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An Examination of the Efficiency, Foreclosure, and Collusion Rationales for Vertical Takeovers

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We investigate the efficiency, foreclosure, and collusion rationales for vertical integration in a large sample of vertically related takeovers. The efficiency rationale, as discussed under the transaction cost economics and property rights theories, posits that vertical integration mitigates contractual inefficiencies between suppliers and customers (termed as holdup) and provides incentives to undertake relationship-specific investments. In contrast, the foreclosure and collusion rationales suggest that vertical integration is anticompetitive in nature. Specifically, the foreclosure argument suggests that vertical integration is used to raise costs of rival firms, and the collusion argument suggests that vertical integration facilitates coordination between the integrated firm and its rivals. To distinguish between the three hypotheses, we examine (1) the announcement period wealth effects to the merging firms, rival firms, and customer firms; and (2) the operating performance changes to the merging firms in vertical takeovers. We find that firms expand their vertical boundaries consistent with an efficiency enhancing rationale.

Key words: finance; corporate finance; vertical integration; antitrust; efficiency; market power; mergers; acquisitions; product markets; firm boundaries; corporate restructuring; foreclosure; collusion
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1. Introduction

The decision to vertically integrate is of fundamental importance to firms. The extant literature on vertical integration has developed numerous theories to capture the economic forces that lead firms to vertically integrate.[1] Despite the abundant theoretical literature on vertical integration, relatively little is known about the phenomenon of vertical takeovers. Eckbo (1983) finds insignificant wealth effects to target rival firms in challenged vertical takeovers prior to 1978. More recently, Fan and Goyal (2006) find that almost one-third of the completed takeovers during 1962–1996 displayed vertical relations and that the vertically related takeovers created value to the bidder and target firms. However, the exact sources of this value creation are unclear. In this paper, we draw upon the extant theories of vertical integration, namely, efficiency, foreclosure, and collusion, and investigate how they explain the value creation and operating performance changes in vertical takeovers.

The efficiency argument of vertical integration, as studied under the transaction cost economics and property rights theories, suggests that vertical integration reduces transaction costs by mitigating contractual inefficiencies between nonintegrated suppliers and customers. These contractual inefficiencies, also known as "holdup," lead firms to underinvest in relationship-specific investments (Coase 1937; Williamson 1971, 1979; Klein et al. 1978; Grossman and Hart 1986; Hart and Moore 1990). Vertical integration, by providing common ownership, mitigates these contractual inefficiencies and provides incentives to undertake relationship-specific investments.

In contrast to the efficiency argument, researchers have argued that vertical integration can be anticompetitive via two distinct avenues, namely, foreclosure and collusion. Specifically, the foreclosure argument suggests that a vertical takeover with a supplier (or customer) enhances market power of the integrated firm because it can deny access of critical inputs (outlets) to its nonintegrated rivals (Salinger 1988, Hart et al. 1990, Ordover et al. 1990). The collusion argument suggests that a vertical takeover with a supplier (or customer) acts as a mechanism that facilitates the flow of information between the integrated firm and its nonintegrated rivals. This information flow enhances coordination between the integrated firm and its rivals (Chen 2001, Nocke and White 2007).

Indeed, consistent with the above anticompetitive rationales developed in the academic literature, the nonhorizontal merger guidelines of the U.S. Federal Trade Commission (FTC) and the U.S. Department of Justice (DOJ) recognize both the foreclosure and collusion motives in vertical takeovers. This led to

[1] Perry (1989), Bolton and Scharfstein (1998), Holmstrom and Roberts (1998), Joskow (2005), and Lafontaine and Slade (2007) provide extensive discussions on the vertical integration literature.

the challenge of a considerable number of vertical takeovers during the past three decades (Schlossberg 2004). Furthermore, past and current FTC economists and commissioners have stressed the importance of vertical enforcement but admit that there is a paucity of empirical evidence and a lack of consensus about the nature of vertical mergers (Simons 2002, Pitofsky 2005, Harbour 2007). Our analysis, which aims to distinguish between the efficiency and anticompetitive rationales, is a step in this direction.

We distinguish between the three hypotheses by performing univariate and cross-sectional analyses on (1) the announcement period wealth effects to the merging firms, acquirer rivals, target rivals, and corporate customers in successful and challenged vertical takeovers; and (2) the changes in operating performance to the merging firms in successful vertical takeovers. To identify vertical takeovers, we compute the vertical relatedness coefficient between the acquirer and target industry using the benchmark input-output accounts of the U.S. economy (Fan and Goyal 2006). Our sample comprises of 225 successful vertical takeovers during 1981–2004 with a vertical relatedness of 5% or greater.

For the overall sample of vertical takeovers, we find that the acquirer rivals, target rivals, and customers are associated with insignificant abnormal returns. To provide additional insights on our hypotheses, we subdivide our sample based on whether the takeover generates a positive or negative combined wealth effect to the merging firms. We expect that the reduced transaction costs under the efficiency hypothesis or the increased market power under the foreclosure or collusion hypotheses would create a positive combined wealth effect for the merging firms. In the positive combined wealth effect subsample, we find that the nonintegrated acquirer and target rivals experience positive and significant abnormal returns. We also find that customer firms that are most dependent on inputs from the downstream industry in the takeover experience positive and significant abnormal returns. The big picture that emerges is that when vertical takeovers create value to the merging firms, they convey information to the acquirer and target rival firms that they too can take advantage of these gains by engaging in vertical integration, and that some of the ensuing efficiency gains are passed to the customer firms. This provides some preliminary evidence that is consistent with the efficiency hypothesis.[2]

[2] In the negative combined wealth effect subsample, motives such as agency problems in acquirers (Morck et al. 1990), stock financing by acquirers (Travlos 1987), or poor prospects faced by acquirer industry (Mitchell and Mulherin 1996) are likely to be more dominant. In this subsample, we find that the response to acquirer rivals, target rivals, and dependent customers is generally muted.

To provide additional evidence on the anticompetitive rationales, we identify 21 vertical takeovers that were challenged by the U.S. antitrust regulators during 1981–2004. It is likely that the antitrust authorities stand to challenge potentially anticompetitive vertical takeovers and we look for evidence in this sample. We find that the average wealth effects on merger announcement to the acquirer rivals and customer firms are statistically insignificant, whereas the wealth effects to target rivals are generally positive and significant. The wealth effects to the rival and customer firms in challenged vertical takeovers, although weak in terms of statistical significance, are generally not in the direction predicted by the foreclosure or collusion hypotheses.

Next, we examine the determinants of the combined wealth effect and operating performance changes to the merging firms. We use four different proxies to capture the flavor of the efficiency hypothesis. First, consistent with the extant literature (Levy 1985, Allen and Phillips 2000, Kale and Shahrur 2007), we include the industry-adjusted premerger acquirer (target) research and development (R&D) intensity to capture relationship-specific investments at acquirer (target) level. We posit that the lower the R&D intensity, the greater the underinvestment in relationship-specific assets, which would lead to a higher value creation from the vertical merger. As a second measure, instead of using R&D levels, we measure the change in combined R&D intensity of the merging firms from pre- to postmerger. We posit that the greater the change in the combined R&D intensity, the less severe is the extent of underinvestment after the vertical takeover, which would predict a greater value creation to the merging firms. As a third measure, we use the extent of cross-citations between the acquirer and target patents prior to the merger. The higher the intensity of cross-citations between acquirer and target patents, the greater likelihood that the technologies of the acquirer and target firms are interdependent. Because this could lead to a greater potential for holdup, we expect that higher cross-citation intensity would lead to greater value creation to the merging firms. Finally, we investigate if the acquirer and target firms were partners in prior strategic alliances or joint ventures. The presence of such alternate mechanisms likely suggests that the partner firms may have resolved part of the holdup problem through the venture (Fee et al. 2006). In comparison to vertical deals where no such arrangements existed there is less of a holdup problem and, hence, the lower is the value created to the merging firms.

As a measure of potential foreclosure, we include the truncation-adjusted total citations to target patents. We posit that the higher the number of citations, the greater is the technological importance of the target

patent indicating a greater ability of the integrated firm to foreclose its rivals. We expect a positive relation between the citations to target patents and the combined wealth effect of the merging firms. We use two proxies to measure collusive industry environments. First, we create an indicator variable that is set to one for industries that were subject to vertical price fixing enforcement actions. We hand collect this data by reading the federal and state case summaries. We posit that industries subject to enforcement actions are likely to be those where the benefits of collusion are high. Second, we use the acquirer industry median capital intensity based on Symeonidis (2003), who finds a positive relation between capital intensity and the likelihood of collusion. We expect a positive relation between the combined wealth effect to the merging firms and both these proxies of collusion.

Our findings on the cross-sectional determinants are generally supportive of the efficiency hypothesis. Specifically, we find that the extent of the holdup problem or underinvestment in relationship-specific assets (based on the four efficiency proxies) generally explains the combined wealth effect and the change in operating performance for the merging firms. Furthermore, our proxies for the foreclosure and collusion hypotheses have little bearing on the combined wealth effect or operating performance changes.

Finally, we examine the determinants of the wealth effects of the acquirer and target rivals and customer firms. We find that the wealth effect of the acquirer rivals, target rivals, and customer firms is positively related to the combined wealth effect of the merging firms. This result suggests that if more value is created for the merging firms then product market participants such as rivals and customers are also better off. This explanation is consistent with the efficiency hypothesis. Our foreclosure and collusion proxies impact rival and customer returns in a manner that is inconsistent with these hypotheses.

Our study makes the following contributions. First, we show that the average successful vertical takeover is motivated by efficiency improvement rather than the foreclosure or collusion rationales. Additional analysis of challenged vertical takeovers also fails to uncover evidence supportive of the market power rationales. We note that our results could be attained either if efficiency was the primary motivation for vertical mergers or if the threat of regulation deterred anticompetitive deals from being attempted. Our analysis does not enable us to distinguish between these two possible explanations. Second, our analysis of the wealth effects to the merging firms and the related product market participants like rivals and customers gives insights on the overall welfare implications of vertical takeovers. This evidence could be useful to evaluate vertical enforcement decisions. Finally, our analysis builds upon recent studies that show that contracting costs explain the incidence of equity stakes of customers in suppliers (Fee et al. 2006) and the cross-country variation in vertical integration (Acemoglu et al. 2009). We show that firms expand their vertical boundaries through takeovers consistent with an efficiency enhancing rationale.

2. Univariate Predictions on Wealth Effects and Related Literature

In this section, we present the univariate predictions on the signs of the announcement period wealth effects to the merging firms, acquirer and target rivals, and corporate customers. A summary of these predictions is presented in Table 1. In our hypotheses, vertical takeovers are considered as backward (forward) when the acquirer (target) is downstream in the supply chain and the target (acquirer) is upstream in the supply chain. Customer firms are identified as firms that buy the output of the downstream industry in the vertical takeover (see the online companion, available from the author, for a schematic diagram).

2.1. Efficiency Hypothesis

The transaction cost economics and property rights theories posit that contractual incompleteness leads to situations where the contracting parties (such as suppliers and customers) take advantage of the ambiguities in contracts and behave opportunistically in their own interests. Such opportunistic behavior is termed as "holdup" and leads to suboptimal relationship-specific investments, which are investments specific to supplier or customer and lose value outside the relationship. Vertical integration leads to common ownership leading to a lower holdup problem and provides incentives to undertake relationship-specific investments (Klein et al. 1978; Williamson 1971, 1979; Grossman and Hart 1986; Hart and Moore 1990).[3]

We expect the merging firms in vertical takeovers to experience a positive wealth effect due to a reduction in the holdup problem. The nonintegrated acquirer and target rivals would experience a positive wealth effect if the announcement disseminates information about possible efficiency gains from vertical integration and that rivals could implement similar vertical acquisitions (better information view). In contrast, they would experience a negative wealth effect because they are still subject to the holdup problem and are at a competitive disadvantage compared to the vertically integrated firm (competitive advantage view). Because of the two opposing effects, the wealth effects of the nonintegrated acquirer and target rival firms are unrestricted in sign. If vertical

[3] Other benefits of vertical integration are elimination of double marginalization and a reduction in supply uncertainty (for survey articles, see Perry 1989, Joskow 2005).

Table 1 Summary of Univariate Predictions for the Efficiency, Foreclosure, and Collusion Hypotheses

	Merging firms	Nonintegrated acquirer rivals	Nonintegrated target rivals	Customers
Efficiency hypothesis:				
(i) Better information	Positive Reduction in holdup problem	Positive Implement efficiency enhancing vertical takeovers	Positive Implement efficiency enhancing vertical takeovers	Zero to positive Series of vertical acquisitions, lower costs passed as lower prices
(ii) Competitive advantage	Positive Reduction in holdup problem	Negative Still face holdup, competitive disadvantage	Negative Still face holdup, competitive disadvantage	Zero to positive More intense competition upstream
Foreclosure	Positive Integrated firm has an unfair advantage over rivals	Negative *Backward takeover*: Squeezed margins due to higher input prices from integrated firm *Forward takeover*: Reduced revenues because integrated firm does not buy their output	Negative *Backward takeover*: Integrated firm does not buy the output of independent suppliers *Forward takeover*: Squeezed margins due to higher input prices from integrated firm	Negative Increased market power of the integrated firm
Collusion between integrated firm and acquirer rivals	Positive Higher likelihood of collusion enhances ability to extract rents from customers	Positive Higher likelihood of collusion enhances ability to extract rents from customers	Negative *Backward takeover*: Downstream collusion leads to a reduced demand for their output *Forward takeover*: Upstream collusion leads to higher input prices	Negative Face higher prices due to collusion upstream

Notes. This table summarizes the predictions under the efficiency, foreclosure, and collusion hypotheses regarding the signs of announcement period abnormal returns to the merging firms, acquirer rivals, target rivals, and customer firms. Acquirer rivals are firms with the same four-digit primary Standard Industrial Classification (SIC) code as the acquirer, but no segment in the target's four-digit primary SIC code. Target rivals are firms with the same four-digit primary SIC code as the target, but no segment in the acquirer's four-digit primary SIC code. Irrespective of the type of vertical takeover (forward or backward), we identify customers as firms that buy the product of the downstream industry in the vertical takeover.

integration reduces transaction costs, it is likely that some of these benefits will be passed on to the customer firms through lower prices. The customer firms would experience a zero or positive wealth effect if some of the efficiency benefits are passed on to them.

In prior research, Spiller (1985) finds that asset specificity as measured by the distance between acquirer and target plants explains gains to merging firms in 32 challenged vertical mergers. Jain et al. (2011) show that vertically related divestitures are motivated by efficiency considerations.

2.2. Foreclosure Hypothesis

A large body of theoretical literature (post-Chicago school) shows that vertical integration can harm competition by disadvantaging the upstream or downstream rivals (Salinger 1988, Hart et al. 1990, and Ordover et al. 1990). Specifically, a firm acquires a potential supplier or customer firm and finds it profitable to deny access of critical inputs or outlets to the nonintegrated rivals. This leads to a reduction in the margins of the rivals and increases the likelihood of their exit from the industry. Furthermore, foreclosure creates barriers to entry for potential entrants.

Because of the increase in market power for the integrated firm, we expect the merging firms to experience a positive combined wealth effect. We expect that the wealth effects of both the nonintegrated acquirer and target rivals to be negative because the vertically integrated firm can now squeeze their margins by denying access to critical inputs or sources of outlets. Finally, the increased barriers of entry and the unfair advantage of the integrated firm over the nonintegrated rivals enable it to extract rents from customer firms who would also experience negative wealth effects.

The nonhorizontal merger guidelines of the FTC and DOJ specifically recognize foreclosure effects of vertical takeovers. The takeover of Wavefront Technologies, a graphics software developer, by Silicon Graphics (SGI), a manufacturer of graphics workstations in 1995 is an example of a challenge by the FTC on account of foreclosure. As such, the FTC contended that the takeover could lead to an increase in costs of obtaining graphics software from Wavefront for the competitors of SGI. Another concern was the foreclosure of the competitors of Wavefront due to the increased costs of developing software adaptable on SGI workstations. The FTC required that SGI maintain an open architecture so that independent software developers could sell their product for use on SGI computers (Morse 1998).[4, 5]

[4] The nonhorizontal merger guidelines are available at the DOJ website, http://www.usdoj.gov/atr/public/guidelines/2614.htm.

[5] The Time Warner and AOL merger in 2000 was also challenged by the FTC for foreclosure (Schlossberg 2004).

The extant empirical literature provides mixed evidence regarding the foreclosure hypothesis. Whereas some studies find evidence supportive of the foreclosure hypothesis (Hastings and Gilbert 2005) others find evidence that is inconsistent with it (Mullin and Mullin 1997, Chipty 2001, Hortaçsu and Syverson 2007, Rosengren and Meehan 1994).

2.3. Collusion Hypothesis

Several research studies have examined the possibility that horizontal takeovers create an environment conducive to collusion among rival producers (Eckbo 1983, 1985; Fee and Thomas 2004; Shahrur 2005). Even though there is less reason to believe that vertical takeovers increase likelihood of collusion extant research does point that vertically integrated firms were common in collusive industries (Tosdal 1917). In addition, the FTC and DOJ recognize collusive intent arising from vertical mergers (see Footnote 4) and in the past have challenged vertical deals on the grounds of collusion. As an example, in 1995, the FTC challenged the proposed takeover of PCS Health Systems, a pharmacy benefits management company, by Eli Lilly, a drug manufacturer. The FTC required a firewall to prevent the passing of confidential information on the pricing structure of other drug manufacturers from PCS to Lilly, which may have facilitated collusion between Lilly and its rivals (Morse 1998).[6]

Recent theory papers also show that vertical integration increases the likelihood of collusion (Chen 2001, Nocke and White 2007). Chen (2001) models the upstream and downstream industries as duopolies. Chen shows that a backward takeover with a supplier creates incentives for the unsuccessful bidder to strike a deal with the integrated firm for input supply. The integrated firm supplies inputs but now has incentives to compete less aggressively in the downstream market because its profits depend on the input sold to the rival. In Nocke and White (2007), the vertical takeover of a downstream target by an upstream acquirer facilitates collusion because it becomes harder for the nonintegrated upstream rivals to sell to the downstream segment of the integrated firm if they defect from collusive agreements, and because the vertically integrated firm is better equipped to punish defections of upstream rivals by competing more aggressively in the downstream market.

Based on the above arguments, we posit that the merging firms and the nonintegrated acquirer rivals would experience a positive wealth effect because there is a higher likelihood of collusion after the vertical takeover.[7] Furthermore, in backward takeovers, the nonintegrated target rivals would experience a negative wealth effect due to the reduced demand for their output on account of downstream collusion. In forward takeovers, the nonintegrated target rivals would also experience a negative wealth effect because they receive inputs at a higher price due to upstream collusion. Finally, the ongoing collusion between the integrated firm and nonintegrated acquirer rivals enables them to extract rents from customer firms who would, in turn, experience a negative wealth effect.

3. Data Sources, Takeover Sample, and Identification of Rival Firms and Customer Firms

3.1. Takeover Sample

We use the *SDC Platinum Mergers and Acquisitions* database to obtain all takeovers between 1981 and 2004 and include deals that meet the following characteristics: (i) the deal should not be classified as a spin-off, repurchase, recapitalization, divestiture, leveraged buyout, or self-tender offer; and (ii) the "form" of the deal should not be classified as "acquisition of remaining interest," "acquisition of assets" or "buyback." We define a contest for each target to include all bids for that target such that the period between two consecutive bids is less than a year. Consistent with Kale et al. (2003), successful bids are identified as those where the acquirer owned less than 50% of the target shares prior to the deal announcement and acquired at least 15% of the target shares during the contest.[8] We only include those contests where both the acquirer and target are U.S. public firms. We also exclude contests where the acquirer or target is a financial firm (four-digit SIC codes between 6,000 and 6,999). For each contest, we obtain the following dates: (i) the announcement date of the first bid in the contest, (ii) announcement date of the first bid by the successful acquirer, and (iii) the announcement date of the successful bid.

3.2. Identification of Vertical Takeovers

Kahle and Walkling (1996) find that firms change their industry classification over time and suggest using

[6] Likewise, the AT&T and McCaw Cellular Communications merger in 1994 was challenged by the DOJ for collusion (Morse 1998).

[7] Our predictions for the acquirer and target rivals assume that collusion occurs at the acquirer's industry level. This is plausible because the acquirer seeking to collude with its rivals initiates the vertical merger.

[8] The choice of 15% target shares was originally proposed by Bradley et al. (1983). Our results are qualitatively similar if we defined successful takeovers as those where the bidder acquires 100% of target shares.

the historical SIC codes instead of the current SIC codes. For each successful bid in our sample, we find the four-digit historical primary SIC code (Compustat data item 324) for the acquirer and target during the year of takeover announcement. Compustat provides the historical SIC code only beginning 1987. For takeovers prior to 1987, we use the SIC code of the segment with the highest sales during the announcement year. If this is found missing we use the 1987 historical SIC code. We exclude takeovers with horizontal relations, where the acquirer and target share the same four-digit SIC code.

To identify vertical relations, we utilize the *Use Table* for the U.S. economy that provides the commodity flows between different pairs of input-output (IO) industries. This data is available in the benchmark input-output accounts published by the Bureau of Economic Analysis every five years. We use the Fan and Lang (2000) SIC-IO conversion table to map the acquirer and target four-digit SIC codes to their six-digit IO codes. Because there is likely time-series variation in input-output relations, we use the 1982, 1987, 1992, and 1997 *Use* tables for takeovers taking place during the periods 1981–1985, 1986–1990, 1991–1997, and 1998–2004, respectively. The 1997 benchmark input-output accounts rely on North American Industry Classification System (NAICS) codes instead of SIC codes for industry classification. Hence, for takeovers during 1998 to 2004, we first map the four-digit SIC codes of acquirers and targets to their six-digit NAICS codes using the bridge tables provided by the Bureau of Census. We then find their respective IO industries using the NAICS-IO concordance table provided in the 1997 benchmark input-output accounts.

For every takeover, we calculate the vertical relatedness coefficient (*VRC*) between the acquirer and target IO codes in the spirit of Fan and Goyal (2006). Specifically, we find (i) the dollar flow from the acquirer (target) to the target (acquirer) industry for every dollar of the acquirer industry total output ($V_{1,AT}(V_{1,TA})$), and (ii) the dollar flow from the acquirer (target) to the target (acquirer) industry for every dollar of the target industry total output ($V_{2,AT}(V_{2,TA})$). Then, the vertical coefficient (*VRC*) is calculated as the maximum of the four coefficients. We retain takeovers with a *VRC* of 5% or greater in our sample. The above sample selection criteria yield 225 successful vertical takeovers during 1981–2004. We note that the true level of economic linkages between the acquirer and target industry may be much higher than 5% once we consider that the total output of an industry comprises of value added components, like compensation of employees and indirect business tax and nontax liability, in addition to intermediate inputs. Using the National Bureau of Economic Research (NBER)–Center for Economic Studies (CES) manufacturing database, we find that the value added components account for 50% of the total output (on average) for manufacturing industries. Thus, once we adjust for the value added component, the true degree of vertical linkage in our sample would be roughly twice in magnitude (in the range of 10%). Table 2 presents the descriptive statistics for our sample. We find that the mean (median) value of vertical relatedness is 16.54% (12.26%). The representative deal in our sample has much higher level of economic linkages between the acquirer and target industries than our 5% cutoff.[9]

3.3. Identification of Acquirer Rivals, Target Rivals, and Corporate Customers

We identify nonintegrated acquirer (target) rivals as all firms on Compustat with the same primary SIC code as the acquirer (target) provided they did not have a segment in the target (acquirer) primary SIC industry.[10] We identify the customer firms for each vertical takeover as follows. First, we identify the downstream industry in the vertical takeover. Specifically, if the takeover is backward, the downstream industry in the vertical takeover is the acquirer's IO industry; and if the takeover is forward, the downstream industry in the vertical takeover is the target's IO industry. Second, we find the industry that buys the highest proportion of the total output produced by the downstream industry in the vertical takeover (main customer industry), and the industry that obtains the highest proportion of its inputs from the downstream industry in the vertical takeover for production of its total output (dependent customer industry). Furthermore, to consider only significant input-output relationships, we consider the main/dependent customer industry only if the proportions (as identified above) are at least 5%. Finally, we identify single segment firms on Compustat that belong to the main and dependent customer industries during the year of takeover announcement. We consider only single-segment firms for customer portfolios because each six-digit customer IO industry typically includes multiple four-digit SIC codes, and including multisegment firms also would create a noisy proxy for customer returns.

4. Univariate Results

4.1. Measurement of Abnormal Returns

We use the market model, based on a CRSP value-weighted market portfolio, to calculate the parameter estimates of the return generating process of the acquirer and target. We use the daily returns for

[9] Using a 10% (1%) cutoff for vertical relatedness yield us 140 (453) vertical deals. The results for these samples are qualitatively similar to the sample based on the 5% cutoff.

[10] If we construct acquirer (target) rival portfolios using single segment firms we find qualitatively similar results.

Table 2 Descriptive Statistics of Vertical Takeovers During 1981–2004

	N	Mean	Median
Firm and industry characteristics			
Vertical relatedness coefficient (*VRC*)	225	16.54%	12.26%
Acquirer industry-adjusted R&D intensity (*ACQRDI*)	225	0.47%	0
Target industry-adjusted R&D intensity (*TARRDI*)	225	4.70%	0
Industry adjusted change in combined R&D intensity (*RDICHG*)	225	−0.01%	0
Cross-citations of target patents by acquirer (*CROSSCITE*)	225	13.36	0
Strategic alliances and joint ventures (*SAJV*)	225	0.3556	0
Truncation-adjusted citations to target patents (*TOTCITE*)	225	163.03	0
Collusive industry (*PRICE_FIXING*)	225	0.2222	0
Industry median capital intensity (*K_TO_L*), $ in thousands	225	97.15	33.75
Acquirer market share ($MKTSH_{ACQ}$)	225	15.56%	6.06%
Target market share ($MKTSH_{TAR}$)	225	5.20%	1.43%
Acquirer industry herfindahl index ($CONC_{ACQ}$)	225	0.2019	0.1439
Deal characteristics			
Stock dummy (*Stock*)	225	0.2844	0
Tender offers (*Tender Offer*)	225	0.3111	0
Hostile dummy (*Hostile*)	225	0.0533	0
Relative size (*Relsize*)	225	33.78%	8.35%

Notes. The sample consists of 225 successful vertical takeovers during 1981–2004. Deals in which either the acquirer or target is a financial firm are not considered. *VRC* is the vertical relatedness coefficient and captures the extent of commodity flow between the acquirer and target industries per dollar of acquirer or target industry total output. Takeovers in this sample have *VRC* of 5% or greater. *ACQRDI* (*TARRDI*) is the industry-adjusted R&D intensity of acquirer (target) firm for the year prior to merger announcement. *RDICHG* is the change in industry-adjusted combined R&D intensity of the acquirer and target measured over the $(t-1, t+2)$ calendar year window where t is the year of merger announcement. *CROSSCITE* is the number of cross-citations of target patents by the acquirer patents during the five years prior to the year of merger announcement. *SAJV* is an indicator variable set equal to 1 in the presence of strategic alliances or joint ventures between the acquirer and target firm during the past five years of merger announcement and 0 otherwise. We rely on the SDC Platinum database and Factiva to identify strategic alliances and joint ventures. *TOTCITE* is the total truncation-adjusted citations to target patents filed during the three years prior to the merger announcement. *PRICE_FIXING* is an indicator variable set equal to 1 if the acquirer industry was identified as a collusive industry based on vertical price fixing enforcement actions. *K_TO_L* is the acquirer industry median capital to labor ratio. Capital is measured as net property, plant and equipment (Compustat Data8) and labor as number of employees (Compustat Data29). $MKTSH_{ACQ}$ and $MKTSH_{TAR}$ are the acquirer and target market shares in its primary industry during the year of the takeover. $CONC_{ACQ}$ is the sales based Herfindahl Index of the four-digit SIC industry of the acquirer during the takeover year. *Stock* is a dummy variable that equals 1 if deal is stock financed and 0 for deals that rely on cash or a combination of cash and stock as a means of financing. *Tender Offer* is an indicator variable that equals 1 for tender offers and 0 for mergers. *Hostile* is an indicator variable that equals 1 for hostile deals as reported by SDC Platinum database and 0 otherwise. *Relsize* is the ratio of the market value of the target to the market value of the acquirer measured fifteen days prior to the first bid by successful acquirer.

240 trading days beginning 300 days before the announcement of the first bid by the successful acquirer as the estimation period. We require a minimum of 200 daily returns during estimation period. We calculate the cumulative abnormal returns for the acquirer and target over the windows of $(-5, +5)$ and $(-10, +10)$ trading days around the period between the announcement of the first bid by the successful acquirer and the announcement of the ultimately successful bid. We use rolling windows to compute the bidder and target abnormal returns to accurately measure synergies in the takeover (Bradley et al. 1988, Kale et al. 2003).[11] Consistent with Bradley et al. (1988), we measure the combined wealth effect to the merging firms as the value-weighted cumulative abnormal return to the acquirer (*ACAR*) and target (*TCAR*). The weights are the market capitalizations of the acquirer and target fifteen days prior to the announcement of the first bid by the successful acquirer.

For every vertical takeover in our sample, we combine the acquirer rival, target rival, main customer, and dependent customer firms into separate equally weighted portfolios to account for the contemporaneous cross-correlation in returns. The equally weighted portfolio approach is consistent with Eckbo (1983), Song and Walkling (2000), Fee and Thomas (2004), and Shahrur (2005). We calculate the abnormal returns to the portfolios using fixed windows of $(-1, +1)$, $(-2, +2)$, $(-5, +5)$ and $(-10, +10)$ trading days around the announcement of the first bid by the successful acquirer.

4.2. Wealth Effects of the Merging Firms, Rivals, and Customers in Successful Vertical Takeovers

For the overall sample of 225 successful vertical takeovers, we find that the average cumulative abnormal return to acquirer firms is −1.48% and to target firms is 27.83% as measured over $(-10, +10)$ trading days around the period between the announcement

[11] Alternatively, we treat announcement of the successful bid as day 0. We measure bidder and target abnormal returns over windows of $(-1, +1)$ and $(-10, +10)$ days around day 0 and find qualitatively similar results.

of the first bid to the successful bid in the contest. The wealth effect to acquirer firms is statistically indistinguishable from zero, whereas the wealth effect to target firms is statistically significant. The average combined wealth effect to the acquirer and target firms over the (−10, +10) window is 1.63% and is statistically significant.

In panel A of Table 3, we report the announcement period wealth effects of the rival and customer firms for our 225 vertical takeovers. Consistent with the extant literature, we use the Patell Z-score to test the statistical significance of abnormal returns (Eckbo 1983, Song and Walkling 2000). We apply the Mikkelson and Partch (1988) correction to adjust for

Table 3 Cumulative Abnormal Returns to Acquirer Rivals, Target Rivals, and Customers in Successful Vertical Takeovers

Panel A: Abnormal returns for overall sample of vertical takeovers

	Acquirer rivals		Target rivals		Main customers		Dependent customers	
Number	$N = 218$		$N = 221$		$N = 176$		$N = 175$	
Mean (*median*)	55 (32)		65 (41)		65 (20)		29 (9)	
Event windows	Mean	%Positive	Mean	%Positive	Mean	%Positive	Mean	%Positive
(−1, 0)	0.11	53.66	0.13	51.11	0.16	47.15	−0.02	48.00
	(1.019)	(0.628)	(1.483)	(−0.205)	(−0.747)	(−1.232)	(0.825)	(−0.709)
(−1, +1)	0.19	54.13	0.13	56.11	0.23	46.59	0.17	45.71
	(1.348)	(0.763)	(1.28)	(1.276)	(−0.397)	(−1.383)	(1.00)	(−1.31)
(−2, +2)	0.23	52.75	0.08	50.68	0.05	44.32**	0.51	52.00
	(1.392)	(0.357)	(0.638)	(−0.34)	(−1.045)	(−1.99)	(1.112)	(0.349)
(−5, +5)	−0.42	46.33	−0.34	46.61	−0.62**	41.47***	0.99	59.43**
	(−0.99)	(−1.54)	(−0.147)	(−1.55)	(−2.10)	(−2.74)	(1.61)	(2.32)
(−10, +10)	−0.10	47.25	−0.36	47.06	−0.70**	46.59	1.14	52.57
	(−0.209)	(−1.27)	(−0.098)	(−1.417)	(−2.590)	(−1.38)	(0.824)	(0.50)

Panel B: Abnormal returns for subsample with positive combined wealth effect to merging firms

	Acquirer rivals		Target rivals		Main customers		Dependent customers	
Number	$N = 112$		$N = 114$		$N = 89$		$N = 88$	
Mean (*median*)	55 (25)		65 (32)		49 (19)		23 (9)	
Event windows	Mean	%Positive	Mean	%Positive	Mean	%Positive	Mean	%Positive
(−1, 0)	0.21*	57.14	0.35*	52.63	0.07	44.94	0.42*	56.81
	(1.84)	(1.196)	(1.74)	(0.303)	(0.56)	(−1.296)	(1.85)	(1.068)
(−1, +1)	0.37**	58.04	0.58**	57.89	0.25	47.19	1.17**	55.68
	(2.36)	(1.385)	(2.48)	(1.43)	(−0.006)	(−0.872)	(2.515)	(0.854)
(−2, +2)	0.55***	53.57	0.74**	54.39	0.48	44.94	1.06*	55.68
	(3.01)	(0.44)	(2.41)	(0.678)	(0.168)	(−1.296)	(1.829)	(0.854)
(−5, +5)	0.09	50.00	0.28	50.00	−0.13	42.69	1.75*	61.36*
	(1.079)	(−0.316)	(1.338)	(−0.259)	(−0.827)	(−1.57)	(1.943)	(1.92)
(−10, +10)	0.35	50.89	0.91**	57.69	0.76*	55.05	3.10**	60.22*
	(1.221)	(−0.127)	(2.262)	(0.303)	(1.65)	(0.613)	(2.018)	(1.71)

Panel C: Abnormal returns for subsample with negative combined wealth effect to merging firms

	Acquirer rivals		Target rivals		Main customers		Dependent customers	
Number	$N = 106$		$N = 107$		$N = 87$		$N = 87$	
Mean (*median*)	55 (37)		66 (48)		81 (23)		34 (11)	
Event windows	Mean	%Positive	Mean	%Positive	Mean	%Positive	Mean	%Positive
(−1, 0)	0.01	50.00	−0.11	49.53	0.25	49.42	−0.47	39.08**
	(−0.438)	(−0.33)	(0.337)	(−0.607)	(−0.498)	(−0.44)	(−0.433)	(−2.08)
(−1, +1)	0.00	50.00	−0.34	54.21	0.21	45.97	−0.85	35.63***
	(−0.494)	(−0.33)	(−0.714)	(0.361)	(−0.562)	(−1.084)	(−1.129)	(−2.72)
(−2, +2)	−0.11	51.89	−0.62	46.73	−0.39	43.68	−0.06	48.28
	(−1.098)	(0.059)	(−1.57)	(−1.19)	(−1.66)	(−1.51)	(−0.27)	(−0.362)
(−5, +5)	−0.77**	42.45*	−1.01	42.99**	−1.11**	40.22**	0.22	57.47
	(−2.53)	(−1.88)	(−1.59)	(−1.96)	(−2.15)	(−2.16)	(0.315)	(1.35)
(−10, +10)	−0.57	43.40*	−1.72**	41.12**	−2.18***	37.93**	−0.84	44.83
	(−1.56)	(−1.69)	(−2.48)	(−2.35)	(−3.44)	(−2.59)	(−0.858)	(−1.055)

Table 3 (Continued)

Panel D: *t*-statistics for the difference between positive and negative combined wealth effect subsamples

	Acquirer rivals		Target rivals		Main customers		Dependent customers	
Number	$N = 106$		$N = 107$		$N = 87$		$N = 87$	
Mean (*median*)	55 (37)		66 (48)		81 (23)		34 (11)	
Event windows	Mean	%Positive	Mean	%Positive	Mean	%Positive	Mean	%Positive
$(-1, 0)$	0.71	1.05	1.29	0.39	−0.45	−0.48	1.16	2.14**
$(-1, +1)$	0.98	1.19	2.39**	0.48	−0.06	0.25	2.74***	3.07***
$(-2, +2)$	1.32	0.39	2.57**	1.07	1.31	0.40	1.54	1.69*
$(-5, +5)$	0.78	1.11	1.48	0.98	1.01	0.28	1.34	1.29
$(-10, +10)$	0.90	1.11	2.11**	1.66*	2.22**	2.29**	2.09**	1.54

Notes. This table provides the cumulative abnormal returns (CARs) to the acquirer rival, target rival, main customer, and dependent customer portfolios in the vertical takeover sample based on a 5% cutoff. Acquirer CAR and Target CAR is measured around the window $(-10, +10)$ days around the period running from the first bid by the successful acquirer to the announcement of the successful bid in the contest. Combined wealth effect of a takeover is the value weighted CAR to the acquirer and target, where the weights are computed using the market capitalization of the acquirer fifteen trading days prior to the announcement of the first bid by the successful acquirer. Acquirer rival and target rival portfolios are based on all Compustat firms during the takeover year. We exclude firms with segments in target (acquirer) primary SIC while constructing acquirer (target) rival portfolios. The main customer industry is identified as the industry that accounts for the highest proportion of the total output of the downstream industry in the vertical takeover as long as it is greater than 5%. Dependent customer industry is identified as the industry that receives the highest proportion of its inputs from the downstream industry in vertical takeover to produce its total output as long as it is greater than 5%. Customer portfolios are based on single segment firms in Compustat. The acquirer rival portfolio, target rival portfolio, and customer portfolio returns are calculated as equally weighted returns for the $(-1, 0)$, $(-1, +1)$, $(-2, +2)$, $(-5, +5)$, and $(-10, +10)$ trading day windows around the first bid by the successful acquirer. *Z* statistics are used to test if the mean cumulative abnormal returns are statistically different from zero and are provided in the parentheses. %Positive represents the proportion of portfolios that have positive returns. A generalized sign test is performed to test their statistical significance. *Number* is the number of portfolios of rivals or customers and *Mean* (*Median*) is the mean (median) number of firms in each rival or customer portfolio. Panel A provides the CARs for the overall sample. Panel B (panel C) provides the CARs for the subsample of takeovers with a positive (negative) combined wealth effect over the $(-10, +10)$ window. Panel D provides the $t(z)$ statistic for the difference between the positive and negative combined wealth effect subsamples.

***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

serial dependence. We perform a generalized sign test for the statistical significance of the percentage of portfolios with positive cumulative abnormal returns (CARs). For the overall sample, we find that the average announcement period abnormal returns to the acquirer rivals, target rivals, main customers, and dependent customers are statistically insignificant for most of the windows. The efficiency, foreclosure, and collusion hypotheses, all suggest that the takeover creates value for the acquirer and target firm. To improve the power of our tests, we subdivide our sample based on whether the takeover generates a positive or negative combined wealth effect. We expect the efficiency, foreclosure, and collusion rationales to be more prominent in the positive subsample.

In panel B of Table 3, we present the wealth effects to the rival and customer firms in the subsample of takeovers with a positive combined wealth effect to the merging firms. We find that the acquirer rivals experience positive and significant abnormal returns in three event windows. For example, the average abnormal return of acquirer rivals over the $(-2, +2)$ window is 0.55% and is statistically significant. The generally positive stock price response of the acquirer rivals is inconsistent with competitive advantage or foreclosure hypothesis but is consistent with better information or collusion hypothesis. In addition, we find that target rivals experience positive and significant abnormal returns over four event windows. For example, the average abnormal return to target rivals over the $(-10, +10)$ window is 0.91% and is statistically significant. The generally positive average response for the target rivals is in the direction predicted by the better information hypothesis and is inconsistent with the competitive advantage, foreclosure, or collusion hypotheses. The positive wealth effects to target rivals are also consistent with the acquisition probability hypothesis of Song and Walkling (2000).

Furthermore, we find that the main customer firms experience positive and significant abnormal returns of 0.76% only over the $(-10, +10)$ window. Although the evidence that the abnormal returns to main customers are positive can be characterized as weak, the picture that clearly emerges is that the main customers do not appear to be harmed as a result of foreclosure or collusion. We expect the efficiency and anticompetitive effects of vertical takeovers to be more pronounced for dependent customers rather than main customers because these are firms that depend most on inputs supplied by the downstream industry in the vertical takeover. Consistent with this notion, we find that the dependent customers experience positive and significant abnormal returns over

all event windows. For example, the dependent customers experience a positive and significant abnormal return of 3.10% over the $(-10, +10)$ window. The positive returns of dependent customers support the efficiency hypothesis and complement our results on the acquirer rival and target rival firms in rejecting the foreclosure and collusion hypotheses.

In panel C of Table 3, we report wealth effects to the rival and customer firms in the subsample of takeovers with a negative combined wealth effect to the merging firms. Although it is possible that the efficiency, foreclosure, and collusion rationales are valid here, there are likely other more dominating motives. First, these takeovers could be driven by agency problems prevalent in acquirer firms (Morck et al. 1990). Second, these takeovers may be stock financed and, hence, could indicate overvaluation of the acquirer's equity (Travlos 1987). Finally, it is likely that the acquirer expands into the supplier (customer) industry because its own industry faces negative prospects and the announcement is perceived as new bad news regarding the acquirer and its industry (Mitchell and Mulherin 1996).

In the negative combined wealth effect subsample, we find that acquirer and target rivals experience negative and significant abnormal returns in only one of the five event windows examined. Furthermore, the dependent customers experience insignificant abnormal returns over all event windows, whereas the main customer firms experience negative and significant abnormal returns over two event windows. In sum, the abnormal returns to the acquirer rivals, target rivals, and dependent customers can be characterized as weak. The negative abnormal returns to main customers suggests that value destroying vertical takeovers can have potentially harmful effects on firms that buy the output produced by the downstream industry in the vertical takeover.[12]

4.3. Challenged Vertical Takeovers

It is likely the antitrust authorities stand to challenge potentially anticompetitive vertical takeovers. To provide further discriminating evidence on the anticompetitive rationales, we investigate the wealth effects in challenged vertical takeovers. For this purpose, we hand collect data on vertical takeovers that were challenged in the courts or by the FTC or DOJ during 1981–2004. Our primary source of vertical merger challenges is Schlossberg (2004). We read case documents from the FTC or DOJ websites and the CCH Trade Regulation Reporter to verify that these deals were scrutinized based on anticompetitive effects of vertical integration. Furthermore, to ensure if we missed out on any challenged vertical deals not contained in Schlossberg (2004), we search the FTC and DOJ websites with the keyword "vertical." This approach fails to yield additional deals.

We identify 33 vertical deals out of which 8 deals get eliminated because the bidder and target share the same four-digit primary SIC on Compustat (horizontal relations) and 4 more deals get eliminated because either bidder or target are private. Our final sample therefore includes 21 vertical deals involving public acquirers and targets. We examine the wealth effects around the merger announcement and the announcement of subsequent challenge. We find that the average combined wealth effect to the merging firms is 1.06% and 1.72% over the $(-5, +5)$ and $(-10, +10)$ day windows around the date of announcement. Around the date of challenge, we find that the average combined wealth effect is -2.48% and -1.56% over the same windows. As such, the above evidence indicates that the announcement of a challenge imposes costs on the merging firms by making it harder to engage in anticompetitive behavior, or by reversing the efficiency benefits that would accrue to the merging firms. To separate the efficiency and market power rationales, we investigate the wealth effects of the rivals and customer firms.

In panel A of Table 4, we provide results for the wealth effects of rivals and customers around the date of the merger announcement. The wealth effect of the acquirer rivals is found to be statistically insignificant in all four event windows. However, the wealth effect of target rivals is found to be positive and statistically significant in three of the four windows. Finally, the wealth effect of the main and dependent customers is found to be statistically insignificant. The positive response of target rivals is consistent with the better information view of efficiency hypothesis and inconsistent with the foreclosure and collusion hypotheses. The insignificant wealth effects to customers are inconsistent with the foreclosure or collusion hypotheses.

In panel B of Table 4, we provide results for the wealth effects of rivals and customers around the date of challenge. We expect that the wealth effects from enhanced market power would reverse on the announcement of a challenge. Inconsistent with this notion, we find that the wealth effects of acquirer rivals, target rivals, main customers, and dependent customers are all statistically insignificant. In sum, the wealth effects to the rival and customer firms in challenged vertical takeovers, although weak in terms of statistical significance, are generally not in the direction predicted by foreclosure or collusion hypotheses.

[12] If we construct rival and customer portfolios based on firms that are geographically closer to the merging firms, i.e., firms with the same headquarters as the acquirer and target, we obtain qualitatively similar results as in Table 3.

Table 4 Cumulative Abnormal Returns to Acquirer Rivals, Target Rivals, and Customers in Challenged Vertical Takeovers

Panel A: Abnormal returns on "date of announcement" for challenged vertical takeovers

Number	Acquirer rivals $N = 20$		Target rivals $N = 21$		Main customers $N = 19$		Dependent customers $N = 18$	
Event windows	Mean	%Positive	Mean	%Positive	Mean	%Positive	Mean	%Positive
$(-1, 0)$	−0.13	50.00	0.57	61.90	−1.39	52.63	−1.62	38.89
	(−0.13)	(−0.10)	(1.38)	(0.90)	(−0.62)	(−0.14)	(−0.57)	(−1.09)
$(-1, +1)$	−0.06	45.00	1.05**	66.67	−0.05	42.11	−0.98	44.44
	(0.34)	(−0.55)	(2.42)	(1.34)	(0.67)	(−1.06)	(−1.06)	(−0.61)
$(-2, +2)$	−0.40	35.00	1.54***	80.95**	−0.23	52.63	−0.39	44.44
	(−0.64)	(−1.44)	(2.76)	(2.65)	(−0.96)	(−0.14)	(−0.88)	(−0.61)
$(-5, +5)$	1.91	50.00	1.89**	71.43*	−0.34	47.37	0.68	50.00
	(1.45)	(−0.10)	(2.37)	(1.77)	(−1.05)	(−0.60)	(−0.62)	(−0.14)
$(-10, +10)$	1.00	50.00	0.55	57.14	3.14	47.37	3.86	55.56
	(0.66)	(−0.10)	(0.73)	(0.46)	(−0.68)	(−0.60)	(0.15)	(0.33)

Panel B: Abnormal returns on "date of challenge" for challenged vertical takeovers

Number	Acquirer rivals $N = 20$		Target rivals $N = 21$		Main customers $N = 18$		Dependent customers $N = 15$	
Event windows	Mean	%Positive	Mean	%Positive	Mean	%Positive	Mean	%Positive
$(-1, 0)$	−0.15	45.00	0.24	47.62	−0.27	50.00	1.06*	60.00
	(−0.33)	(−0.46)	(0.67)	(−0.37)	(−0.38)	(−0.23)	(1.82)	(0.429)
$(-1, +1)$	0.00	50.00	0.20	38.10	−0.13	38.89	1.06	40.00
	(−0.03)	(−0.01)	(0.06)	(−1.24)	(−0.07)	(−1.17)	(1.61)	(−1.13)
$(-2, +2)$	0.19	45.00	−0.55	42.86	−0.44	50.00	1.09	53.33
	(−0.20)	(−0.46)	(−0.57)	(−0.81)	(0.02)	(−0.23)	(1.28)	(−0.09)
$(-5, +5)$	−0.83	45.00	−0.09	47.62	−0.33	50.00	0.91	60.00
	(−0.89)	(−0.46)	(−0.17)	(−0.37)	(0.43)	(−0.23)	(0.92)	(0.43)
$(-10, +10)$	−1.93	30.00*	0.00	47.62	−0.78	61.11	0.12	46.67
	(−1.29)	(−1.80)	(0.03)	(−0.37)	(0.01)	(0.72)	(0.23)	(−0.61)

Notes. This table provides the cumulative abnormal returns (CARs) to the acquirer rival, target rival, main customer, and dependent customer portfolios for *challenged* vertical takeovers during 1981–2004. Acquirer rival and target rival portfolios are based on all Compustat firms during the takeover year. We exclude firms with segments in target (acquirer) primary SIC while constructing acquirer (target) rival portfolios. The main customer industry is identified as the industry that accounts for the highest proportion of the total output of the downstream industry in the vertical takeover as long as it is greater than 1%. Dependent customer industry is identified as the industry that receives the highest proportion of its inputs from the downstream industry in vertical takeover to produce its total output as long as it is greater than 1%. Customer portfolios are based on single segment firms in Compustat. The acquirer rival portfolio, target rival portfolio, and customer portfolio returns are calculated as equally weighted returns for the $(-1, 0)$, $(-1, +1)$, $(-2, +2)$, $(-5, +5)$, and $(-10, +10)$ trading day windows around the announcement date of the takeover. *Number* is the number of portfolios of rivals or customers. *Z* statistics are used to test if the mean cumulative abnormal returns are statistically different from zero and are provided in the parentheses. %Positive represents the proportion of portfolios that have positive returns. A generalized sign test is performed to test their statistical significance. Panel A provides the CARs around the date of announcement of challenged vertical takeovers, and panel B provides the CARs around the date of challenge.

***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

4.4. Strong and Weak Antitrust Enforcement Regimes

Our evidence suggests that the anticompetitive rationales are not significant determinants of the wealth effects to the merging firms, rivals, and customers. An alternate explanation for our findings could be that regulators effectively deter anticompetitive vertical takeovers, in which case we will not find evidence supportive of these rationales in the data. In this section, we exploit the variation in antitrust enforcement regimes and study the valuation effects of the rival firms and customer firms in strong versus weak antitrust enforcement regimes. Presumably, the deterrent effect of regulation should be much weaker during weak enforcement regimes.

Anecdotal evidence suggests that the Ronald Reagan, George H. W. Bush and George W. Bush, administrations were considered to be periods of weak antitrust enforcement, whereas the Clinton administration was considered to be a period of strong antitrust enforcement.[13] We follow Bittlingmayer (1992)

[13] For example, see the article by Labaton (2006), which highlights the less aggressive stance of President Bush's administration toward merger enforcement. In contrast, see FTC Commissioner Varney's (1996) remarks, which calls for aggressive vertical enforcement. Varney was the FTC Commissioner during President Clinton's administration.

and track the number of Hart–Scott–Rodino case filings at the DOJ during different presidential regimes. We find that the average filings per year of President Clinton's administration to be 11.5. In contrast, the corresponding numbers are much lower during the other three regimes. Specifically, they are 4.0, 3.5, and 5.8 during the Ronald Reagan, George H. W. Bush, and George W. Bush administrations, respectively. As such, this provides more robust evidence to support the view in the anecdotes that Clinton administration was more active in antitrust enforcement.

To study the wealth effects of vertical mergers by enforcement regime, we start with all successful and challenged vertical mergers used in our study. We separate those announced during the Clinton administration (1993–2000) as belonging to strong enforcement regimes and all others (1981–1988, 1989–1992, and 2001–2004) as belonging to weak enforcement regimes. If a deterrent effect of regulation exists, we should observe evidence supportive of the foreclosure and collusion hypotheses during the weak enforcement regime. We investigate the wealth effects to the acquirer rivals, target rivals, main customers, and dependent customers during the strong versus weak enforcement regimes. In unreported results, we find that the differences for the wealth effects between the two regimes are statistically insignificant. We are, therefore, unable to draw reliable inferences on the effect of regulation.

5. Cross-Sectional Analysis of Wealth Effects and Operating Performance

In our cross-sectional analyses, we include economic variables related to our efficiency, foreclosure, and collusion hypotheses and other control variables that impact the combined wealth effect and change in operating performance to the merging firms. We do not rely on the split based on positive or negative combined wealth effect to the merging firms used in our univariate analyses. We investigate the determinants of (i) the combined wealth effects to merging firms, (ii) the wealth effect of the rival and customer firms, and (iii) the operating performance changes of the merging firms.

5.1. Determinants of the Combined Wealth Effect of the Merging Firms

The efficiency hypothesis posits that vertical integration mitigates the underinvestment problem and provides incentives to undertake relationship-specific investments. We use four different proxies to capture the extent of underinvestment and holdup problem. First, the extant literature has employed R&D intensity to measure relationship-specific investments (Levy 1985, Allen and Phillips 2000, Kale and Shahrur 2007). Consistent with this literature, we use the premerger industry-adjusted R&D intensity of the acquirer firm (*ACQRDI*) and target firm (*TARRDI*) as explanatory variables. We posit that the lower the R&D intensity of the acquirer (target), the more severe is the extent of underinvestment in relationship-specific assets prior to the merger, and therefore the greater would be the potential for efficiency gains to the acquirer (target) firm from a vertical takeover. We thus expect the combined wealth effect to be negatively related to *ACQRDI* and *TARRDI*.[14]

Second, as another method to measure efficiency gains from vertical takeovers we look at the change in combined relationship-specific investments of the merging firms. Specifically, the greater the change in relationship-specific investments of the merging firms around the merger, the less severe is the extent of the underinvestment after the vertical takeover, and therefore the higher the value created to the merging firms. In line with this argument, instead of using R&D levels, we use the change in the industry-adjusted combined R&D intensity (*RDICHG*) measured as the post-merger R&D intensity of the integrated firm (for year $t+2$) minus the premerger weighted R&D intensity of acquirer and target (for year $t-1$).[15] We adjust the pre- and post-R&D intensities by the industry median values. Specifically, the pre- and postmerger industry median R&D intensities are calculated as the asset weighted R&D intensity of the median firm in the acquirer and target industry. We expect a positive relation between *RDICHG* and the combined wealth effect to the merging firms.

Third, we measure the cross-citations between acquirer and target patents. It is likely that higher cross-patenting suggests research specific to the target made by the acquirer firm or a greater likelihood of interdependent technologies of the acquirer and target firms. As such, higher intensity of cross-citations prior to the merger is likely to indicate a greater potential for holdup problems prior to the merger, and accordingly a greater value creation from the merger. We use the NBER patents database and create a variable *CROSSCITE* that measures the number of cross-citations by acquirer patents of target patents that were applied for in the five years prior to the merger announcement year. We expect a positive relation between *CROSSCITE* and the combined wealth effect to the merging firms.

Finally, we investigate if the acquirer and target firms were partners in prior strategic alliances or joint ventures. Fee et al. (2006) argue that strategic

[14] Missing R&D values are replaced by zero, as in Fee et al. (2006) and Kale and Shahrur (2007).

[15] Armour and Teece (1980) find that vertical integration in the petroleum industry promoted R&D investments.

alliances and joint ventures are alternate mechanisms to vertical integration for solving holdup problems. The presence of such alternate mechanisms indicates that the partner firms may have resolved part of the holdup problem through the venture. In comparison to vertical deals where no such arrangements existed, there is less of a holdup problem, so we expect lesser value creation. We create an indicator variable *SAJV* that equals 1 if a strategic alliance or joint venture existed between the merging firms during the five years prior to merger announcement year and 0 otherwise. We expect a negative relation between *SAJV* and the combined wealth effect to the merging firms.

As measures of potential foreclosure, we investigate if the target firm has access to any key patents that prevent rivals to compete effectively. We use the NBER patents database and first identify the patents that the target firm applied for during the three years prior to the merger announcement year. Extant literature argues that the number of citations received by a patent is an indicator of the technological importance of the patent (Albert et al. 1991, Lerner et al. 2011). We calculate the truncation-adjusted citations received by these patents (*TOTCITE*) as a measure for foreclosure. We posit that the higher the number of citations, the greater is the technological importance of the target patent indicating a greater ability for the integrated firm to foreclose nonintegrated rivals. We expect a positive relation between *TOTCITE* and the combined wealth effect to the merging firms.

We create two measures for collusive environments. First, we hand collect data on vertical price fixing enforcement actions during our sample period 1981–2004. The extant literature argues that a main mode of vertical price fixing is resale price maintenance.[16] Under this scheme, an upstream manufacturer requires its distributors to maintain minimum resale prices to consumers. The concern is that the minimum resale prices might facilitate collusion between the manufacturers. We search all federal and state cases available through LexisNexis US Legal and all FTC enforcement actions through Factiva that involved resale price maintenance or vertical price fixing. We go through each case and identify cases where the court (or FTC) ruled in favor of the plaintiff on the antitrust charge. We link the product(s) in each case to four-digit SIC codes and merge it to the industries in the merger sample. We create a dummy variable *PRICE_FIXING* that equals 1 if the acquirer industry was a party to enforcement action. It is likely that in these industries the benefits of collusion are high. We thus expect a positive relation between *PRICE_FIXING* and combined wealth effect. As a second approach to identify collusive environments, we rely on Symeonidis (2003), who finds that collusive price-fixing agreements were prevalent in capital intensive industries. We include the acquirer industry median capital to labor intensity (*K_TO_L*) as an additional measure. Capital is measured as net property, plant and equipment (Compustat Data8), and labor as number of employees (Compustat Data29). We posit that the higher the capital intensity, the greater is the likelihood of the merger being collusive. Accordingly, we expect a positive relation between *K_TO_L* and the combined wealth effect to the merging firms.

We include the following control variables in our regressions. To investigate if agency problems in acquirers impact wealth effects in vertical takeovers, based on Lang et al. (1991), we include acquirer cash flow (*ACQCF*) and an interaction term between acquirer cash flow and a dummy variable that equals 1 if acquirer's Tobin's q is less than 1 and 0 otherwise (*ACQCF* ($q < 1$)). We expect that cash rich acquirers with low Tobin's q are more likely to engage in value-destroying acquisitions that would predict a negative sign on *ACQCF* ($q < 1$). As in Lang et al. (1991), we include a dummy variable that equals 1 if the target Tobin's q is greater than 1 and 0 otherwise (*TAR* ($q > 1$)). We expect a negative sign on *TAR* ($q > 1$) because targets with low Tobin's q have poor quality of current management and the potential gains from a change in control would be higher.[17]

Additionally, we include the intensity of foreign competition in the acquirer (target) industry measured as ratio of the level of imports in the acquirer (target) industry to the total supply in the acquirer (target) industry (Mitchell and Mulherin 1996, Shahrur 2005). We also include relative size of target to acquirer (Servaes 1991, Mulherin and Boone 2000, Shahrur 2005), a dummy for stock offers (Travlos 1987), and a dummy for hostile takeovers (Schwert 2000, Shahrur 2005) as control variables. We measure relative size as the ratio of the target to the acquirer market capitalization fifteen days prior to announcement of the first bid by the successful acquirer.

We present the results for the determinants of the combined wealth effect to the merging firms over the $(-10, +10)$ window in Table 5. As our baseline model, we implement weighted least square (WLS) regressions where the weights are the inverse of the standard deviation of the market model residuals. However, merger events are endogeneous because bidder managers, who likely possess private information on merger synergies, voluntarily engage in these

[16] Harbour (2007) and European Union policy on vertical restraints (http://europa.eu/legislation_summaries/other/l26061_en.htm).

[17] Tobin's q is calculated as {Data6 + (Data25 × Data199) − Data60} divided by Data6 and cash flow as {Data13 − Data15 − (Data16 − Change in Data35) − Data19 − Data21} divided by Data6. Data items are from Compustat.

Table 5 Determinants of the Combined Wealth Effect to the Merging Firms

Dependent variable: *Combined wealth effect*	WLS	MLE	WLS	MLE	WLS	MLE	WLS	MLE
Intercept	0.02*	1.05***	0.02	1.06***	0.02	1.06***	0.03*	1.05***
	(1.67)	(13.74)	(1.58)	(13.92)	(1.56)	(13.91)	(1.95)	(13.63)
Acquirer R&D intensity (*ACQRDI*)	0.09	0.08						
	(1.06)	(0.93)						
Target R&D intensity (*TARRDI*)	−0.09**	−0.11***						
	(−2.28)	(−3.01)						
Change in combined R&D intensity (*RDICHG*)			0.18	0.18***				
			(1.58)	(3.57)				
Cross-citations of target patents by acquirer (*CROSSCITE*)					0.0002***	0.0003*		
					(2.65)	(1.83)		
Strategic alliances and joint ventures (*SAJV*)							−0.03***	−0.04***
							(−3.27)	(−3.41)
Truncation-adjusted citations to target patents (*TOTCITE*)	0.000003	0.00000	0.000004	0.00001	−0.000009	−0.00001	0.000006	0.00001
	(0.40)	(0.41)	(0.55)	(0.67)	(−1.14)	(−0.83)	(0.89)	(1.02)
Collusive industry (*PRICE_FIXING*)	−0.01	−0.03*	−0.01	−0.03**	−0.01	−0.04**	−0.01	−0.03*
	(−0.50)	(−1.73)	(−0.52)	(−2.07)	(−0.96)	(−2.47)	(−0.83)	(−1.82)
Industry capital intensity (*K_TO_L*)	0.00001	−0.00001	0.00001	0.000001	0.00001	0.000001	0.00001	−0.00001
	(0.49)	(−0.30)	(0.83)	(−0.05)	(1.01)	(0.07)	(0.68)	(−0.19)
Acquirer cash flow (*ACQCF*)	0.02	−0.24***	0.03	−0.20**	0.02	−0.20***	0.02	−0.21***
	(0.19)	(−2.91)	(0.32)	(−2.58)	(0.24)	(−2.67)	(0.22)	(−2.82)
ACQCF ($q < 1$)	0.10	0.55	0.08	0.54	0.12	0.56	0.12	0.52
	(0.37)	(1.13)	(0.33)	(1.13)	(0.48)	(1.18)	(0.44)	(1.09)
Target $q > 1$	−0.02	−0.19***	−0.02*	−0.19***	−0.02*	−0.20***	−0.02	−0.18***
	(−1.49)	(−9.24)	(−1.66)	(−9.60)	(−1.72)	(−9.77)	(−1.32)	(−9.02)
Acquirer industry foreign competition ($FORCOMP_{ACQ}$)	0.04	−0.03	0.03	−0.06	0.02	−0.06	0.05	−0.05
	(0.85)	(−0.51)	(0.60)	(−1.08)	(0.48)	(−1.06)	(0.99)	(−0.79)
Target industry foreign competition ($FORCOMP_{TAR}$)	0.03	−0.01	0.03	0.00	0.05	0.01	0.02	−0.01
	(0.71)	(−0.12)	(0.67)	(0.02)	(0.99)	(0.27)	(0.40)	(−0.14)
Stock dummy (*Stock*)	−0.02*	−0.06***	−0.02**	−0.06***	−0.02*	−0.05***	−0.02*	−0.05***
	(−1.94)	(−4.36)	(−2.12)	(−4.81)	(−1.73)	(−4.18)	(−1.74)	(−3.82)
Hostile dummy (*Hostile*)	0.06	0.03	0.06	0.03	0.05	0.02	0.05	0.02
	(1.48)	(0.95)	(1.45)	(1.03)	(1.20)	(0.84)	(1.34)	(0.81)
Relative size (*Relsize*)	0.005	−0.003	0.006	−0.003	0.006	−0.003	0.006	−0.002
	(0.62)	(−1.36)	(0.63)	(−1.34)	(0.68)	(−1.04)	(0.71)	(−0.93)
Standard error of manager's private information (w)		0.24***	—	0.24***	—	0.24***	—	0.24***
		(13.10)		(13.10)		(13.13)		(13.28)
Observations	225	225	225	225	225	225	225	225

Notes. The dependent variable is the combined wealth effect to the merging firms for the window $(-10, +10)$ days around the period between the first bid by the successful acquirer to the announcement of the successful bid in the contest. *ACQRDI* (*TARRDI*) is the industry-adjusted R&D intensity of acquirer (target) firm for year $t-1$, where t is the year of merger announcement. R&D intensity is the ratio of R&D expenditures (Compustat data item 46) to book value of total assets (Compustat data item 6). *RDICHG* is the industry-adjusted change in combined R&D intensity for the acquirer and target firm measured over the $(t-1, t+2)$ calendar year window where t is the year of merger announcement. *CROSSCITE* is the number of cross-citations of target patents by the acquirer patents during the five years prior to the year of merger announcement. *SAJV* is an indicator variable set equal to 1 in the presence of strategic alliances or joint ventures between the acquirer and target firm during the five years prior to the merger announcement and 0 otherwise. *TOTCITE* is the total truncation-adjusted citations to target patents filed during the three years prior to the merger announcement. *PRICE_FIXING* is and indicator variable set equal to 1 if the acquirer industry was identified as a collusive industry based on vertical price fixing enforcement actions. *K_TO_L* is the acquirer industry median capital to labor ratio. *ACQCF* is the acquirer cash flow and measured as operating income before depreciation minus interest expense, taxes, preferred dividends, and dividends for the year prior to the takeover. Cash flow is calculated based on Compustat items as {Data13 − Data15 − (Data16 − Change in Data35) − Data19 − Data21} divided by Data6. *ACQCF* ($q < 1$) is an interaction between acquirer cash flow and a dummy variable that equals 1 when acquirer Tobin's q is less than 1 and 0 otherwise. Tobin's q is measured based on Compustat data items as {Data6 + (Data25 × Data199) − Data60} divided by Data6. *Target* $q > 1$ is a dummy variable that equals 1 when target Tobin's q exceeds 1 and 0 otherwise. $FORCOMP_{ACQ}$ and $FORCOMP_{TAR}$ are the foreign competition in acquirer (target) industry and calculated as total imports divided by total supply in the industry. *Relsize* is the ratio of the market value of the target to the market value of the acquirer measured 15 days prior to the first bid by successful acquirer. *Stock* is a dummy that equals 1 when the deal is stock financed and is 0 otherwise. *Hostile* is a dummy that equals 1 when the deal is reported as hostile by SDC and is 0 otherwise. MLE procedure is based on the methodology in Eckbo et al. (1990) and w represents the standard error of the manager's private information. t-statistics based on heteroskedasticity consistent standard errors are provided in the parentheses.

***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

activities. We control for this endogeneity by also performing the Eckbo et al. (1990) maximum likelihood (MLE) approach.

In models (1) and (2), we report the WLS and MLE estimation results when we use the acquirer and target R&D intensity as explanatory variables for the efficiency hypothesis. As hypothesized, we find that target R&D intensity (*TARRDI*) is negatively related to the combined wealth effect. This indicates that the greater the extent of underinvestment in relationship-specific assets at the target level, the greater is the combined value created in the takeover. Acquirer R&D intensity (*ACQRDI*) is however insignificantly related to the combined wealth effect of the merging firms. In model (4), we find that the industry-adjusted change in R&D intensity (*RDICHG*) is positive and significant and in model (3) the relation is positive but just beyond the 10% significance level. This indicates that the value created to the merging firms is greater when the change in relationship-specific investments around the merger is higher. In models (5) and (6), we find that the coefficient on the number of cross-citations between acquirer and target patents (*CROSSCITE*) is found to be positive and significant. This finding suggests that the wealth effect to the merging firms is greater when the potential for holdup is higher. In models (7) and (8), we find a negative relation between strategic alliance and joint venture dummy (*SAJV*) and the combined wealth effect. This is consistent with our expectation that part of the holdup problem may be already resolved through the venture, in which case the merger would be associated with a lower value creation. Inconsistent with the foreclosure hypothesis, the coefficient on citations to target patents (*TOTCITE*) is insignificant in all models. Finally, the generally insignificant coefficient on capital intensity (*K_TO_L*) and indicator variable for collusive industries (*PRICE_FIXING)* is inconsistent with the collusion hypothesis.

We find that the coefficient on the cash flow for low q acquirers (*ACQCF* ($q < 1$)) is insignificant in all models, which is inconsistent with the agency hypothesis. We find that low q targets are associated with higher takeover gains in most models (*Target* $q > 1$). If low q targets have inefficient management, then this result suggests that a change in control through a corporate takeover creates value. Consistent with the extant takeover literature, we find that stock financed takeovers (*Stock*) are associated with lower takeover gains. The coefficients on relative size (*Relsize*) and hostile takeover dummy (*Hostile*) are found to be insignificant. Finally, the standard error of manager's private information (w) is positive and significant suggesting that the model of Eckbo et al. (1990) is well specified.[18, 19, 20]

5.2. Determinants of the Wealth Effects of Rival Firms and Customer Firms

In this section, we investigate the determinants of the wealth effects to the nonintegrated acquirer rivals (*ACQRIVCAR*), nonintegrated target rivals (*TARRIVCAR*), main customers (*MCUSTCAR*), and dependent customers (*DCUSTCAR*). We assess the impact of the foreclosure hypothesis by including truncation-adjusted citations to target patents (*TOTCITE*) and the collusion hypothesis by including the indicator variable for industries subject to vertical price fixing enforcement actions (*PRICE_FIXING*) and the industry median capital intensity (*K_TO_L*) as independent variables. In addition, we include the combined wealth effect to the merging firms as an independent variable in all regressions.

We include the following control variables in our regressions. To investigate the acquisition probability hypothesis of Song and Walkling (2000), we create a dummy variable *Initial* that equals 1 when there is no acquisition between the acquirer and target three-digit SIC industries during the one year prior to the takeover announcement and equals 0 otherwise. Under their hypothesis, merger announcements lead to a reassessment of the likelihood of takeover attempts for target rivals. The magnitude of abnormal returns to the target rivals would thus be increasing in the degree of surprise in the acquisition. We posit that the variable *Initial* captures the degree of surprise in an acquisition and expect it to be positively related to *TARRIVCAR*. We include *Initial* in the acquirer rival and customer regressions as well. Finally, we include acquirer and target industry foreign competition ($FORCOMP_{ACQ}$ and $FORCOMP_{TAR}$) and dummy variables for stock financed and hostile deals (*Stock* and *Hostile*).

We report results for the determinants of the wealth effects to the rival firms in models (1) and (2) and the customer firms in models (3) and (4) of Table 6.

[18] We perform falsification tests to verify that our holdup and relationship-specific investment arguments are valid only in vertical mergers. We identify a control sample of nonvertical mergers. Specifically, we identify 312 horizontal and diversifying mergers with less than 1% vertical relatedness. We find that our proxies for efficiency hypothesis do not impact the value created to the merging firms.

[19] We find that there is no differential impact of the type of vertical takeover (forward versus backward) on the combined wealth effect to the merging firms.

[20] Deals where the target (acquirer) already has a segment in the primary industry of the acquirer (target) may be conducted for consolidation or expansion of an existing business. We find 38 deals where such overlaps in industries exist. Exclusion of such deals from our sample yields qualitatively similar results.

Table 6 Determinants of Wealth Effects to the Rival and Customer Firms in Vertical Takeovers

	(1)	(2)	(3)	(4)
Dependent variable	*ACQRIVCAR*	*TARRIVCAR*	*MCUSTCAR*	*DCUSTCAR*
Intercept	−0.003	−0.014	−0.015	−0.004
	(−0.39)	(−1.64)	(−1.63)	(−0.29)
Combined wealth effect (*CWE*)	0.118***	0.131***	0.099***	0.219***
	(4.48)	(4.15)	(2.68)	(3.93)
Truncation-adjusted citations to target patents (*TOTCITE*)	0.00001***	−0.00001*	0.00002**	0.00001
	(2.65)	(−1.64)	(2.48)	(1.36)
Industry capital intensity *(K_TO_L*)	0.00003*	0.00001	−0.00001	0.00000
	(1.66)	(1.09)	(−0.22)	(0.07)
Collusive industry (*PRICE_FIXING*)	−0.012	0.011	−0.002	0.009
	(−1.40)	(1.24)	(−0.18)	(0.48)
Initial vertical takeover (*Initial*)	0.005	0.018**	0.001	0.032**
	(0.60)	(2.19)	(0.08)	(2.09)
Acquirer industry foreign competition ($FORCOMP_{ACQ}$)	0.012	−0.002	0.022	−0.102
	(0.30)	(−0.06)	(0.56)	(−1.38)
Target industry foreign competition ($FORCOMP_{TAR}$)	−0.011	0.001	−0.020	−0.020
	(−0.33)	(0.02)	(−0.66)	(−0.32)
Stock dummy (*Stock*)	−0.009	0.000	0.003	0.003
	(−1.09)	(0.06)	(0.27)	(0.18)
Hostile dummy (*Hostile*)	−0.055***	0.001	−0.032	−0.091***
	(−4.17)	(0.07)	(−1.24)	(−3.30)
Number of observations	218	221	176	174

Notes. In models (1) and (2), the dependent variable is the abnormal returns to acquirer rivals (*ACQRIVCAR*) and target rivals (*TARRIVCAR*) over the (−10, +10) day window around the date of first bid announcement by the successful acquirer. In models (3) and (4), the dependent variable is the abnormal return to main customers (*MCUSTCAR*) and dependent customers (*DCUSTCAR*) over the (−10, +10) day window around the date of first bid announcement by the successful acquirer. The main customer industry is identified as the industry that accounts for the highest proportion of the total output of the downstream industry in the vertical takeover provided it is greater than 5%. The dependent customer industry is identified as the industry that receives the highest proportion of its inputs from the downstream industry in vertical takeover to produce its total output, provided it is greater than 5%. Combined wealth effect (*CWE*) of a takeover is calculated as the value weighted abnormal return to the acquirer and target measured for the window (−10, +10) days around the period between the announcement of the first bid by the successful acquirer to the announcement of the successful bid in the contest. *TOTCITE* is the total truncation-adjusted citations to target patents filed during the three years prior to the merger announcement. *PRICE_FIXING* is an indicator variable set equal to 1 if the acquirer industry was identified as a collusive industry based on vertical price fixing enforcement actions. *K_TO_L* is the acquirer industry median capital to labor ratio. *Initial* is a dummy that equals to 1 if the there is no vertical takeover between the acquirer and target three-digit SIC industries in the year prior to announcement and 0 otherwise. $FORCOMP_{ACQ}$ and $FORCOMP_{TAR}$ are the foreign competition in acquirer (target) industry and calculated as the ratio of total imports divided by total supply in the industry. *Stock* is a dummy that equals 1 when the deal is stock financed and is 0 otherwise. *Hostile* is a dummy that equals 1 when the deal is reported as hostile by SDC and is 0 otherwise. *t*-statistics based on heteroskedasticity consistent standard errors are provided in the parentheses.

***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

We perform weighted least square estimations. We document a positive and statistically significant relation between combined wealth effect to merging firms (*CWE*) and rival wealth effects in models (1) and (2) and a similar positive relation with customer wealth effects in models (3) and (4). These results suggest that if more value is created to the merging firms then product market participants such as rivals and customers are also better off. They are consistent only with the efficiency hypothesis where the rivals use the better information from the merger announcement to effectively restructure and some of the resultant gains are passed to customer firms.

Under the foreclosure hypothesis, we expect the wealth effects of the rival and customer firms to be lower when the total citations to target patents are higher. We document a negative and significant relation between citations to target patents (*TOTCITE*) and target rival wealth effect (model (2)). We also document a positive and significant relation between *TOTCITE* and acquirer rival wealth effect (model (1)) as well as the main customer wealth effect (model (3)), whereas we find that this relation is positive but insignificant for dependent customers (model (4)). Overall, we obtain weak evidence favoring foreclosure hypothesis. Consistent with the collusion hypothesis, we document a positive and significant relation between industry capital intensity (*K_TO_L*) and acquirer rival wealth effects. However, the relation between *K_TO_L* and the wealth effects to target rivals, main customers, and dependent customers is found to be statistically insignificant. Furthermore, the relation between the dummy variable for collusive industries (*PRICE_FIXING*) and the wealth

effects to acquirer rivals, target rivals, main customers, and dependent customers is found to be statistically insignificant. Overall, we find weak evidence in favor of the collusion hypothesis.

Finally, in model (2), the coefficient on *Initial* is found to be positive and significant indicating that the returns to the target rivals are positively related to the magnitude of surprise in the vertical takeover. This result is consistent with the acquisition probability hypothesis of Song and Walkling (2000). The coefficients on stock dummy, hostile dummy, and the intensity of foreign competition in the acquirer and target industries tend to be generally insignificant in models (1)–(4).

5.3. Determinants of Operating Performance Changes of Merging Firms

In this section, our goal is to assess whether vertical takeovers lead to improvements in the cash flow of merging firms and whether these changes are attributable to a reduction in holdup and the resultant improvement in relationship-specific investments or enhanced incentives to foreclose or collude. Consistent with the extant merger literature, we use operating income before depreciation (Compustat data item 13) scaled by net sales (Compustat data item 12) as our measure of operating performance (Fee and Thomas 2004). For each vertical deal, we identify a matching firm for the acquirer (target) based on industry, asset size, and prior operating performance, as in Barber and Lyon (1996) and Fee and Thomas (2004). First, we identify all firms in the acquirer (target) two-digit SIC industry excluding the acquirer and target firms. We retain firms with an asset size that is between 25% and 200% of the acquirer (target) firm and the matching firm is identified as the firm that is closest in premerger operating performance of the acquirer (target) firm.

As a measure of premerger combined operating performance, we use the sales-weighted operating performance of the acquirer and target for year $t-1$. For postmerger performance, we use the operating performance of the integrated firm for year $t+2$. For each year in consideration, we find the performance of the benchmark portfolio as the sales-weighted operating performance of the matched firm for the acquirer and target, where the relative weights are based on the sales of the acquirer and target firms for year $t-1$. Based on the extant merger literature, we examine changes in benchmark portfolio adjusted operating performance of the acquirer and target firms over the $(t-1, t+2)$ window (Healy et al. 1992 and Powell and Stark 2005). We find that the median change in benchmark portfolio adjusted cash flows to the merging firms for the $(t-1, t+2)$ window is 0.52%. For the same window, the median change in operating performance is 1.24% and −1.71% in the positive and negative combined wealth effect subsamples, respectively.

Table 7 presents results for the determinants of changes in operating performance in vertical takeovers. The dependent variable *DIFF_CF*1 is the change in benchmark portfolio adjusted operating performance measured as the benchmark portfolio adjusted operating performance of the integrated firm for year $t+2$ minus the benchmark portfolio adjusted weighted average performance of the acquirer plus target for year $t-1$. We use median regressions because our operating performance measures are highly skewed. Finally, in all models we adopt the same set of independent variables as in our wealth effects regressions of the merging firms.

We find a negative relation between target R&D intensity (*TARRDI*) and change in operating performance in model (1). This result indicates that the greater the underinvestment in relationship-specific assets at the target level, the greater is the change in operating performance to the merging firms. Furthermore, we find a positive and significant relation between the change in R&D intensity (*RDICHG*) and the change in operating performance of the merging firms in model (2). This result indicates that the greater the increase in relationship-specific investments around the merger, the greater is the change in operating performance for the merging firms. Both these results are similar to those we obtained when combined wealth effect was the dependent variable. However, the coefficients on *SAJV* and *CROSSCITE* are found to be statistically insignificant. Inconsistent with the foreclosure hypothesis, the coefficient on citations to target patents (*TOTCITE*) is insignificant. Finally, inconsistent with the collusion hypothesis, the coefficients on *K_TO_L* and *PRICE_FIXING* are found to be generally insignificant.

6. Summary and Conclusions

Vertical integration has been a topic of interest to the economists over several decades (Joskow 2005). However, little is known regarding the sources of value creation in vertical takeovers. We attempt to bridge this gap by providing a large sample study that investigates the efficiency, foreclosure, and collusion rationales for vertical takeovers. We investigate these rationales by studying (1) the announcement period wealth effects of the merging firms, acquirer rivals, target rivals, and customer firms; and (2) the operating performance changes to the merging firms in vertical takeovers. Our analyses reveal that a resolution of the holdup and underinvestment in relationship-specific investments is a major determinant of the combined wealth effect and changes in operating

Table 7 Determinants of Operating Performance in Vertical Takeovers

Dependent variable	*DIFF_CF*1	*DIFF_CF*1	*DIFF_CF*1	*DIFF_CF*1
Intercept	−0.029	−0.024	−0.022	−0.123***
	(−1.36)	(−1.14)	(−1.03)	(−3.35)
Acquirer R&D intensity (*ACQRDI*)	−0.105			
	(−0.99)			
Target R&D intensity (*TARRDI*)	−0.091*			
	(−1.86)			
Change in combined R&D intensity (*RDICHG*)		0.157**		
		(2.40)		
Cross-citations of target patents by acquirer(*CROSSCITE*)			−0.0001	
			(−1.19)	
Strategic alliances and joint ventures (*SAJV*)				−0.037
				(−1.31)
Truncation-adjusted citations to target patents (*TOTCITE*)	0.000	0.000	0.000	0.000
	(0.76)	(0.69)	(1.14)	(0.44)
Industry capital intensity (*K_TO_L*)	0.000	−0.000	0.000	0.000**
	(0.67)	(−0.04)	(0.17)	(2.20)
Collusive industry (*PRICE_FIXING*)	0.030	0.021	0.024	0.026
	(1.56)	(1.11)	(1.23)	(0.78)
Acquirer cash flow (*ACQCF*)	0.258***	0.237***	0.222**	0.603***
	(2.68)	(2.63)	(2.43)	(3.51)
ACQCF ($q < 1$)	−0.680*	−0.649*	−0.670*	−0.449
	(−1.74)	(−1.65)	(−1.70)	(−0.75)
Target $q > 1$	0.010	0.005	0.005	−0.015
	(0.48)	(0.22)	(0.26)	(−0.41)
Acquirer industry foreign competition ($FORCOMP_{ACQ}$)	−0.060	−0.033	−0.042	−0.010
	(−0.83)	(−0.47)	(−0.58)	(−0.08)
Target industry foreign competition ($FORCOMP_{TAR}$)	0.064	0.060	0.043	0.176
	(0.98)	(0.90)	(0.64)	(1.45)
Stock dummy (*Stock*)	−0.031*	−0.028	−0.028	−0.062**
	(−1.81)	(−1.61)	(−1.62)	(−2.02)
Hostile dummy (*Hostile*)	−0.001	0.006	0.004	0.004
	(−0.04)	(0.18)	(0.11)	(0.06)
Relative size (*Relsize*)	0.004***	0.004***	0.004***	0.007***
	(4.14)	(4.44)	(3.97)	(4.94)
Observations	225	225	225	225

Notes. This table presents the determinants of change in operating performance to the merging firms. Operating performance is measured as operating income before depreciation divided by net sales. The dependent variable *DIFF_CF*1 is the change in benchmark portfolio adjusted operating performance measured as the benchmark portfolio adjusted operating performance of the integrated firm for year $t + 2$ minus the benchmark portfolio adjusted sales-weighted performance of the acquirer and target for year $t - 1$. The benchmark firm for the acquirer (target) is identified as the firm that is closest in the premerger acquirer (target) performance and matched on the acquirer (target) two-digit SIC industry and size. The operating performance of the benchmark portfolio is then the sales (for year $t - 1$) weighted performance of the acquirer plus target benchmark firm. *ACQRDI* (*TARRDI*) is the industry-adjusted R&D intensity of acquirer (target) firm for year $t - 1$. *RDICHG* is the change in industry-adjusted combined R&D intensity measured over calendar year windows ($t - 1, t + 2$). *CROSSCITE* is the number of cross-citations of target patents by the acquirer patents in the five years prior to the year of merger announcement. *SAJV* is an indicator variable set equal to 1 in the presence of strategic alliances or joint ventures between the acquirer and target firm prior to the merger announcement and 0 otherwise. *TOTCITE* is the total truncation-adjusted citations to target patents filed during the three years prior to the merger announcement. *PRICE_FIXING* is and indicator variable set equal to 1 if the acquirer industry was identified as a collusive industry based on vertical price fixing enforcement actions. *K_TO_L* is the acquirer industry median capital to labor ratio. *ACQCF* is the acquirer cash flow for the year prior to the takeover. *ACQCF*($q < 1$) is an interaction between acquirer cash flow and a dummy variable that equals 1 when acquirer Tobin's q is less than 1. *Target* $q > 1$ is a dummy variable that equals 1 when target Tobin's q exceeds 1 and 0 otherwise. $FORCOMP_{ACQ}$($FORCOMP_{TAR}$) is the intensity of foreign competition in the acquirer (target) industry. *Relsize* is the ratio of the market values of the target to the bidder measured fifteen days prior to the first bid by successful acquirer. *Stock* is a dummy that equals 1 for stock financed deals and 0 otherwise. *Hostile* is a dummy that equals 1 for hostile deals and 0 otherwise. *t*-statistics are provided in the parentheses.

***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

performance to the merging firms. Further analyses of the determinants of wealth effects to the rivals and customers yield additional corroborating evidence consistent with the efficiency motivation for vertical takeovers. In all the above analyses, we find that foreclosure and collusion rationales generally do not explain the wealth effects. We note that our results could be attained either if the primary motivation for vertical mergers is economic efficiency or if the threat of enforcement by the regulators effectively

deterred anticompetitive deals. Our analysis does not enable us to distinguish between these two alternatives.

Collectively, our findings indicate that firms use corporate takeovers to expand their vertical boundaries consistent with an efficiency improvement rationale as predicted by the transaction cost economics and property rights theories. Our findings build upon the work in Eckbo (1983) and Rosengren and Meehan (1994) that does not find evidence supporting anticompetitive motives in vertical takeovers challenged by U.S. antitrust regulators prior to 1978. In addition, our paper complements extant literature that finds that horizontal takeovers are also generally motivated by efficiency enhancement (Eckbo 1983, 1992; Fee and Thomas 2004; and Shahrur 2005). Finally, the past and current FTC economists and commissioners have stressed the importance of vertical enforcement matters but admit that there is a lack of consensus about the nature of vertical mergers (Simons 2002, Pitofsky 2005, and Harbour 2007). In this regard, our analysis of the wealth effects of the merging firms and related product market parties such as rivals and customers provides insights on the overall welfare effects of vertical takeovers and may be useful in evaluating vertical enforcement decisions.

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