance at 10%, 5%, and 1%.

	Reliant customer CAR			
	Equal weighted		Value weighted	
	(1)	(2)	(3)	(4)
Acquirer's average product similarity	−0.001	−0.001	−0.002**	−0.002**
	(−1.01)	(−1.54)	(−2.40)	(−2.06)
Acquirer's product concentration	0.030	0.030	0.054	0.036
	(0.83)	(0.77)	(1.44)	(0.84)
Acquirer's product market fluidity	0.003	0.009	−0.005	−0.007
	(0.03)	(0.09)	(−0.05)	(−0.06)
Acquirer's SIC HHI	0.007	0.010	−0.028	−0.030
	(0.32)	(0.43)	(−0.94)	(−0.97)
Same SIC-4 ind dummy	−0.004	−0.006	−0.007	−0.008
	(−0.61)	(−0.91)	(−1.05)	(−1.08)
Target relative size	−0.003	−0.000	0.005	0.007
	(−0.46)	(−0.03)	(0.67)	(0.71)
Log total size	−0.002	−0.002	−0.002	−0.002
	(−1.66)	(−1.63)	(−1.21)	(−1.16)
Reliant customer ind SIC HHI	0.010	−0.009	0.013	0.002
	(0.90)	(−0.75)	(1.39)	(0.19)
Reliant customer ind dependence	0.007	0.005	0.023	0.019
	(0.41)	(0.36)	(1.47)	(1.11)
Reliant customer log size	0.001	0.000	0.001	−0.001
	(0.76)	(0.01)	(0.35)	(−0.27)
Year effects		Y		Y
R^2	0.01	0.07	0.03	0.07
Observations	295	295	295	295

Appendix 1

List of related mergers with top quartile average product similarity but different two-digit SIC codes of merging firms

List of related mergers in nonfinancial and unregulated industries during 1998–2009 within the top quartile of the acquirers' average product similarity but different two-digit SIC codes of merging firms. The list includes the acquirer name, target name, and their four-digit primary SIC codes and 2-digit SIC industry descriptions.

No.	Year	Acquirer			Target		
		Company Name	SIC	2-digit SIC Industry Description	Company Name	SIC	2-digit SIC Industry Description
1	1998	McMoRan Oil & Gas Co	1311	Oil And Gas Extraction	Freeport-McMoRan Sulphur Inc	1479	Mining And Quarrying Of Nonmetallic Minerals, Except Fuels
2	1998	Oakwood Homes Corp	1522	Building Construction General Contractors And Operative Builders	Schult Homes Corp	2451	Lumber And Wood Products, Except Furniture
3	1998	Foilmark Inc	3497	Fabricated Metal Products, Except Machinery And Transportation Equipment	HoloPak Technologies Inc	2671	Paper And Allied Products
4	1998	Keystone Automotive Industries Inc	5013	Wholesale Trade-durable Goods	Republic Automotive Parts Inc	3714	Transportation Equipment
5	1998	Harrahs Entertainment Inc	7993	Amusement And Recreation Services	Rio Hotel & Casino Inc	7011	Hotels, Rooming Houses, Camps, And Other Lodging Places
6	1998	MGM Grand Inc	7999	Amusement And Recreation Services	Primadonna Resorts Inc	7011	Hotels, Rooming Houses, Camps, And Other Lodging Places
7	1998	National Vision Associates Ltd	8042	Health Services	New West Eyeworks Inc	5995	Miscellaneous Retail
8	1998	Gentle Dental Service Corp	8099	Health Services	Dental Care Alliance Inc	8741	Engineering, Accounting, Research, Management, And Related Services
9	1998	Correctional Services Corp	9223	Justice, Public Order, And Safety	Youth Services International Inc	8351	Social Services
10	1999	Corixa Corp	2836	Chemicals And Allied Products	RIBI ImmunoChem Research Inc	8731	Engineering, Accounting, Research, Management, And Related Services
11	1999	Diedrich Coffee Inc	5499	Food Stores	Coffee People Inc	5812	Eating And Drinking Places
12	1999	International Game Technology	7373	Business Services	Sodak Gaming Inc	5099	Wholesale Trade-durable Goods

Appendix 1 (continued)

No.	Year	Acquirer			Target		
		Company Name	SIC	2-digit SIC Industry Description	Company Name	SIC	2-digit SIC Industry Description
13	1999	Isle of Capri Casinos Inc	7999	Amusement And Recreation Services	Lady Luck Gaming Corp	7011	Hotels, Rooming Houses, Camps, And Other Lodging Places
14	2000	Weyerhaeuser Co	2411	Lumber And Wood Products, Except Furniture	Willamette Industries Inc	811	Forestry
15	2000	Key Technology Inc	3556	Industrial And Commercial Machinery And Computer Equipment	Advanced Machine Vision Corp	3823	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks
16	2000	Komag Inc	3572	Industrial And Commercial Machinery And Computer Equipment	HMT Technology Corp(Stamps Woodsum & Co)	3695	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
17	2000	Thermo Electron Corp	3829	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks	Thermo Ecotek Corp (Thermo Electron Corp)	4911	Electric, Gas, And Sanitary Services
18	2000	EGL Inc	4214	Motor Freight Transportation And Warehousing	Circle International Group Inc	4731	Transportation Services
19	2000	Sanmina Corp	7373	Business Services	Hadco Corp	3672	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
20	2000	MGM Grand Inc	7999	Amusement And Recreation Services	Mirage Resorts Inc	7011	Hotels, Rooming Houses, Camps, And Other Lodging Places
21	2001	United Parcel Service Inc{UPS}	4215	Motor Freight Transportation And Warehousing	Fritz Cos Inc	4731	Transportation Services
22	2001	Suiza Foods Corp	5143	Wholesale Trade-non-durable Goods	Dean Foods Co	2026	Food And Kindred Products
23	2002	Identix Inc	7373	Business Services	Visionics Corp	3577	Industrial And Commercial Machinery And Computer Equipment
24	2002	Penn National Gaming Inc	7948	Amusement And Recreation Services	Hollywood Casino Corp	7011	Hotels, Rooming Houses, Camps, And Other Lodging Places
25	2003	Yellow Corp	4731	Transportation Services	Roadway Corp	4213	Motor Freight Transportation And Warehousing

Appendix 1 (continued)

No.	Year	Acquirer			Target		
		Company Name	SIC	2-digit SIC Industry Description	Company Name	SIC	2-digit SIC Industry Description
26	2004	MGM Mirage Inc	7999	Amusement And Recreation Services	Mandalay Resort Group	7011	Hotels, Rooming Houses, Camps, And Other Lodging Places
27	2005	IAC/InterActiveCorp	5961	Miscellaneous Retail	Ask Jeeves Inc	7389	Business Services
28	2006	Protection One Inc	3669	Communications Equipment, Not Elsewhere Classified	Integrated Alarm Services Group Inc	7382	Security Systems Services
29	2006	Northrop Grumman Corp	3812	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks	Essex Corp	7371	Business Services
30	2006	West Corp	7389	Business Services	Raindance Communications Inc	4899	Communications
31	2006	GEO Group Inc	8744	Engineering, Accounting, Research, Management, And Related Services	Centracore Properties Trust	6798	Holding And Other Investment Offices
32	2007	URS Corp	8711	Engineering, Accounting, Research, Management, And Related Services	Washington Group International Inc	1522	Building Construction General Contractors And Operative Builders
33	2008	Smith International Inc	3533	Industrial And Commercial Machinery And Computer Equipment	W-H Energy Services Inc	7359	Business Services
34	2008	OReilly Automotive Inc	5531	Automotive Dealers And Gasoline Service Stations	CSK Auto Inc	5013	Wholesale Trade-durable Goods

Appendix 2: Variable descriptions

Definitions of variables. Variables are in alphabetical order. All variables are measured at the end of the fiscal year before the merger announcement, unless noted otherwise.

Variable	Definition
Ln RPPI	Proxy of the product selling price of the acquirer's four-digit primary industry. We retrieve the Producer Price Index (PPI) starting 12 months before the merger announcement to 36 months after the merger completion and adjust the PPI series for inflation using the GDP price deflator to obtain *RPPI*. Pre-merger *Ln RPPI* is calculated as the acquirer' four-digit primary SIC industry's the average log *RPPI* over the 12 months before the merger announcement. Post-merger *Ln RPPI* for horizons Y 1, 2, and 3 are calculated as the acquirer' four-digit primary SIC industry's average log *RPPI* over the 1−12, 13−24, and 25−36 months after the merger completion. PPI data are from the Bureau of Labour Statistics (BLS), available at http://download.bls.gov/pub/time.series/compressed/tape.format/.
Δ*Ln RPPI*	The ex post change of *Ln RPPI*. Δ*Ln RPPI* for horizons Y −1 to 1, Y −1 to 2, and Y −1 to 3 are calculated as the post-merger *Ln RPPI* for horizons Y 1, 2, and 3 minus the pre-merger *Ln RPPI*. Δ*Ln RPPI* for horizon Y −1 to post-merger median is the median of the three post-merger *Ln RPPI*s minus the pre-merger *Ln RPPI*.
Acquirer's SIC HHI	The sales-based Herfindahl concentration index of the acquirer's four-digit primary SIC industry calculated from Compustat.
Acquirer's product concentration	The sales-based Herfindahl concentration index of the acquirer's TNIC-3 industry (Hoberg and Phillips, 2014). The TNIC product concentration is retrieved from Hoberg-Phillips Industry-Level Data at Hoberg-Phillips Data Library, available at http://alex2.umd.edu/industrydata/industryconcen.htm.
Acquirer's product market fluidity	A measure of the speed with which other firms adopting and dropping product market words used in the acquirer's product description (Hoberg, Phillips, and Prabhala, 2014). The TNIC product market fluidity is the product market fluidity of Hoberg and Phillips (2014) divided by 100. Product market fluidity data are retrieved from Hoberg-Phillips Industry-Level Data at Hoberg-Phillips Data Library, available at http://alex2.umd.edu/industrydata/industryconcen.htm.
Acquirer's average product similarity	The total product similarity of all firms in the acquirer's TNIC-3 industry divided by the number of firms in this industry. Product similarities are based on the degree to which two firms use the same words in their 10-K product descriptions. A higher similarity implies a firm has a product description using more words common to other firms (Hoberg and Phillips, 2014). TNIC product similarity is retrieved from Hoberg-Phillips Industry-Level Data at Hoberg-Phillips Data Library, available at http://alex2.umd.edu/industrydata/industryconcen.htm.
Combined CAR	The market-value-weighted abnormal returns of the merging firms. The abnormal returns are market-model-adjusted returns measured from two days before to two days after the announcement day, i.e. (−2, 2).
Democratic administration	Dummy variable equals one if the merger is initiated in democratic administration years, i.e., 1998–2001 during the Clinton administration and 2009 during the Obama administration.
Deal size	SDC reported deal value in $ millions.
Hostile takeover	Dummy variable equals one if the merger is hostile and zero otherwise.
Industry growth	The acquirer's TNIC-3 industry median ratio of the difference between sales in a year before merger announcement and sales in the previous year to sales in the previous year.
$\Delta Ln\ RPPI_{sup}$	Ex post price changes in the acquirer industry's primary supplier industry. We calculate $\Delta Ln\ RPPI_{sup}$ for horizons Y −1 to 1, Y −1 to 2, Y −1 to 3 and Y −1 to post-merger median in the same manner as for Δ*Ln RPPI*. The supplier industries are defined by the Bureau of Economic Analysis (BEA)'s Benchmark Input–Output (IO) accounts of 1997 Use table, available at http://www.bea.gov/industry/io_benchmark.htm. PPI data are obtained from the Bureau of Labour Statistics (BLS), available at http://download.bls.gov/pub/time.series/compressed/tape.format/.
Log total size	The natural logarithm of the summed ex ante market values of the acquirer and the target.

Appendix 2 (continued)

Variable	Definition
Offer includes stock	Dummy variable equals one if the bid includes stock, zero otherwise.
Reliant customer CAR (equal-weighted)	Equal weighted market-model-adjusted returns to the reliant customer portfolio over a (−2, 2) day window around the announcement date. A customer firm is a reliant customer if it operates in the customer industry with the highest dependence (defined below) on the acquirer industry's product as input. Customer industries are identified using 1997 Use table, available at http://www.bea.gov/industry/io_benchmark.htm.
Reliant customer CAR (value-weighted)	Value weighted market-model-adjusted returns to the reliant customer portfolio over a (−2, 2) day window around the announcement date. A customer firm is a reliant customer if it operates in the downstream industry with the highest dependence (defined below) on the acquirer industry's product as input. Customer industries are identified using 1997 Use table, available at http://www.bea.gov/industry/io_benchmark.htm.
Reliant customer ind dependence	The dollar amount of the acquirer industry's output sold to the most reliant customer industry divided by the total output of the reliant customer industry.
Reliant customer ind SIC HHI	The sales-based Herfindahl concentration index of the most reliant customer industry calculated from Compustat.
Reliant customer log size	The logarithm of the median equity market value of the most reliant customer industry in $ millions.
Same SIC-4 ind dummy	Dummy variable equals one if the target and acquirer are in the same four-digit primary SIC code, zero otherwise.
Target relative size	The ex ante market value of equity of the target divided by that of the acquirer.
ΔLn TP	The ex post change in the total production index of the acquirer's four-digit SIC industry. Δ*Ln TP* for horizons Y −1 to 1, Y −1 to 2, and Y −1 to 3 is the acquirer industry's average log real output of the manufacturing, mining and electric and gas utilities industries over the 1−12, 13−24, and 25−36 months after the merger completion minus the average log real output over the 12 months before the merger announcement. Δ*Ln TP* for horizon Y −1 to post-merger median is the median value of the changes over the three different time horizons. Real output data are from the Federal Reserve Board, available at http://www.federalreserve.gov/releases/g17/ipdisk/utl_sa.txt.
Δ*Ln Wage*	Ex post changes in the wage level of the acquirer's four-digit SIC industry. Δ*Ln Wage* for horizons Y −1 to 1, Y −1 to 2, and Y −1 to 3 is the acquirer industry's average log hourly earnings of production workers over the 1−12, 13−24, and 25−36 months after the merger completion minus the average log hourly earnings of production workers over the 12 months before the merger announcement. Δ*Ln Wage* for horizon Y −1 to post-merger median is the median value of the changes over the three different time horizons. Hourly earnings data are from the Current Employment Statistics (CES) survey conducted by the BLS, available at http://www.bls.gov/ces/home.htm.